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Urban Local Governments' Response to Urbanisation and its Impact on Municipal Finance: An Overview of India

SHAFIQ AHMED*

ABSTRACT

Urbanisation refers to an increase in the proportion or share of the population residing in urban areas as opposed to rural areas. It is growing faster in East Asia and Pacific regions. Consequently, the city area of different states starts growing, which in return has exerted great pressure on the existing urban infrastructure like availability of water, transport system, health facilities and drainage system etc. The local government across the world plays an important role in providing basic services to the people, but these institutions especially in developing countries face great challenges like rapid urbanisation, climate change among others. Besides this, the fundamental challenge is widening the gap between the availability of financial resources and municipal expenditure. In this paper, an attempt has been made to understand the issues posed by the urbanisation on the financial conditions of Indian ULBs with special reference to six largest Municipal Corporations of India.

Keywords: *Urbanisation, Urban Local Bodies, Finance, Municipal Finance*

INTRODUCTION

Urbanisation refers to an increase in the proportion or share of the population residing in urban areas as opposed to rural areas. These areas are densely packed and offer more opportunity to their residents in the form of higher paying jobs, better educational opportunities and better quality of life. The genesis of urbanisation can be traced back to

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the dawn of civilisation. However, it can be said that as the nature of the state's economies shifted from agrarian sector to industrial sector, further expansion of economic activities, growth and development of trade routes, advancement of tourism sector, all these factors have paved the way for urbanisation. With this background, a good number of thinkers and researchers have given their view points. According to Thompson and Lewis, "Urbanisation is the movement of people from communities chiefly concerned with agriculture to other communities, generally large, whose activities are primarily centred in government, trade, manufacture or allied activities" Chapagain (2018). Further, explaining the phenomenon being studied, Burgel said that, "The transformation process of rural area into an urban area is known as urbanisation. This process has immense impact on rural economic structure". Making it more understandable, Bogue highlighted that, "About 70 per cent of the increase in city dwellers come from reproductive change (Natural increase) and about 30 per cent rural urban migration (Prasad and Xuequan, 2017). The phenomenon of urbanisation remained unnoticed and unchecked for quite a long time across the developing world. Due to the non-seriousness of the authorities, the space and resource limit of major cities were being threatened. Eventually, it became a problem for the establishments to control issues of trespassing, crime and providing civic amenities at large (O'Donnel, 2018).

Consequently, the urban areas of different states starts growing, which in return have exerted great pressure on the existing urban infrastructure like availability of water, transport system, health facilities, drainage system, etc., especially in the developing world. This pressure has directly affected the urban local governments in providing a range of services from water and sewer infrastructure to social services and housing (Slack, 2009). At the global level, presently around 50 per cent population is residing in urban areas and they are contributing around 80 per cent in world Gross Domestic Product (GDP) (World Bank, 2020). In case of India, urban population contributes 63 per cent to the GDP of the country. How significant this chunk of population is for the growth and development of the economy, it can be understood by analysing the contribution made by them in the world GDP and in national GDP (Gupta, 2019).

To meet rapid urbanisation, European countries have decentralised their administrative approaches. Moreover, urban local bodies have been given adequate autonomy to frame their policies, fix their financial resources and further use them appropriately (Organisation for Economic Co-operation and Development, 2020). In this paper, an attempt has been made to understand the issues posed by the

urbanisation on the financial conditions of Indian ULBs and their response to tackle the same.

Review of Related Literature

Urbanisation is growing faster in East Asia and Pacific regions, the responsibility of the urban policy makers has increased to tackle urbanisation challenges in different aspects like usage of land, water, health, education, etc., to provide all benefits to the urban people which will directly accelerate overall development of the economy. With effective coordination in urban planning, the inclusive growth of the people is possible and the chain of vicious circle of poverty, unemployment and illiteracy can end that would even foster the goals of ending poverty and boosting the shared prosperity across the globe (World Bank, 2015). India has been experiencing a rapid growth of urban areas and increasing urban population in the last few decades. This has been indicated by the United Nations in its report of 2018 namely, *World Urbanisation Prospects* which elaborated that about 34 per cent of India's population now lives in urban areas (*The Hindu*, 2018). On the other hand, urban local bodies which have a mandate to deal with urbanisation are generating small revenue surplus with low resource gaps. More than that, they are spending lower than required amount for minimal civic services (Habitat, 2015). Furthermore, these institutions are not even autonomous in term of decision making especially in financial matters (Paul, 2014). India has to improve its urban infrastructure as it is far from the desired infrastructure, which can cope up with the rapid urbanisation. As per population projection by the Registrar General of India, in 2026 there would be 534 million urban population, whereas it was 286 million in 2001. Besides, the level and pattern of urbanisation would be different in various states (Vaidya, Urban issues, Reforms, and way forward in India, 2009).

The Census of 2011 discloses that there is an increase of 2774 towns comprising of 242 statutory bodies and 2532 census towns over the decade. Growth rate of population in urban areas was 31.8 per cent. Further, 2001 census highlighted that the number of million plus cities managed by Municipal Corporation has increased from 35 in Census 2001 to 53. The newly Million plus cities are Srinagar and Jammu — two important cities of J&K, Union Territory of Chandigarh, Jodhpur and Kota of state Rajasthan, Ghaziabad of Uttar Pradesh, Ranchi of Jharkhand, Raipur and Durg-Bhilainagar of Chhattisgarh, Gwalior of Madhya Pradesh, Vasai Virar and Aurangabad of Maharashtra, Kozhikode, Thrissur, Malappuram, Thiruvananthapuram, Kannur, and Kollam of state Kerala, and Tiruchirappalli, of Tamil Nadu (Ministry of Housing and Urban Affairs, 2021). To strengthen the

urban governance mechanism, scholars have suggested that there should be a Constitutional amendment in the existing framework. As the existing framework (74th CAA) only gives functions but does not delineate how these functions should be carried out as ultimate power regarding revenue generation lies with the state government. Moreover, in India, the municipal finance system has little authority when it comes to setting tax rates, defining tax exemption policies, gaining access to capital markets, and reorganising personnel practises. Their taxation and spending abilities have been limited by state laws, which frequently prohibit municipalities the ability to impose a specific tax or a tax on a specific group of taxpayers. The state laws neither protect the municipal fiscal domain nor establish a framework for governing the transfer of funds to ULBs in an appropriate manner.

Statement of the Problem

From the available literature, it is found that Municipalities across the world are facing financial crisis and population explosion. At present, as more than 55 per cent people of the globe are residing in urban areas. To provide them a range of civic services, the institutions of ULBs with different nomenclatures have been setup in the world. Their autonomy, capacity, and concern of higher tier of government vary from state to state. However, the way in which these august institutions are being dealt with in the developing countries is really a matter of concern for communities across the globe.

Today's world is more or less based on the idea of 'sink and sunk together' in terms of matters related to environment, poverty, development, education, infrastructure, etc. Moreover, as it is the matter of Urban Governance and further, these institutions play a very important role in enabling cities as engines of economic growth. In this background, it has also been seen that the ULBs of India have not been given adequate powers to fix their user charges, taxes, fines and other sources of revenue. As the ultimate power lies with the state governments, under such circumstances, where urban population is increasing day-by-day, their financial capacity is being compromised and jeopardized. There is a great need to conduct studies on urbanisation and its impact on municipal finance in particular and urban governance in general.

Objectives of the study

1. The main objective of this study is to know about the recent pattern of urbanisation and its impact on urban governance in India;
2. To examine the financial status of six largest Municipal Corporations of India and major issues pertaining to them.

Strategic Inquiry

In research, strategic inquiry plays a very important role which is also known as Research methodology, that acts as path finder for a researcher to reach the desired ends. The present study is based on mixed method research approach followed by descriptive research design. Moreover, the study is entirely based on secondary data which has been collected from various sources like Ministry of Housing and Urban Affairs Government of India, Official website of Municipal Corporations, Census Reports, Government reports, newspapers, magazines, etc.

Pattern of Urbanisation

The recent pattern of Indian urbanisation is 377 million, which means more than 33 per cent population of the country is settled in the urban areas. If we look at the phenomenon being studied through the lenses of history, it was a mere 64 million (M) in 1951, 78M in 1961, 109M in 1971, 159M in 1981, 217M in 1991 and 286M in 2001 (Office of the Registrar General and Census Commissioner of India, 2001). The present demographic of Indian urban population has been explained in Table 1.

From the data given in Table 1, it is clearly visible that from all the Indian Union territories of India, the National Capital Territory of Delhi and Chandigarh are most urbanised with 97.5 per cent and 97.25 per cent respectively, followed by Daman and Diu (75.%) and Puducherry (68.3%). As far as the states are concerned, Goa stood first comprising of 62.2 per cent, the state of Kerala is at second position having 47.7 per cent. From the North-Eastern States of India, the state of Mizoram is most urbanised with 51.5 per cent. Interestingly, when it comes to absolute contribution in the total urban population of the country, it contributes only 0.1 per cent. Sikkim stood at second number with 25 per cent urban population, in 2001 it was mere 11.0 per cent.

In terms of lowest urbanised states, the state of Himachal Pradesh is lowest with 10.0 per cent followed by Bihar with 11.3 per cent, Assam with 14.1 per cent and Orissa with 16.7 per cent. Overall, the number of census towns has increased massively – from 1,362 to 3,892 between 2001 to 2011. The rising urbanisation pattern of India can be understood from the statistics of the 2011 census when it was 286 million (286,119,689). But within ten years in 2011, it reached 377 million (377,106,125), with an addition of 91.0 million. There is no doubt that still more of the Indian population is residing in rural areas, but the Indian urban areas being the engines of economic growth are contributing 63 per cent in Gross Domestic Product of the country and it is expected to reach at 70 per cent in 2030 (NITI AYOGE, 2021; Kapoor & Sinha, 2020). This increasing urban population has affected the financial health of ULB's in India by

TABLE 1: INDIAN POPULATION DEMOGRAPHY

S. No.	States/UTs	2001 Population			2011 Population		
		Rural	Urban	Total	Rural	Urban	Total
1	Andaman & Nicobar Islands	239,954	116,198	356,152	237,093	143,488	380,581
2	Andhra Pradesh	55,401,067	20,808,940	76,210,007	56,361,702	28,219,075	84,580,777
3	Arunachal Pradesh	870,087	227,881	1,097,968	1,066,358	317,369	1,383,727
4	Assam	23,216,288	3,439,240	26,655,528	26,807,034	4,398,542	31,205,576
5	Bihar	74,316,709	8,681,800	82,998,509	92,341,436	11,758,016	104,099,452
6	Chandigarh	92,120	808,515	900,635	28,991	1,026,459	1,055,450
7	Chhattisgarh	16,648,056	4,185,747	20,833,803	19,607,961	5,937,237	25,545,198
8	Dadra & Nagar Haveli	170,027	50,463	220,490	183,114	160,595	343,709
9	Daman & Diu	100,856	57,348	158,204	60,396	182,851	243,247
10	Goa	677,091	670,577	1,347,668	551,731	906,814	1,458,545
11	Gujarat	31,740,767	18,930,250	50,671,017	34,694,609	25,745,083	60,439,692
12	Haryana	15,029,260	6,115,304	21,144,564	16,509,359	8,842,103	25,351,462
13	Himachal Pradesh	5,482,319	595,581	6,077,900	6,176,050	688,552	6,864,602
14	Jammu & Kashmir	7,627,062	2,516,638	10,143,700	9,108,060	3,433,242	12,541,302
15	Jharkhand	20,952,088	5,993,741	26,945,829	25,055,073	7,933,061	32,988,134
16	Karnataka	34,889,033	17,961,529	52,850,562	37,469,335	23,625,962	61,095,297
17	Kerala	23,574,449	8,266,925	31,841,374	17,471,135	15,934,926	33,406,061
18	Lakshadweep	33,683	26,967	60,650	14,141	50,332	64,473

(contd.)

(Table 1 contd.)

S. No.	States/UTs	2001 Population			2011 Population		
		Rural	Urban	Total	Rural	Urban	Total
19	Madhya Pradesh	44,380,878	15,967,145	60,348,023	52,557,404	20,069,405	72,626,809
20	Maharashtra	55,777,647	41,100,980	96,878,627	61,556,074	50,818,259	112,374,333
21	Manipur	1,717,928	575,968	2,293,896	2,021,640	834,154	2,855,794
22	Meghalaya	1,864,711	454,111	2,318,822	2,371,439	595,450	2,966,889
23	Mizoram	447,567	441,006	888,573	52,5435	571,771	1,097,206
24	Nagaland	1647,249	342,787	1,990,036	1,407,536	570,966	1,978,502
25	New Delhi	9,44,727	12,905,780	13,850,507	419,042	16,368,899	16,787,941
26	Odisha	31,287,422	5,517,238	36,804,660	34,970,562	7,003,656	41,974,218
27	Puducherry	325,726	648,619	974,345	395,200	852,753	1,247,953
28	Punjab	16,096,488	8,262,511	24,358,999	17,344,192	10,399,146	27,743,338
29	Rajasthan	43,292,813	13,214,375	56,507,188	51,500,352	17,048,085	68,548,437
30	Sikkim	480,981	59,870	540,851	456,999	153,578	610,577
31	Tamil Nadu	34,921,681	27,483,998	62,405,679	37,229,590	34,917,440	72,147,030
32	Tripura	2,653,453	545,750	3,199,203	2,712,464	961,453	3,673,917
33	Uttar Pradesh	131,658,339	34,539,582	166,197,921	155,317,278	44,495,063	199,812,341
34	Uttarakhand	6,310,275	2,179,074	8,489,349	7,036,954	3,049,338	10,086,292
35	West Bengal	57,748,946	22,427,251	80,176,197	62,183,113	29,093,002	91,276,115
	India	742,617,747	286,119,689	1,028,737,436	833,748,852	377,106,125	1,210,854,977

Source: Ministry of Housing and Urban Affairs, GoI, 2021.

manifolds, which consequently has derailed, undermined, compromised and threatened the urban governance.

Rising Urbanisation and its Impact

The increasing concentration of population in city areas has threatened the availability of resources like water, electricity, housing facility, geographical limit, etc. Since, every city has its own limit and in India most of the cities are about to cross that limit like New Delhi, Chandigarh, Mumbai, Kolkata, Hyderabad, and Lucknow, etc. Consequently, increasing urban population in the study area is straining the already ill-equipped local government, infrastructure, planning mechanism and urban finance (Robert, 2016). Some of the major areas which have threatened and eventually exerted pressure on municipal finance are listed below:

Availability of Drinking Water: Municipal water shortage is a crucial problem in the study area due to increasing urbanisation and climate change (Mukhrejee & Schutt, 2018). Because of the delayed monsoon and poor water management, Delhi, the world's most urbanised metropolis, is experiencing water scarcity. According to the Delhi government's 2017 economic survey, 20 per cent of the drinking water gets wasted due to inadequate management (*The Hindu*, 2021). To deal with the drinking water issue, the Delhi Government and local government have spent 3.815 crores in 2018-19, 4.555 crores in 2019-20 and 5.395 crores in 2020-21. Other cities like Hyderabad are also grappling with a severe water crisis. Two of its primary water sources: the Nagarjuna Sagar reservoir and the Yellampalli reservoir, are reported to have dangerously low water levels. To tackle the water crisis, the Greater Hyderabad Municipal Corporation (GHMC) has spent 131 crores on water management which was two per cent of total budget. This has increased to 70 per cent within the span of a year (*The Times of India*, 2020). The financial records of GHMC have revealed that in 2020-21 the total expenditure increased, whereas, the revenue has declined drastically (*The Times of India*, 2020). According to a research conducted by the State University of Tamil Nadu, Chennai the capital city of the state had also faced water crisis due to rapid urbanisation and climate change between the years of 1983 and 2017 and Chennai's aquatic bodies have shrunk in size from 12.6 sq km to roughly 3.2 sq km. Researchers have further predicted that if the same level of urbanisation and climatic conditions continue by the year 2030, around 60 per cent of the city's ground level water will be reduced. This will indeed hamper the urban governance and exert pressure on municipal finance which in return has potential to derail the urban governance mechanism in Chennai (*The Economic Times*, 2021).

Housing Problems: The total population of India is 1.3 billion, out of which nine per cent live in slum areas. Almost all the metropolitan cities of India are facing the issue of affordable housing due to the rising number of slums in the city area. A city like Mumbai – the financial capital of India, has 41 per cent homeless population out of its 12.4 million population of Greater Mumbai (Penn Institute for Urban Research, 2019). The prevailing circumstances are forcing them to live on pavements, railways, under flyovers, inside concrete pipelines or in open available public spaces. This has increased the issues of begging at public places and crime against women and children, and many times cases like molestation and rape go unreported among homeless women (Natu & Das, 2021). Similarly, in the national capital of India (New Delhi) there are about 750 slum areas, the concentration of slums population in these areas is around 15 to 20 lakhs. Ensuring urban governance in these areas is a challenging task for the concerned local government. Moreover, Delhi is experiencing the highest population growth rate among mega cities in India. Its population is expected to be over 27 million in 2021, according to estimates. A severe lack of housing and related infrastructure has emerged in Delhi as a result of fast population growth and shifting socio-economic patterns, particularly for the poor and low-income households. Nearly half of the population, on the other hand, lives in abject poverty, crammed into congested slums. (Sivam, 2021). Additionally, as per Census 2011, access to tap water in urban India is about 70 per cent and the rest have to walk long distances. For example, in Chhattisgarh only 50 per cent households have access to water outside their premises. Even in states like Tamil Nadu and Madhya Pradesh things are no better with all their attendant public health hazards. Furthermore, a bird's eye view of the access to tap water and toilets in other states of India is presented in Table 2.

TABLE 2

<i>Access to Tap Water in below mentioned States</i>	<i>per cent</i>	<i>Access to Toilets in below mentioned States</i>	<i>per cent</i>
Chhattisgarh	51.3	Chhattisgarh	39.8
Nagaland	47.9	Uttar Pradesh	18.0
Tamil Nadu	46.0	Odisha	35.2
Madhya Pradesh	44.6	Jharkhand	32.8
Odisha	43.1	Bihar	31.0
Jharkhand	39.9	Maharashtra	28.7
Andhra Pradesh	32.0	Madhya Pradesh	25.8
Karnataka	30.0	Tamil Nadu	24.9

Source: Census, 2011

Urban Transport System: Most Indian cities have struggled with urban transportation challenges for many years, limiting people's mobility and stunting urban economic growth. These issues are caused by a prevailing modal split imbalance, insufficient transportation infrastructure and its inefficient use. The lack of synergy between land use and transportation planning, and no increase in city bus service, all of which support a move to individualised modes of transportation. As a result, the Indian government passed the National Urban Transport Policy in April 2006. The policy largely deals with people's mobility rather than vehicle mobility (Vaidya, 2009). But the implementation part as usual remains unsatisfactory (Mueller, 2020). Urbanisation is currently growing at a rate of 3.16 per cent per year, while automobile sales are expanding at a rate of nine per cent each year. The overall number of automobiles on the road has increased dramatically from 55 million in 2001 to 210 million in 2015. Two-wheelers accounted for 73.5 per cent, autos, jeeps, and taxis for 13.6 per cent, buses for 4.4 per cent, freight vehicles for 4.4 per cent, and other vehicles for 7.5 per cent. Since 2001, the proportion of two-wheelers has increased by 3.40 per cent, while the proportion of cars, jeeps, and taxis has decreased by 0.80 per cent, the proportion of buses has decreased by 0.2 per cent, the proportion of cargo vehicles has decreased by one per cent, and the proportion of other vehicles has increased by 3 per cent. Many cities' public transit systems have shrunk, and some services have been terminated entirely (Gijre & Gupta, 2019). Eventually, it has derailed the urban governance process in city areas, as the municipalities failed to tackle these urban transport emerging challenges as it is beyond their administrative and financial capacity (Indian Institute for Human Settlements, 2019).

Issue of Urban Sustainability: The rising urbanisation clearly indicates that urbanisation is the way forward. In order to tackle the global urban challenge, Chilean architect Alejandro Aravena states, "we will have to build a one-million-person city per week with 10,000 dollars per family during the next 15 years. If we don't solve this equation, people will come anyhow, but they will live in slums, favelas and informal settlements." (Urban Net, 2016). But in India, the required urban infrastructure has not been developed so far. According to several studies, "65 per cent of the 7933 urban settlements lack a master plan, which serves as a tool to guide and regulate city development and is essential for managing urbanisation and spatial sustainability". (NITI Aayog, 2021). Moreover, the capacity building of urban local bodies is another matter of concern for future planning and creating urban infrastructure to tackle emerging urban issues. But the irony of Indian ULBs is that they are facing financial crisis, even some municipalities

are not able to pay the salary to their employees. Their financial capacity can be better understood by the statistics mentioned in Table 3.

TABLE 3: FISCAL STATUS OF INDIAN ULBs (2002-18)

<i>Financial Year</i>	<i>Municipal Revenue as per cent of GDP</i>	<i>Municipal Expenditure as per cent of GDP</i>	<i>Municipal taxes as per cent of combined tax revenues of Centre, states and local bodies</i>	<i>Municipal own revenue</i>
2002-03	1.05%	1.08%	2.4%	0.37%
2007-08	1.02%	1.09%	1.7%	0.52%
2012-13	1.05%	0.83%	1.8%	0.50%
2017-18	1.00%	0.78%	1.8%	0.50%

Source: 15th Central Finance Commission of India.

The facts and figures mentioned in Table 3 depict that municipal revenue as percentage of country's Gross Domestic Product (GDP) was 1.05 per cent in the year of 2002-03 and in 2017-18 it reached at 1.00 per cent. Similarly, Municipal combined tax revenue of Centre, state and local bodies has declined from 2.4 per cent in 2002-03 to 1.8 per cent in 2017-18. But the ray of hope lies in Municipal own revenue, as it has increased from 0.37 per cent in 2002-03 to 0.50 per cent in 2017-18.

Urban Governance and Financial Position of Major Urban Local Bodies of India: To understand this phenomenon, the researcher has chosen the six largest Municipal Corporations (MCs) of the country. Furthermore, the issues pertaining to their governance mechanism has also been elaborated (See Table 4).

TABLE 4: FINANCES OF SIX LARGEST MUNICIPAL CORPORATION OF INDIA

<i>Municipal Corporation</i>	<i>Municipal Revenue</i>		<i>% Change</i>	<i>Municipal Expenditure</i>		<i>% Change</i>
	<i>2012-13</i>	<i>2017-18</i>		<i>2012-13</i>	<i>2017-18</i>	
Mumbai	14104.3	18601.2	31.88%	12598.4	15740.6	24.94%
Bengaluru	3870.0	6371.5	64.64%	4950.0	4476.7	-9.56%
Hyderabad	3375.7	5379.7	59.37%	2587.4	4165.8	61.00%
Ahmedabad	5317.4	8006.5	50.57%	3297.0	4838.2	46.75%
Chennai	4800.5	8704.9	81.33%	4588.3	9444.5	105.84%
Kolkata	7261.8	8976.1	23.61%	6906.8	8468.2	22.61%

Source: Finances of Municipal Corporations in Metropolitan Cities of India, Indian Council for Research on International Economic Relations (ICRIER) Team, 2019.

From Table 4, it is clearly visible that a considerable (31.88%) and almost one fourth (24.94%) percentage change has been witnessed in the total revenue and expenditure of Mumbai Municipal Corporation respectively. Likewise, a considerably good percentage change (64.64%) has been observed in the revenue part of Bengaluru Municipal Corporation. However, very insignificant (-9.56%) fluctuation was noticed in expenditure part. The city of Hyderabad has experienced nearly two thirds (61%) change in its expenditure. Whereas, the revenue side too has witnessed more than half (59.37%). Ahmedabad, the capital city of Gujarat has witnessed (50.57%) change in its total revenue over the years (2012-18), nearly half (46.75%) percentage change was reported in its expenditure. Chennai stood at top with (81.33%) and (105%) change in its revenue and expenditure respectively. Lastly, the Kolkata Municipal Corporation has viewed a percentage change of 23.61 per cent and 22.61 per cent in its revenue and expenditure correspondingly.

According to the 2011 census, the Chennai Municipal Corporation had 87.28 lakh population and the same is expected to reach 115.03 lakh in 2022. The rise in population is 31 per cent over a decade. The total revenue and expenditure of the Municipal Corporation has increased by good percentage over the years 2012-18. At the same time, there are various urban governance issues that have suffered a lot due to the increase in urban population in Chennai, namely, drainage problem and scarcity of water. This was witnessed during the floods of 2020 so much so that the National Green Tribunal of India has taken a *suo -moto* action on the same and asked for a report from the State Government. The Government of Tamil Nadu in its report, listed several factors which caused the issues of encroachment, faulty drainage system, rapid urbanisation resulting in changing land patterns. Without making the necessary adjustments for an appropriate drainage system to control the flow of excess water from conventional tanks as well as flood waters from catchment areas, the modifications in land use patterns were made subsequently causing major floods (Government of Tamil Nadu, 2021). The number of water bodies in Chennai has seen a significant decline and reduction in surface area, majorly affecting the city's ability to replenish groundwater as the number of water bodies in 1893 was 60 and in the year 2017, only 28. Consequently, the people residing in the urban areas of Chennai are facing acute shortage of drinking water and water required for miscellaneous purposes. They are completely dependent on water tankers run by private agencies which bring water from other areas, subsequently, becoming a major financial burden on the citizens. Another issue ailing the city of Chennai due to the rise in population is municipal solid waste management. The identified sites of disposal, Kodungaiyur and Perungudi, have far exceeded their limits

proving to be a health hazard. Similarly, when it comes to roads and transport mechanism, according to National Crime Record Bureau, 5880 people died in road accidents from 2015-2019. Furthermore, the number of people injured in accidents over there were 35,784.

Hyderabad Municipal Corporation is responsible for ensuring governance to 67.31 lakh people according to the Census 2011, the same was expected to reach 81 lakhs in 2022. The city is witnessing tremendous rise in urbanisation. Although, the financial data provided by the Municipal Corporation shows an increase in its revenue over the years, the issue pertaining to urban governance in Hyderabad remains neglected. The city of Hyderabad has been facing issues with its drainage since many years which is attributed to many factors including unplanned construction, insufficient widening of drainage system, etc. The entire drain and sewerage system has not undergone a significant overhaul since it was modified a century ago after the catastrophic Musi river flooding; rather, successive governments have merely built additions. In 2021, the city witnessed floods like situation not only resulting in disruption of livelihood but even loss of life. With the increase in the number of industrial sectors in the centre of the city along with the peripheral areas, leading to the migration of people from different states, which eventually put pressure on the existing transport system in Hyderabad (*The Times of India*, 2021). Furthermore, due to the decrease in public transport system, the individual transportation has further deteriorated. Even metro rail is not well-connected or accessible throughout the city. The inadequacy in the transport system and incessant traffic jams have made congestion a common problem on the roads of the city. In 2022, according to Hyderabad Metropolitan Water Supply and Sewerage Board, there has been a decline in water levels in the eight major reservoirs of the city causing a havoc on the citizens, impressing upon them a need to order water through private tankers.

According to the census 2011, the population in the city of Bangalore was 86.35 lakhs that grew tremendously, with the number expected to reach 131.93 lakhs in 2022. The available data shows an increase in revenue and expenditure over the years as well. However, this financial data does not go in tandem with the reality, thereby, depicting the miserable condition of the city management. The city's current sewage system and infrastructure are unable to handle the extra water that gets accumulated once it rains. Originally, Bangalore's storm water models were developed to complement the three valleys that cut across the city - Koramangala-Challaghatta, Hebbal, and Vrishabhavathy. They were effective as long as the city's population remained within a certain range (K. N. P., 2021). As far as the roads of the city are concerned,

the city police had submitted a 567 pages report to state government, citing the reasons for traffic jams and road accidents. According to the report, the city is plagued by the issue of poor roadways and existing roadways are in poor condition. This research also identifies 518 locations with potholes. The traffic police stations at Kumaraswamy Layout, Banaswadi, Whitefield, Mico Layout, Hulimavu, and RT Nagar have the most potholed roads. "Potholes contribute to traffic jams and accidents, primarily for two-wheeler riders. The report advises that such roads be rebuilt as soon as possible. It further said that the 78 highways should not be used by vehicles until they are maintained properly. Due to the bad conditions of roads, 832 people were died in 810 incidents in 2019, 655 people died and 632 accidents occurred in 2020, with 655 fatalities in 632 accidents in 2021 (*The Times of India*, 2021).

Upon analysing the three other largest municipal corporations of India, the available data show that both the revenue and expenditure of the municipal corporations is increasing, over the years. With the increase in population and business activities in urban areas in different countries of world, the tax revenue, non-tax revenue, property tax and municipal own revenue also increased but not in accordance with the rise in urban population (Almujadidi, Azoury, Schmautzer, & Woetzel, 2019). The biggest reason for this is the municipal corporations do not have the power to fix their revenue part on their own as this power lies with the state government under Article 243X (Jha, 2012). The population in the Mumbai Municipal Corporation was 184.64 lakh in the year 2011, expected to go up to 209.61 lakh in the year 2022, with Ahmedabad Municipal Corporation being 64.12 lakh in 2011, expected to reach 84.50 lakh in 2022 whereas the figures are 140.85 lakh in 2011 expected to go up to 151.33 lakh for the Kolkata Municipal Corporation. The major urban issues pertaining to these Municipal Corporations include improper drainage system, waterlogging, inundation, inadequate infrastructure to deal with the growing population. Mumbai and Kolkata being some of the oldest cities of India are drowning in an array of problems especially due to slums issues. Mumbai has become synonymous with civic and sanitisation issues. The high density of population in the city is plagued by poor mechanism of garbage collection, thereby, leading to numerous health problems. Meagre measures are taken to provide proper sanitation and disposal of garbage (Prajna Foundation, 2021). According to National Crime Record Bureau, in the year 2019, the city of Mumbai had witnessed the highest number of road accident fatalities across the 53 cities of India. Kolkata has been undergoing tremendous strain due to urbanisation. The city also has unsatisfactory solid waste management system where conventional methods need to be modernised in order to deal with the issues at hand. Furthermore,

the built-up areas in Kolkata increased from 22 per cent in 1990 to 31.4 per cent in 2000 to 44.2 per cent in 2010 to 55.7 per cent in 2020. The heat island effect has been caused by the city's annual mean land surface temperature, which has increased by as much as 4.72 degrees celsius over the past three decades due to climate change and urbanisation. This causes heat distress in both plants and animals (*The Times of India*, 2022). In the Ahmedabad Municipal Corporation, the situation is not very different. The city has to deal with the same issues as other municipal corporations including overflow of drainage, inundations, etc, mainly due to urban sprawl. The death rate in road accidents in the city has increased by six per cent higher fatalities on the city roads, with as many as 13,456 deaths occurring in a span of two years, 2019 and 2020. Higher ratio of accidents is seen on the eastern parts of the cities when compared to the western parts, which is attributed to the movement of heavy vehicles (Avidha & Patel, 2018).

Discussion

After analysing the available data on the phenomenon being studied, it has been seen that the urban local bodies of India are under the tremendous strain on their fiscal health due to rapid urbanisation. In this regard, statistics have shown that in 1951, the urban population of India was a mere 64 million, the same had reached 286 million in 2001. Interestingly, within a decade, urbanisation reached 377 million in 2001 with the growth rate of 3.16 per cent. As a result, the already financially strapped ULBs, are under the immense pressure to meet citizens' development and service needs. (Meyer & Auriyacomb, 2019).

The researcher upon analysis of the six largest municipal corporations wherein lie the major chunk of urban population found that although, the financial records of these states show minor variations, the urban governance in these six cities is struggling almost the same problems like drainage system, scarcity of water resources, inadequate transport systems, etc. The municipal corporations remain entangled in trying to solve the same issues every year which seem recurrent, thereby, unable to cast its focus on real development of urban infrastructure, such as, widening of roads, alternative transport facilities, health and educational infrastructure development, etc. The governing bodies (UBLs) of major cities are under many constraints and are not autonomous, with no financial and administrative independency. Under such circumstances, there is a need to strengthen ULBs in India, because the urban areas contribute 63 per cent share in the national GDP (Gupta , 2019). Ironically, institutions meant for management of cities has been placed under the control of state governments, by placing

them under State List. The dependency level of ULBs is very high. For example, city management is lacking in many ULBs around the country, and several city-level tasks are performed by parastatals (managed by and accountable to the state). Several taxing powers have not been given to these entities, putting local finances under strain. These issues are likely to result in poor public service delivery in cities. (Kaur & Gupta, 2020; Bagchi, 1999; Paul, 2014).

Moreover, the fiscal status of Indian ULBs is worst and these are the weakest ULBs of the world (Mohanty, 2016). In this regard, we have analysed the case of some countries in terms of their local government. Therein, it has been seen that the ratio of local government revenue as percentage to gross domestic product at factor cost in Austria is estimated at 7.8 per cent, Estonia 10.4 per cent, Czech Republic 11.6 per cent, United Kingdom 13.9 per cent, Norway 14.2 per cent, Italy 15.3 per cent, Finland 22.4 per cent, Denmark 37.1 per cent. On the other hand, Portugal stood at 6.3 per cent, Spain 6.4 per cent and India at 1.03 per cent (Mohanty, 2016). Keeping in view the rising urban population, the need of the hour is that the ULBs should be given adequate authority in financial matters to lead the cities (engines of growth) towards amelioration.

The cities which are highly urbanised like New Delhi, Chandigarh, Goa, Hyderabad, Mumbai, Chennai, Bangalore, Kolkata, etc. has reached at a particular point wherein their resources and capacity have been threatened. Now, the higher tier of the government should develop other adjoining areas of the cities to ensure balance of migration to ensure that the people can make their shift in the newly emerging cities too. Furthermore, according to an Oxford economic analysis, 10 of the world's fastest-growing cities will be from the Indian subcontinent in the next few years, since their GDP will rise at an exponential rate. Surat, Agra, Bengaluru, Hyderabad, Nagpur, Tiruppur, Rajkot, Tiruchirappalli, Chennai, and Vijaywada are some of these cities. However, it requires transformation and desirable change in the existing urban framework and procedural administrative setup (Gupta, 2019; World Bank, 2015).

With the existing Indian models of urban governance and approaches to tackle issue of urbanisation, millions are being denied the basic necessities like access to tap water, access to toilet, affordable housing, transport facilities, quality education, quality air to breathe, etc. Moreover, due to the prevailing municipal financial system and urban governance mechanism, none of our cities features among the top 50 cities in many global rankings (NITI Aayog, 2021). Likewise, Indian ULBs failed to provide range of civic services and basic necessities to their clients, because of non-availability of financial resources (Mohanty,

2016). To ensure urban governance, time bound delivery of services and well-being of country's fiscal health, cities must strengthen without any further delay. Cities function similar to living beings. Their economic and social infrastructure must be in a good working order for them to thrive. This can be accomplished in a variety of ways, including the use of spatial planning, giving them reasonable and legal rational powers of raising finance on their own (NITI Aayog, 2021). In addition, the rising urban population in city areas should not be considered as burden, as urbanisation is boon or a bane always depends on how the same is being handled. China has the potential to bring growth as it goes hand in hand with development (Gangola, 2020). In case of India, National Commission on Population in its report has projected that 36.8 per cent population (600M) will be in cities by 2036 (*Observer Research Foundation, 2021*). As a result, the country's urban local governments are in desperate need of attention in order to ensure urban governance and long-term growth (Bernardo, 2020; Zargar S., 2020, Gupta, 2019; Gijre & Gupta, 2020).

CONCLUSION

In spite of having limited funds and financial autonomy at their disposal, the Indian cities are contributing 62 per cent to the GDP. Taking their economic contribution into consideration, one can say that cities are playing a very important role in growth and development of India. They will play an even more vital role for the same in the coming days. Therefore, at present, the only sector which is in dire need of reform, transformation, and autonomy is the Urban Local Bodies of India. The imperatives for India in 2022 include improving the lives of marginalised communities, establishing systems for citizen participation in civic activities, and limiting population increase. The Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Housing for All, Smart Cities, Swachh Bharat, and Rurban Missions, among other national and state-level efforts, provide an opportunity to better manage India's urban transition. Governments at all levels, national, state, and municipal must work harder to guarantee that the benefits of urbanisation reach all segments of society.

REFERENCES

1. Almujadidi, L., Azoury, C., Schmutz, D. and Woetzel, J. (2019). Unlocking the full potential of city revenues. New York: McKinsey and Company. Retrieved June 12, 2022, from <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/unlocking-the-full-potential-of-city-revenues>
2. Avidha, R. M. and Patel, A. C. (2018). About Urban Sprawl: A case Study of Ahmedabad City. *International Research Journal of Engineering and Technology*, 5(01), 2-3. Retrieved July 9, 2022.

3. Bagchi, S. (1999). Myth of empowering Urban Local Bodies. *Economic and Political Weekly*, 1-2.
4. Bandyopadhyay, S. (2014). Municipal Finance in India: Some critical issues. New York: International Center For Public Policy.
5. Bank, W. (2015). East Asia's Changing Urban Landscape. In W. Bank, East Asia's Changing Urban Landscape : Measuring a Decade of Spatial Growth (p. 02). World Bank Publications. Retrieved from <https://ebookcentral.proquest.com/lib/inflibnet->
6. Chapagain, D. (2018, December 12). Present Situation of Urbanization in Nepal. *International Journal of Humanities Social Sciences and Education (IJHSSE)*, v (12), 1-6. Retrieved June 5, 2022, from <https://www.arcjournals.org/pdfs/ijhsse/v5-i12/17.pdf>
7. Datta, A. (1995). Municipal Reforms in India: Comparative models and processes. *Economic and Political Weekly*, 1-5.
8. Friedman, J. (2018, April). What is Urbanization and what are the positive and negative effects. 1-8. Conservation Institute.
9. Gangola, P. S. (2020). Urbanization: Boon or Bane with Reference to Rudrapur. *Indian Journal of Society and Politics*, 7(2), 1-6. doi: 2455-2127
10. Gijre, V. and Gupta, S. (2019). Urban Transport Governance Practice and Challenges in an Emerging Economy –Case Study of India. Mumbai: Transportation Research Procedia. doi:2435-2445
11. Government of India. (2016, June). Urbanisation in India. Retrieved from https://en.wikipedia.org/wiki/Urbanisation_in_India#:~:text=The%20population%20residing%20in%20urban,to%20reside%20in%20urban%20areas.
12. Government of Tamil Nadu. (2021). Before the Honorable National Green Tribunal. Chennai: Insight I.A.S. Retrieved July 11, 2022, from <https://www.insightsonindia.com/2021/09/27/state-government-report-on-chennai-flood/>
13. Gupta, P. (2019, August 7). Three-fourth of India's GDP to come from urban population if these reforms are made. Retrieved from *Financial Express*: <https://www.financialexpress.com/economy/three-fourth-of-indias-gdp-to-come-from-urban-population-if-these-reforms-are-made/1668629/>
14. Indian Brand Equity Foundation. (2013, March). Jammu and Kashmir Paradise on Earth. 1-48. New Delhi: IBEF.
15. Indian Institute for Human Settlement (2019). Urban Transport In India: Issues and Challenges. New Delhi : IIHS.
16. Jha, R. K. (2012). Public Finance. Puduchery: Pearson. Retrieved July 10, 2022.
17. K, N. P. (2021, December 4). Bengaluru's stormwater drain story: Lack of planning, design, maintenance. Bengaluru, Karnataka: Citizens Matter. Retrieved July 11, 2022.

18. Kapoor, A. and Sinha , H. (2020, November). View: India's urbanisation challenges and the way forward. 1-15. New Delhi: *The Economic Times*.
19. Kaur, P. and Gupta , S. (2020). Examining urban local governance in India through the case of Bengaluru. PRS Legislative Research, 1-8.
20. Kaw, M. A. and Annanya, S. (2016). Urbanization and its impact. Taylor and Francis, 1-16.
21. Khan, K. A. and Mondal, N. A. (2018). Urbanisation Level and Pattern in Jammu and Kashmir: A Regional and District level Analysis. *IJAR- International Journal of Research and Analytical Review*, 5(3), 1-6.
22. Kousar, R. (2021). Border conflict: Undersatnding the impact on the Education of the children in Jammu region. Taylor and Francis, 1-25.
23. Meyer, N. and Auriyacomb, C. (2019). Good Urban Governance and City Resilience: An Afrocentric Approach to Sustainable Development. MDPI, 11(19), 1-12. doi:10.3390/su11195514
24. Ministry of Housing and Urban Affairs. (2021). Government of India.
25. Mohanty, P. K. (2016). Financing Cities In India. New Delhi:SAGE Publication India Pvt. Ltd, 978-93-515-0875-5, P 150-180.
26. Mueller, B. (2020). Why public policies fail: Policymaking under complexity. Science Direct: *Economia*, 1-12. doi: D8; D04; D78; H5
27. Mukherjee, B. S. and Schutt, B. (2018). An overview of the impact of land use land cover changes (1980-2014) on urban water security of Kolkata. Tylor and Francis, 1-21. doi:10-3390.
28. Natu, N. and Das, M. (2021). No shelter for homeless women for whom each day is fraught with risk. 1-8. Mumbai, Maharashtra: *The Times of India*. Retrieved from <https://timesofindia.indiatimes.com/city/mumbai/no-shelter-for-homeless-women-for-whom-each-day-is-fraught-with-risks/articleshow/86330856.cms>
29. NITI Aayog. (2021). Reforms in Urban Planning Capacity in India. New Delhi: Government of India. Retrieved from <https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf>
30. Observer Research Foundation. (2021). Managing India's Urban Transition in 2021. New Delhi: Observer Research Foundation (ORF).
31. Office of the Registrar General and Census Commssioner of India. (2001). Variation in Population since 1901. New Delhi: Ministry of Home. Retrieved from https://censusindia.gov.in/census_data_2001/india_at_glance/variation.aspx
32. Organisation for Economic Co-operation and Development. (2020). Current trends in decentralisation. New york: OECD.
33. Paul, S. (2014). Finances and Governance of Urban Local Bodies: An Approach Of Uban Deveelopment Perspective from a Developing Country (India). *Journal of Urban and Regional Analysis*, 1-6.

34. Penn Institute for Urban Research. (2019). The Hidden Costs of “In-Situ” Slum Redevelopment in Mumbai. Mumbai: Penn Institute for Urban Research.
35. Poel, V. D., Donnel, O. O. and Doorslaer, E. V. (2009). The Health Penalty Of China’s Rapid Urbanization. Rotterdam: Tinbergen Institute. Retrieved 12 14, 2021.
36. Praja Foundation. (2021). Report on Status of Civic Issues in Mumbai. Mumbai: Praja Foundation. Retrieved July 8, 2022, from https://www.praja.org/praja_docs/praja_downloads/Report%20on%20Status%20of%20Civic%20Issues%20in%20Mumbai%202021.pdf
37. Prasad, V. S. and Xueqian, S. (2017). Urbanization and Its Impact on Rural Livelihoods: A Study of Xichang City Administration, Sichuan Province, China. *Chinese Journal of Urban and Environmental Studies*, v(4), 4-12. doi:10.1142/S2345748117500282
38. Robert, W. E. (2016). Urban Governance. U.K: Governance social development Humanitarian conflicts.
39. Singh, C. and Singh, C. (2015). Financing of Urban Local Bodies in India. New Delhi: Decan Herald, Indian Institute of Management Bangalore, Working Paper NO. 493.
40. Sivam, A. (2021). Housing Supply in Delhi. *Journal of Urban Affairs*, 20, 1-15. doi: 10.1016/S0264-2751(02)00121-X
41. Slack, E. (2009). Guide to Municipal Finance. Nairobi: United Nations Habitat, 978-1-132027-5, P 12-56.
42. *The Economic Times*. (2021, February). How Chennai, one of the world's wettest major cities, ran out of water. Chennai, Tamil nadu, India: The economic times of India . Retrieved from <https://economictimes.indiatimes.com/news/politics-and-nation/how-chennai-one-of-the-worlds-wettest-major-cities-ran-out-of-water/articleshow/80680182.cms>
43. *The Hindu*. (2018, May). Urbanization on the rise in India. 1-16. New Delhi.
44. *The Hindu*. (2021, July). Water Shortage in Delhi due to Mismanagement. Retrieved from <https://www.thehindu.com/news/cities/Delhi/water-shortage-in-delhi-due-to-mismanagement/article35270022.ece>
45. *The Times of India*. (2020, November). Greater Hyderabad Municipal Corporation proposes Rs 5,600 cr. budget for next fiscal year. Hyderabad, Telengana, India.
46. *The Times of India*. (2021, November 13). Bengaluru saw most accidents caused by overspeeding last year: NCRB. Bengaluru, Karnataka: Times of India. Retrieved July 11, 2022, from <https://timesofindia.indiatimes.com/city/bengaluru/bluru-saw-most-accidents-caused-by-overspeeding-last-year-ncrb/articleshow/87676008.cms>
47. *The Times of India*. (2021, July 16). Hyderabad rains: Repeat of nightmare 2020 as drains overflow. 6. Hyderabad, Telengana: Times of India. Retrieved July 11, 2022.

48. *The Times of India*. (2022, April 8). Kolkata hotter by nearly 5°C as urban sprawl grew 33% in 30 years. Kolkatta. Retrieved July 8, 2022.
49. United Nation Habitat. (2015). *The Challenge of Local Government Financing in Developing Countries*. Nairobi: UN- Habitat.
50. United Nations. (2018). *World Urbanization Prospects*. New York: United Nations (Department of Economic and Social Affairs).
51. Urban Net. (2016). *The Role of Local Governments in Sustainable Urbanisation*. 1-15. New york.<https://www.urbanet.info/local-governments-sustainable-urbanisation/>
52. Vaidya, C. (2009). *Urban Issues, Reforms and way forward in India*. New Delhi: Department of Economic Affairs, Ministry of Finance, Government of India.
53. World Bank. (2015). *East Asia's Changing Urban Landscape: Measuring a Decade of Spatial Growth*. New york: World Bank.
54. World Bank. (2020). *Understanding Poverty*. Chicogo: World Bank. Retrieved from <https://www.worldbank.org/en/topic/urbandevelopment/overview>
55. Zargar, S. (2020, October 16). Why a potential property tax in Jammu and Kashmir has drawn protests from local parties. Srinagar, Jammu and Kashmir, India. Retrieved April 12, 2021, from <https://scroll.in/article/975727/why-a-potential-property-tax-in-jammu-and-kashmir-has-drawn-protests-from-local-parties>

The Typologies of Urban Mixed Landuse: Their Characteristics, Geographical Applicability, Regulations and Prevalence in Pune, India

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ABSTRACT

Mixed landuses are extensively promoted in the contemporary urban planning concepts and policies. In many cities like Pune, mixed landuse is a natural phenomenon existing without being a regulatory compulsion. The form and extent to which different uses mix can vary extensively, giving rise to various mixed landuse types. It gives the opportunity to observe and research the various types in which mixed landuses occur. This research, through literature review and field observations, has defined the mixed landuse typologies. The applicability of the typologies at various geographical scales is discussed. Observation in the three neighbourhoods of Pune, revealed that the vertical and horizontal mix is prevalent along with single-use. There is a certain amount of neighbourhood mix in all three neighbourhoods. Unplanned mixed landuse where originally designed spaces for residential use is being used for non-residential use is also dominant.

Keywords: *Mixed Landuse Typology, Applicable Geographical Scale, Mixed Landuse Typology Prevalence, Planned and Unplanned Mixed Landuse*

INTRODUCTION

Mixed landuse is a contemporary planning strategy promoted in many urban planning policies such as smart city, new urbanism,

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compact city and 15-minutes city (Pisano, 2020; Zagorskas, 2016). The popularity is due to the mixed landuse character of co-locating various uses, thereby reducing travel distances and increasing social connection (Jacobs, 1961; Grant, 2002; Bahadure & Kotharkar, 2015). Cities have been traditionally mixed settlements with homes and workplaces located within walking distance. The segregated single-use zoning and planning practised since the industrial revolution to protect homes from the impoverished environment around factories prevented the natural and synergic mixing of uses and made the cities automobile-dependent (Herndon, 2011). Post-World War, as city cores declined, single-use zoning faced criticisms of being unsustainable and socially non-conducive (Grant, 2002). Jane Jacobs's book '*The Death and Life of Great American Cities*', published in 1961, portrayed the social relevance of mixed landuses and criticised single-use zoning. This book became the genesis of the revival of mixed landuse in urban planning practices. Since then, mixed landuse in the western world has been encouraged as urban infill, urban renewal, and improved neighbourhood quality strategy (Vreeker, et al., 2004). Mixed landuse in this context can be defined as '*the extent of coexistence of non-residential uses with residential use in an integrated way within walking distances of homes*' (Hirt, 2007).

In Indian cities, the mixing of landuses is a natural phenomenon occurring without being a regulatory compulsion. The city's central core, developed before colonisation, is traditionally highly mixed with a high density of commerce and residences (Spodek, 2013). In contrast, areas developed during the British occupation, have very low density that now houses institutions. The plague in 1896 was associated with poor hygiene and overcrowding in the core areas of the cities, calling for decongestion and segregation. But, owing to the visit of Sir Patrick Geddes in 1914, the foundations of the present-day city planning in India were set, allowing natural mixing of uses (Guha, 2020). He deeply appreciated local culture, heritage and architectural form and advocated for careful restructuring of human habitat and life rather than *ad-hoc* redevelopment. Today's planning practice in Indian cities allows self-led development guided by liberal development plans (Dave, 2010). However, in recent times mixed landuse is being formally recognised in Indian city planning in its Smart City Mission (MoHUA, 2016) and Transit-Oriented-Development Policy (MoHUA, 2017). As it gets formally included in the planning process, the nature or typology of the existing mixed landuse that has naturally evolved must be understood and appropriately managed, promoted or controlled for effective development of implementation methods. The article fulfils the need to define mixed landuse typology and examine the laws

governing their predominance. The implementation of mixed landuses is influenced by many social, cultural, and historical facets of a city (Rowley, 1996). Mixed landuse is not the actual use of land but refers to mixing various other defined landuses. The types, proportions and forms of the different landuses are vital for mixed landuses. If the right balance in mixing the uses is not met, residents may have to suffer from lower housing affordability, noise, litter, privacy, etc. (Mouratidis, 2019; Moos, et al., 2018; Neuman, 2005). In India, in the absence of stringent regulations, the problems associated with mixed landuse can become more intense and diminish its benefits (Dave, 2010; Kotharkar, et al., 2012; Williams, 2004).

To have a conducive mixed landuse, it is essential to understand the various components of mixed landuses. Rowley (1996) and Hoppenbrouwer & Louw (2005) discuss the urban factors that influence mixed landuses such as density, grain, layout, permeability and public policy. Other components of mixed landuse discussed in the literature are – 1) the geographical scale of consideration (floor of a building, plot, street, block, neighbourhood, city or region) (Rodenburg & Nijkamp, 2004); 2) the quantifiable intensity of mixed landuses (Manaugh & Kreider, 2013; Gehrke & Clifton, 2016; Song, et al., 2013); 3) the actual uses and their subcategories that are mixed (multi-home apartment, single-family home, barber shop, stationery shop, school, manufacturing industry, etc); 4) The typology of mixed landuse (the design form in which different uses are integrated) (Hoppenbrouwer & Louw, 2005; Narvaez & Penn, 2016). Although there is considerable literature regarding components one and two, they are rarely used as legal implementation tools. The third component is extensively regulated across cities worldwide in the form of the zoning – landuse matrix. But, there is very little literature on defining the fourth component, the mixed landuse typology, in literature. This paper aims to fill this research gap by defining mixed landuse typologies, especially for developing nations like India.

Methods and Materials

First, the mixed landuse typologies mentioned in the literature were reviewed. Based on the literature, theoretical mixed landuse typology is defined. Second, the applicability of these typologies in different geographical scales was checked. Third, the mixed landuse typologies in the three selected neighbourhoods of Pune were mapped. Fourth, the prevalence of the mixed landuse typologies in the neighbourhoods was analysed. Lastly, the implication of the planning regulations on the typologies is discussed.

Literature on Mixed Landuse Typologies

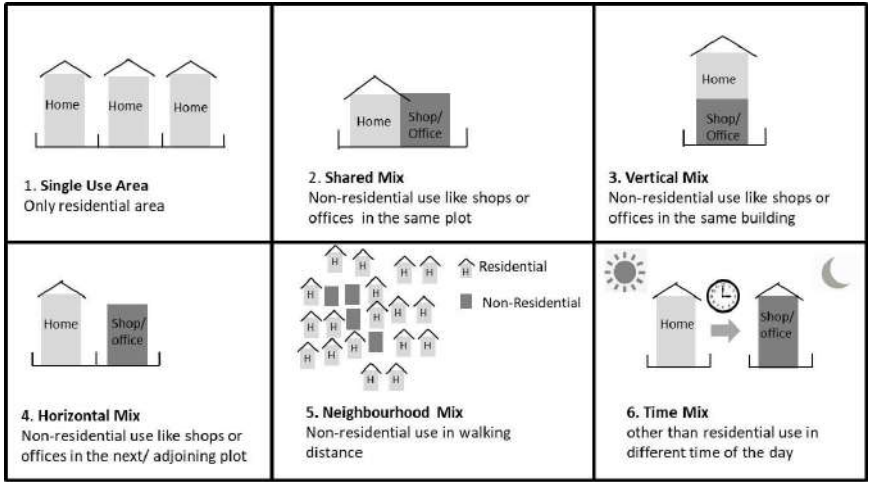
Hoppenbrouwer and Louw (2005) classify mixed landuse into shared, vertical, horizontal, and time mix. In this classification, it is assumed that one use is residential. A shared premise refers to sharing one single plot or premise for residential and work purposes. An example can be a doctor's residence with an outpatient clinic in the front room of his house. Vertical-mix refers to different uses on different floors of a building. Time-wise mix refers to those premises used as a residence and other use at different times of day, week, or month. Horizontal-mix refers to different uses among adjacent premises. Yinan (2009) has added a single function to the dimensions for better comparative understanding. Placemakers (2013) also added block level mixed-use apart from vertical, horizontal and time dimensions. A distinction is made between enterprises employing nearby residents and those run by outsiders. There are studies that look at mixed landuses from beyond the physical or spatial perspective and other dimensions. Evans & Foord (2007) have considered social mix (income, housing tenure, demography, visitors, lifestyles), economic-mix (activity, industry, scales (micro-large), consumption-production), physical land-use mix and temporal mix. Grant (2002) has also considered a mix of different types of housing as a kind of mixed landuse. Narvaez & Penn (2016) defined the typology based on the architectural characteristics based on the location and floor occupancy of uses in a building. For India, Raman & Roy (2019) showed that mixed landuses could be categorised as planned and unplanned. Self-led development of unplanned mixed landuse could be legal. However, there may also be unlawful mixed landuses like running offices in residential apartments without adequate infrastructures like parking or street vending. He has further categorised the legal mixed landuses as zonal, tonal (allowed addition of small proportion of another use to a principal use of a plot) and composite mixed landuses.

Mixed landuse typology in Indian City

The term 'plot' needs some deliberation while defining the mixed landuse typology in the Indian context. A plot is a land parcel enclosed by defined boundaries (UDCPR, 2020), reflected in the legal land records or city survey documents. A plot can have individual or joint ownership of individuals, establishments, or associations. A single-family may have their house and business on the plot. In a housing society, the plot may have multiple apartment buildings where each family has a legal share of the plot. The plot may also have certain floors used for non-residential use or a few buildings dedicated to some non-residential use.

Based on the literature, the mixed landuse typology can be of six types as shown in Figure 1.

Figure 1: Typologies of MLU



Source: Prepared by authors based on literature (Hoppenbrouwer & Louw, 2005)

These types are from a resident’s point of view and can be described as follows:

- 1. Single-use Area:** It is a purely residential area. Non-residential uses are not within walking distance. It is not mixed landuse but is necessary to include in the typology to perceive the other typologies.
- 2. Shared-mix:** Residential and non-residential uses share the premises of a plot even if individual buildings are single-use.
- 3. Vertical-mix:** Mix of uses on different floors of the same building.
- 4. Horizontal-mix:** Individual plots are single-use, but adjoining plots of different uses.
- 5. Neighbourhood-mix:** Non-residential landuses blended in residential neighbourhoods such that necessary non-residential uses are within walkable distances.
- 6. Time Mix:** Plots subjected to different uses at different times of the day/ week/ year.

Type 2 and 3 together are referred to as mixed-use plots where there are different use -occupancy in different portions of the building

or plot with one of the use as residential (UDCPR, 2020). These typologies can be further subdivided based on the number and type of non-residential use, housing typologies or ratio of residential to non-residential use. The population and built-up density of the plots and neighbourhoods and plot sizes would also drastically influence the final mixed landuse form. They could be used to further sub-categorise the typologies. However, discussions on these subcategories are out of the scope of this article.

Applicability of Mixed Landuse Typology at Geographical Scales

Individuals can identify the mixed landuse typology for their residence based on the typology defined in the previous section. However, the context of the typologies differs with geographic scale, and it is necessary to clearly state the applicability of the identified typologies at different urban geographic scale. The geographic scales considered are individual apartment (self-enclosed tenement/ flat/ dwelling unit/ premise which is a part of a building or plot with other units), building, plot, street/ block, neighbourhood, district, City (Hoppenbrouwer & Louw, 2005; Rodenburg & Nijkamp, 2004; UDCPR, 2020). The matrix indicating the applicability of the typologies at different geographical scales is indicated in Table 1. It is based on the experience of mapping mixed landuse typology for three neighbourhoods that are discussed later. The attempt had been to classify every plot into one of the typologies. The possibility of categorising a plot in one of the typologies and for a lower and higher geographical scale was checked.

TABLE 1: APPLICABILITY OF THE TYPOLOGY AT GEOGRAPHICAL SCALES

		Urban Geographical Scale					
		Individual apartment*	Building	Plot	Street/ Block	Neighbourhood	City
Mixed Landuse Typology	Single-Use	✓	✓	✓	✓	✓	
	Shared-Mix	✓	✓	✓			
	Vertical-Mix		✓	✓			
	Horizontal-Mix			✓	✓		
	Neighbourhood-Mix					✓	✓
	Time-Mix	✓	✓	✓			

*applicable only for multi-family, multistorey building.
Source: Prepared by authors.

The typologies at various geographical scales is elaborated as follows:

Individual Apartment Level: Consider a family living in an apartment of a building. It could be completely residential, or a family member could have his painting studio in one room, making the premise a shared-mix. If the apartment has only one room and kitchen and the family uses the room for making handicrafts during the day and the same room for sleeping at night, then the premise would be a time-mix.

Building Level: Consider the same apartment building, which has commercial shops on the ground floor, making it a vertical-mix. If there is no formal non-residential use in the building, but there are families carrying out certain home-based businesses like tailoring or tutoring it would be converted shared-mix. A two-storey building that has an eatery in the front, but the backside is used as residential quarters will be shared-mix. Dead non-residential usage such as parking or storage or even amenity space for the residents like clubhouse need not account for a mix. If there is a school building where the classrooms are used for sleeping at night by occasional group visitors or the homeless or serves as a disaster refuge centre, it can be called a time-mix.

Plot Level: A shared-mix would be a residential apartment building and one commercial building in a plot. If there are multiple buildings with non-residential on the ground floor and residential above, such a plot can be categorised under vertical-mix. If the buildings in the plot are completely residential, but the adjacent plot has some non-residential use, then such plots would be a horizontal-mix. The time-mix for a plot is similar to that of the building level.

Street/Block Level: A street or block may be completely single-use. Plots and buildings in the street or block may have shared or vertical-mix or have a few adjacent residential and non-residential plots (horizontal mix). Time-mix is bound to be present in every street or block, making it unnecessary as a typology at this level.

Neighbourhood Mix: A neighbourhood may be completely residential (single-use). There may be non-residential uses dispersed among residential uses in the form of complete non-residential plots or vertical/ shared mix. It may also have one block or street which is entirely non-residential, and the rest are residential. In both scenarios, non-residential uses are accessible to the residents within walking distance (neighbourhood-mix). Categorising neighbourhoods into a simple yes or no for neighbourhood mix is not relevant. Quantification of neighbourhood-mix in the intensity of mixing is more useful. Several methods of measuring mixed landuse intensity at neighbourhood level

are used in literature, such as Entropy Index, Herfindahl–Hirschman Index and Shannon’s Diversity Index MLU (Manaugh & Kreider, 2013; Song, et al., 2013; Wo, 2019; Zagorskas, 2016).

City Level: For the city level, the entire city cannot be considered as one unit for typology. Instead, the distribution of mixed landuses or intensities is more relevant. One way to do so could be mapping the neighbourhood mix in the form of mixed landuse intensity for all neighbourhoods in the city. The typologies described in this study thus do not directly apply to the city level.

Mapping of Mixed Landuse Typology in Case Study Neighbourhoods

Background of Pune and Neighbourhood Selection

The city of Pune in the western state of Maharashtra, India, has a population of 3.13 million residing in the 331.26 sq km (Pune Municipal Corporation, 2020). The city can be divided into core area, old limit and extended area. The core area of the city developed under the *Maratha Empire* between 1595 and 1817 AD, with segregation based on trade, profession, and social status rather than landuses (Mundhe & Jaybhaye, 2017; Diddee & Gupta, 2013). The core area now is a thriving market serving the entire city and beyond, an important centre of religious destination, traditional craft and industries and a very dense residential population. Low rise, high density built-up with indistinguishable plots due to high ground coverage and vertical mixed-use are the dominant characteristics of the core area. During the British colonisation between 1918 and 1947 AD, some areas were added to the core area for the local population and cantonment areas outside the core area were established. After Independence, the 20 years – Development Plans govern land development. The area covered by the development plan of 1987- 2007 is considered the old limit. Some of the areas in the old limit were developed using town planning schemes (land pooling mechanism). But mostly, the development was self-led. The old limit can be characterised by mid-rise stand-alone apartments and clear plot boundaries. A separate development plan is prepared for the areas added to the municipal corporation between 1997 and 2007. This is the extended area characterised by large gated housing societies with multiple apartment buildings, adjoining but independent commercial complexes or planned mixed landuses.

One neighbourhood from each of the three areas is taken for this study. The purpose of studying the neighbourhood is to validate the theoretical typologies identified. Narayan Peth neighbourhood has

existed since 1773 AD and has a residential population density of 35448 people per square kilometre (Mundhe & Jaybhaye, 2017; Pune Municipal Corporation, 2020). According to the Development Plan of 2007-2027, most of the Narayan Peth area is under the residential zone, and only the portion adjoining the main road is under the commercial zone. Model Colony neighbourhood was developed through a town planning scheme in 1966 and now has a residential population density of 14,395 people per square kilometre. It is under the residential zone but is located near a major commercial street. Kondhwa Budruk was included in Pune Limit after 2001 and has a residential population density of 4497 people per sq km. It is adjoining a dense village settlement as well as an industrial zone. A small portion of the neighbourhood is in an industrial zone. The results and discussion section explain how the mixed landuse typologies are affected under different zones of the development plan.

Neighbourhood Survey and Data Collection

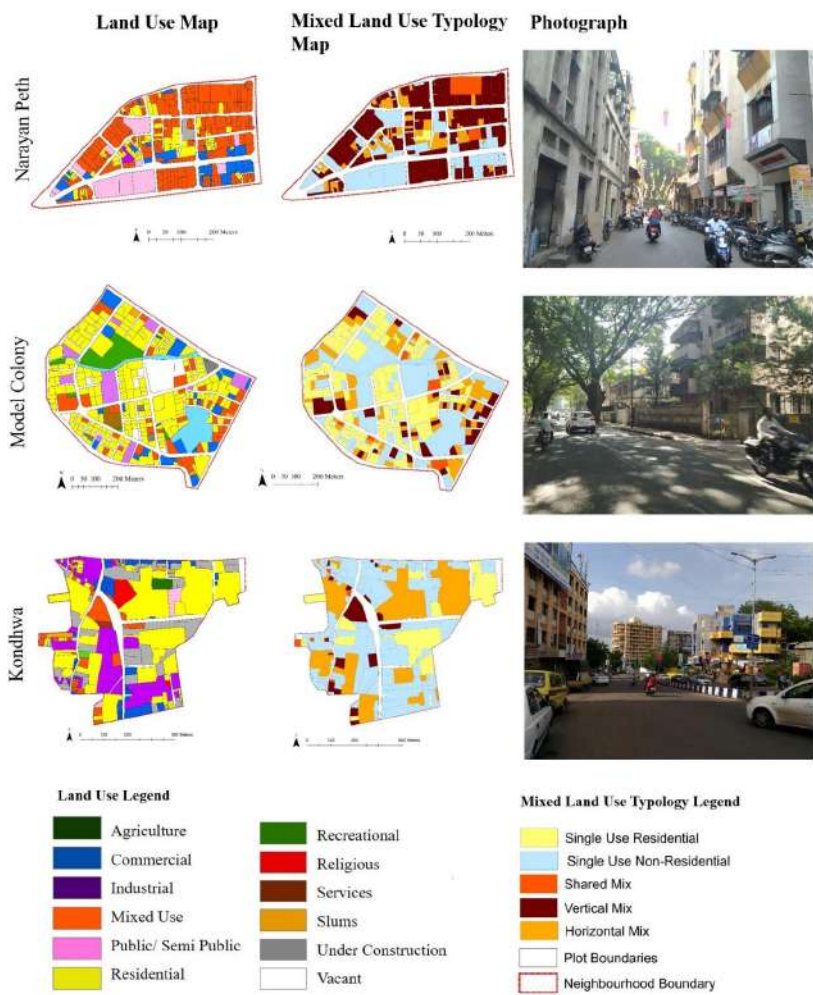
Base maps showing plot boundaries and landuse are based on the development plan maps and other literature sources (Ghosh & Raval, 2021). The neighbourhoods were surveyed during August and September 2019. The mixed landuse typology, if mixed-use, whether it is planned or unplanned, average building age and height were marked for each plot. Figure 2 illustrates the selected neighbourhoods.

Figure 2 indicates the typologies that can be defined at the plot level of the urban geographical scale. For the neighbourhood scale, the mixed landuse intensity index is computed. Time-mix was observed in a few plots in all the neighbourhoods. Some examples observed are restaurants where the staff uses some space by moving furniture for sleeping at night. There were a few household industries where family members make homemade items, and the same place is used at night for sleeping. Similarly, some of the residents ran tuition and other classes from their homes. However, they existed in the same plot with dominant other typologies such as vertical mix; hence, they were not included in the map.

Method for Computing Neighbourhood-Mix

Shannon's Diversity Index is used to compute the mixed landuse intensity or the prevalence of mixed landuse at the neighbourhood level. The index quantifies the diversity based on two components – the number of different patch types and the proportional area distribution among patch types. Adjoining plots that have the same use in the landuse map are grouped together as one patch. The index is calculated by adding the proportion of area covered by each patch, multiplied by

Figure 2: Landuse and Mixed Landuse Typology
Maps of the Neighbourhoods



Source: Landuse based on the development plan and Ghosh & Raval (2021); Mixed landuse typologies and photographs documented through the primary survey.
Note: The mixed-use category in landuse plans indicate vertical or shared mix in plots according to the development control regulations of Pune.

that proportion expressed in natural logarithm (Kajtazi, 2007; Huang & Tsai, 2013; Lu, et al., 2009; Yue, et al., 2017). It can be expressed through the following equation:

$m = \text{total number of patches, } P_i = \text{proportion of area covered by patch } i. \quad \dots(1)$

The larger the index, the more is the intensity of mixed landuse or neighbourhood-mix.

RESULTS AND DISCUSSION

Prevalence of Mixed Landuse Typology

Table 2 indicates the proportion of the total number of plots under each mixed landuse typology in the neighbourhoods. The neighbourhood mix is computed using equation (1).

TABLE 2: PREVALENCE OF MIXED LANDUSE TYPOLOGY
IN THE SELECTED NEIGHBOURHOODS

	<i>Narayan Peth</i>	<i>Model Colony</i>	<i>Kondhwa</i>
Total No. of Plots:	347	318	215
Area of Neighbourhood ((Square Kilometre	0.2	0.48	0.58
*Mixed Landuse Typology			
Single use Residential	1%	46%	8%
Single use non-residential	15%	20%	66%
Vertical Mix	63%	12%	10%
Shared Mix	1%	2%	3%
Horizontal Mix	20%	20%	14%
Neighbourhood Mix	1.02	1.04	0.77

Source: Prepared by authors.
*The cell figures indicate the per cent of the total number of plots under a mixed landuse typology.

It is observed that there is some degree of mixed landuse present in all the selected neighbourhoods even though they were not specifically planned for it. More than half the plots in all three neighbourhoods fall under one of the mixed use typologies. The distribution of plots among single-use, vertical-mix and horizontal mix varies among the neighbourhood. The prevalence of shared-mix and time-mix at the plot level is low in the selected neighbourhoods.

Shannon’s Diversity Index for neighbourhood mix needs to be cautiously interpreted. The index computation is based on two-dimensional distributions of landuses in the neighbourhood. Accordingly, Kondhwa has the lowest neighbourhood mix and model colony has the highest neighbourhood mix among the three neighbourhoods. This is despite Model Colony having the highest single-use residential plots, Narayan Peth with huge dominance of vertical mix and Kondhwa with many single-use plots. As the areas of the patches are used for computation, the plot sizes are not considered. Among the three neighbourhoods, Kondhwa has the largest area but the least number

of plots indicating that the plot sizes are large. Kondhwa being in the newly developed extended area, has a character of large residential gated societies. It also had many under-construction and vacant plots, which were considered non-residential single-use for mixed landuse typology, leading to a higher per cent. As these features generated large patches, the index value is low, reflecting the true nature of the neighbourhood mix. Narayan Peth has the smallest area with the maximum number of plots indicating smaller plot sizes. The prevalence of vertical mixed landuses in most of its plot generated a large patch. However, the index treats it as any other patch and does not incorporate the true essence of mixing in that patch. Therefore the neighbourhood mix of Narayan Peth is likely to be higher than what the index indicates. In Model Colony, the residential and non-residential uses are distributed evenly, generating smaller and many patches giving a higher index value.

Existing Regulations Regarding the Typologies

Pune follows the state's uniform development control regulations, liberal toward mixed landuses (UDCPR, 2020). The associated Development Plan indicates the dominant landuse zones for the city. It also indicates the areas reserved for public utilities and amenities. A plot's use and building regulations vary depending upon its location in a zone and local circumstances such as plot size and adjoining road width. The sub-zones are defined based on the width of the roads and the existing characteristics, creating small clusters within the neighbourhoods instead of large zones.

The amount of built-up allowed in a plot is governed by Floor Space Index (FSI). FSI for a plot varies based on the width of the adjoining road. The minimum plot area required for various uses is also prescribed with a minimum of 30 square metres for residential. Table 3 describes the regulations related to the typologies.

The regulations support the mixing of landuses in almost all parts of the city as seen in Table 3. The dynamics of city growth and change alter the demand for landuses in a particular location over the years.

Like Pune, many Development Plans and Regulations of Indian cities like Bangalore, Ahmedabad and Nagpur do not have any dedicated mixed land use zone. Mixed landuses are generally permitted in most of the landuse zones to different extents but are not compulsory. Segregated landuse planning was practised in Delhi until 2001 when mixed land uses were introduced. It has now adopted a differentiated approach towards allowing non-residential uses in residential colonies based on the characteristics of the colony. Certain streets have been proposed to be converted into mixed land uses due to the potential

TABLE 3: REGULATIONS FOR MIXED LANDUSE TYPOLOGIES IN PUNE, INDIA

	<i>Residential Zone 1 (Road width less than 12 metres)</i>	<i>Residential Zone 2 (Road width more than 12 metres)</i>	<i>Commercial Zone</i>	<i>Industrial Zone</i>
Single-Use	Single-use residential allowed	Single-use residential allowed; Single-use non-residential use in an independent building, including listed non-residential uses are allowed	All uses of residential zones are allowed. Single-use large commercial use like office parks are allowed	Residential hostels are allowed. Residential and commercial use is allowed with special permissions. Segregating distance from obnoxious industries is mentioned.
Shared Mix	Specific listed non-residential use of limited size like creche allowed but need not be in a separate building	Mixing of non-residential uses as per list without floor restrictions	Allowed	No specific mention except residential hostels within the premise of industries is allowed with additional regulations.
Vertical Mix	Shops only on the ground floor. Professional offices and home-based industries on any floor, Nursing homes on any floor with separate entry. Public library on the ground or first floor. Other listed non-residential uses are allowed.			
Horizontal Mix	Allowed – The zone names are indicative, and there is no minimum or maximum per cent necessary for particular use in a zone.			
Neighbourhood Mix	Allowed			
Time Mix	No specific mention			

Source: Prepared by authors based on 'The unified Development Control and Promotion Regulations (DCPR or DCR) for Maharashtra.

and prevalence of mixed landuses there. These practices are starkly different from the western world which implement a landuse zoning matrix and then encourage mixed landuses only in the identified zone (Ghosh & Raval, 2018).

Planned and Unplanned Mixed Landuse in the Neighbourhoods

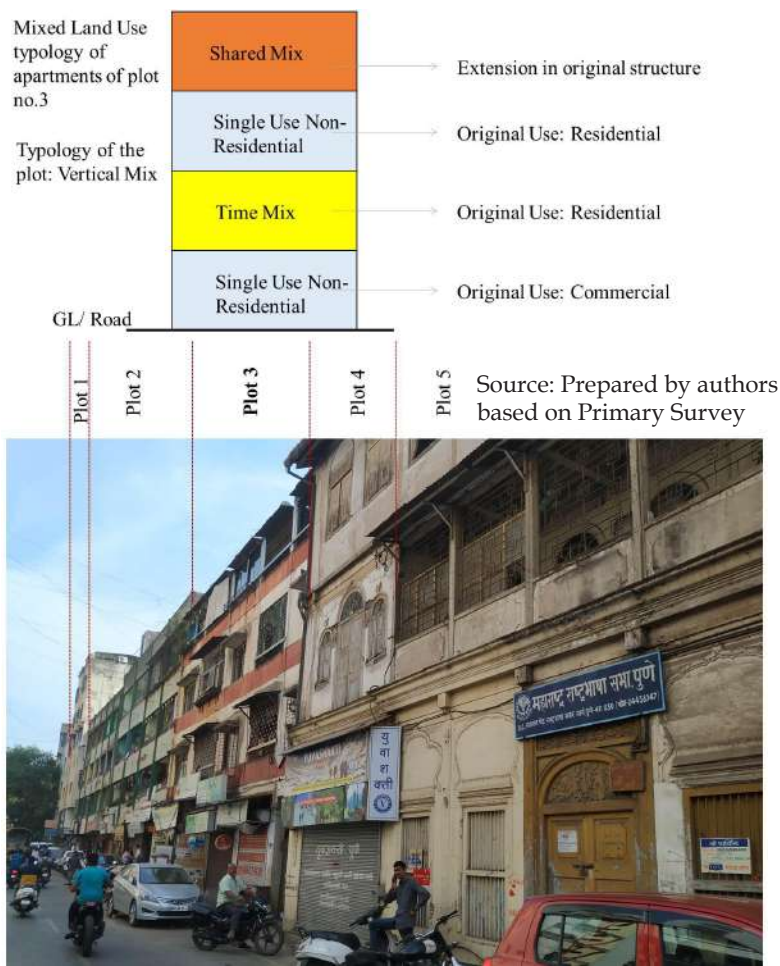
One alluring feature of mixed landuse typology observed in all three neighbourhoods is the non-residential uses in premises originally designed as a residence. The conversion from residential to non-residential use may be due to commercialisation pressure. Very few unused planned commercial spaces were observed, and none were being used for residential purposes, confirming the pressure of commercialisation. The reason could be the higher population density creates the opportunity for businesses to meet their threshold subsistence demand (Vreeker, et al., 2004). The sustenance of mixed landuses is associated with population densities (Mashhoodi & Pont, 2011). The cost of renting or buying a residential property is cheaper than commercial properties leading to small businesses finding it affordable to operate from residential properties. Moreover, property owners may find it financially more beneficial to rent to non-residential uses with a longer contract period and higher rent. There is a tax difference between residential and commercial properties.

Sub-categorisation of mixed landuse typologies into planned and unplanned may be essential in some cases as it does impact external factors such as parking, safety of remaining residents, structural requirements, fire hazard, etc. The same is elaborated through some examples.

Narayan Peth: Major places of commerce surround Narayan Peth. The real estate demand increased in the area, with many plots being redeveloped as vertical mix. As the locational importance for commercial establishments in Narayan Peth became overpowering, many residential apartments are used for non-residential purposes. In the 2007 Development Plan, some areas adjoining the main road were rezoned as commercial, due to which the redeveloped buildings that are now coming up are purely for commercial use.

Figure 3 demonstrates the mixed landuse typology classification of the apartments in a vertical-mix building in Narayan Peth. In the shown example, the building occupies 100 per cent of the plot area and shares common walls with the adjacent plots. The ground floor of the building has planned shops. The first and second floor was planned as residences. While one is occupied by a family who has a home-based business, the other is now an office. The third floor is an unplanned extension, which has a residence and a small office.

Figure 3: Sub-Categorisation of a Vertical Mix Building from Narayan Peth



As observed here, the variety of usage of built spaces is wide, making it tedious to keep official records of the real uses in every apartment, floor, and building.

Model Colony: As Model Colony was planned through Town Planning Scheme for residential purposes, it has ample recreational and public spaces. Being centrally located near Commercial Street with no crowding and parking problems, it is very attractive for small establishments like service centres and professional offices. This has led to the conversion of residential properties for office and commercial use. Figure 4 is an example of a building designed with shops on the ground floor and residences above. However, the first and second floor

is being used by computer service centres while the apartments on the third floor are entirely residential.

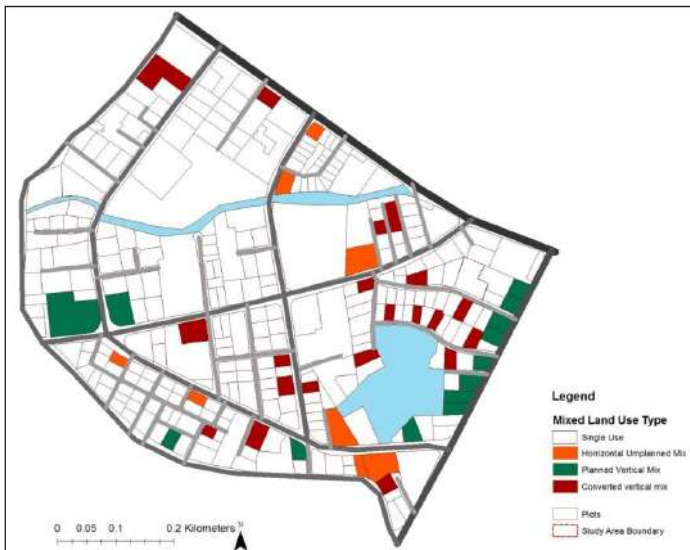
Figure 4: Unplanned Vertical Mix in Model Colony



Source: Authors

Figure 5 maps the planned and unplanned mixed-use typology at the plot level in Model Colony. While the plots adjoining the commercial streets are planned for vertical mix-use, those in the internal areas are converted.

Figure 5: Planned and unplanned mixed usage of plots in Model Colony



Source: Plot boundaries based on the development Plan; Planned and unplanned mixed landuse type mapping by authors based on primary survey

Kondhwa: Kondhwa already had the presence of small and micro industrial units, a spillover of a larger industrial estate nearby, before it was included in the corporation limit. Once included in the corporation, the vacant and agricultural land started to develop as residential and planned mixed-use. Even the industrial units were redeveloped to house residential and office use. This may be due to an increase in real estate value far more than the industrial output value. The newer large gated residential society requires a no-objection certificate from the residents' committee for alternate use of the residential property to make the unplanned mix more acceptable and better managed.

CONCLUSION

This research fulfils the main aim of defining mixed landuse typology for the Indian context. The following conclusions are made:

The mixed landuse can be categorised into typologies such as single-use, shared-mix, vertical-mix, horizontal-mix, neighbourhood-mix and time-mix.

The mixed landuse typologies are relevant to a specific geographical scale. For a particular geographical scale, some typologies are more relevant than others. The typologies defined in this study are most applicable at the plot level.

All the neighbourhoods studied in this research had some level of neighbourhood-mix. Other than single-use, the most prevailing typologies are vertical-mix and horizontal-mix at plot level. Time-mix and shared-mix are more noticeable in a smaller geographical scale of building or apartment.

The regulations allow all typologies in all major landuse zones. Mixed land-use is not compulsory anywhere, and there is no one particular mixed-use zone. Yet mixed landuses exist due to other external forces like density. Adjoining road width is the most crucial determinant of landuse and density in the regulations. The regulations specifically mention the uses which need to be compulsorily housed in an independent building.

Some of the causes for the diversification of the uses in the neighbourhoods are population density, a locational advantage for commercial, transportation ease and access, real estate value, commercial agglomeration and services offered in that area.

Unplanned mixed landuse where premises originally designed for residential purposes are used for non-residential use is observed in all three neighbourhoods. They are not illegal and need to be considered

as subcategories of mixed landuse typologies as they are relevant from structural, environmental, infrastructure and safety perspectives.

The establishment of the mixed landuse typologies that aid in comprehending landuse dynamics and developing mixed landuse strategies is the most significant application of this research. The study's main limitation is that subcategories of the typologies, such as plot size or housing category, are not explicitly discussed.

REFERENCES

1. Bahadure, S. and Kotharkar, R. (2015). Assessing sustainability of mixed use neighbourhoods through residents' travel behaviour and perception: The case of Nagpur India. *Sustainability*, pp. 12164-12189.
2. Dave, S. (2010). High urban densities in developing countries: A sustainable solution? *Built Environment - The Compact City Revisited*, 36(1), pp. 9-27.
3. Diddee, J. and Gupta, S. (2013). *Pune Queen of the Deccan*. Pune: Elephant Design Pvt. Ltd.
4. Evans, G. and Foord, J. (2007). The generation of diversity: Mixed-use and urban sustainability. In: *Urban sustainability through environmental design: Approaches to time-people-place*. s.l.:Taylor & Francis.
5. Gehrke, S. R. and Clifton, K. J. (2016). Toward a spatial-temporal measure of land-use mix. *The Journal of Transportation and Landuse*, 9(1), pp. 1721-186.
6. Ghosh, P. A. and Raval, P. M. (2021). Modelling urban mixed land-use prediction using influence parameters. *Geoscape*, 15(1), pp. 66-78.
7. Ghosh, P. and Raval, P. (2018). *Case Studies of Mixed Land use Policies*. Pune, Urban Infrastructure Development and Management, ICCRIP 2018, NICMAR, Pune.
8. Grant, J. (2002). Mixed use in theory and practice: Canadian experience with implementing a planning principle. *Journal of the American Planning Association*, 68(1), pp. 71-84.
9. Guha, R. (2020). Making Indian Cities Habitable-The Legacy of Patrick Geddes. *The India Forum*. [Online] Available at: <http://www.theindiaforum.in/articlemaking-indian-cities-habitable>
10. Herndon, J. D. (2011). Mixed-use development in theory and practice: Learning from Atlanta's mixed experiences. *Applied Research Paper*, pp. 1- 95.
11. Hirt, S. (2007). The Mixed-use Trend: Planning attitudes and practices in Northeast Ohio. *Journal of Architectural and Planning Research*, 24(3), pp. 224-244.
12. Hoppenbrouwer, E. and Louw, E. (2005). Mixed-use development: Theory and practice in Amsterdam's Eastern Docklands. *European Planning Studies*, 13(7), pp. 967-983.
13. Huang, S.-W. and Tsai, W.-J. (2013). The analysis of measurements and influence

- factors of mixed landuse. *International Journal of Bioscience, Biochemistry and Bioinformatics*, 3(3), pp. 206-210.
14. Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.
 15. Kajtazi, B. (2007). *Measuring multifunctionality of urban area*, Enschede, Netherlands: International Institute for Geo-Information Science and Earth Observation.
 16. Kotharkar, R., Bahadure, P. N. and Vyas, A. (2012). *Compact city concept: It's Relevance and applicability for planning of Indian cities*. Lima, Perú, PLEA2012 - 28th Conference.
 17. Lu, S., Huang, Y., Shi, C. and Yang, X. (2009). Exploring the Associations Between Urban Form and Neighborhood Vibrancy: A Case Study of Chengdu, China. *International Journal of Geo-Information*, 8(4).
 18. Manaugh, K. and Kreider, T. (2013). What is mixed use? Presenting an interaction method for measuring landuse mix. *The Journal of Transport and Landuse*, 6(1), p. 63 – 72.
 19. Mashhoodi, B. and Pont, M. B. (2011). *Studying land-use distribution and mixed-use patterns in relation to density accessibility and urban form*. s.l., s.n.
 20. MoHUA (2016). *Smart City Features*. [Online]Available at: <http://smartcities.gov.in/content/innerpage/smart-city-features.php> [Accessed 2020].
 21. MoHUA (2017). *National Transit Oriented Development (NTOD) Policy*, s.l.: Ministry of Housing and Urban Affairs, Government of India.
 22. Moos, M., Vinodrai, T., Revington, N. and Seasons, M. (2018). Planning for mixed use: Affordable for whom?. *Journal of the American Planning Association*, 84(1), pp. 7-20.
 23. Mouratidis, K. (2019). Compact city, urban sprawl, and subjective well-being. *Cities*, Volume 92, pp. 261-272.
 24. Mundhe, N. N. and Jaybhaye, R. G. (2017). Chronological development of Pune from 758-2014 AD. *International Journal of Environment, Ecology, Family and Urban Studies*, 7(5).
 25. Narvaez, L. and Penn, A. (2016). THE architecture of mixed uses. *The Journal of Space Syntax*, 7(1), pp. 107-316.
 26. Neuman, M. (2005). The compact city fallacy. *Journal of Planning Education and Research*, Volume 25, pp. 11-26.
 27. Pisano, C. (2020). Strategies for post-COVID cities: An insight to Paris En Commun and Milano 2020. *Sustainability*, 12(5883), pp. 1-16.
 28. Placemakers (2013). *Don't Get Mixed Up on Mixed-Use*. [Online]Available at: <http://www.placemakers.com/2013/04/04/mixed-up-on-mixed-use/>
 29. Pune Municipal Corporation (2018). *Development Plans*. [Online] Available at:

<https://pmc.gov.in/en/draft-development-plan-old-pmc-limit-2007-2027-published-us-311-mrtp-act-1966> [Accessed 2018].

30. Pune Municipal Corporation (2020). *Census data*. [Online] Available at: <https://pmc.gov.in/en/census>
31. Raman, R. and Roy, U. K. (2019). Taxonomy of urban mixed landuse planning. *Landuse Policy*, Volume 88.
32. Rodenburg, C. and Nijkamp, P. (2004). Multifunctional landuse in the city: A typological overview. *Built Environment*, 30(4), pp. 274-288.
33. Rowley, A. (1996). Mixed-use development: Ambiguous concept, simplistic analysis and wishful thinking?. *Planning Practice & Research*, 11(1), pp. 85-97.
34. Song, Y., Merlin, L. and Rodriguez, D. (2013). Comparing measures of urban landuse mix. *Computers, Environment and Urban Systems*, Volume 42, pp. 1-13.
35. Spodek, H. (2013). City Planning in India under British Rule. *Economic and Political Weekly*, 48(4), pp. 53-61.
36. UDCPR (2020). *Unified Development Control and Promotion Regulations for Maharashtra State*, s.l.: Government of Maharashtra, Urban Development Department.
37. Vreeker, R., de Groot, H. and Verhoef, E. (2004). Urban multifunctional landuse: theoretical and empirical insights on economies of scale, scope and diversity. *Built Environment*, 30(4), pp. 289-307.
38. Williams, K. (2004). Can urban intensification contribute to sustainable cities? An international perspective. *City Matters; Official Electronic Journal of Urbanicity*.
39. Wo, J. C. (2019). Mixed landuse and neighborhood crime. *Social Science Research*, Volume 78, pp. 170-186.
40. Yinan, Z. (2009). *Intensity control in mixed-used new urban area: a case study of the waterfront in Xiasha, Hangzhou*. Amsterdam, The 4th International Conference of the International Forum on Urbanism (IFoU), pp. 1395-1404.
41. Yue, Y. et al. (2017). Measurements of POI-based mixed use and their relationships with neighbourhood vibrancy. *International Journal of Geographical Information Science*, 31(4), p. 658-675.
42. Zagorskis, J. (2016). GIS-based modelling and estimation of landuse mix in urban environment. *International Journal of Environmental Science*, Volume 1.

Identifying Smart Citizens in an Indian Context: A Study of Ambala Cantonment

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ABSTRACT

The concept of Smart Cities has remained in great hype in the whole world and literature emphasises that Smart Cities actually require Smart Citizens. So, this paper questions: whether or not Citizens are worthy of accommodating Smart Cities? Data of 300 citizens from Ambala Cantonment of Haryana State of India was collected on selected parameters of Smart Behaviour with certain socio-demographic attributes with the help of a questionnaire. With the analysis of data, two segments of citizens named sluggish and smart emerged based on citizens' level of Smart Behaviour. The interesting fact came out that except 'gender' no other socio-demographic attribute differentiated between the obtained segments. Based on findings, this paper calls for citizens' active involvement for developing Smart Cities. This can be better obtained by establishing a connection between citizens and policy makers. Besides, citizens' own willingness and participation is also needed.

Keywords: Ambala, Cantonment, Smart Behaviour, Smart City, Smart Citizens, Smart Living

INTRODUCTION

Background

The mission of Smart Cities has remained a matter of great excitement amongst Indians, since its launch on 25 June 2015 by the Central Government of India. It is one of the key missions in order to fulfill the vision of 'Smart Bharat'. Under it, a total of one hundred cities were to be converted into Smart Cities during the period from 2015-2016 to

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2019-2020 as per an evaluation by 'Ministry of Urban Development, Government of India' (Bhagat, 2015). Allied with this, as declared by 'Ministry of Defence, Government of India', seven cantonment areas were also to be converted into Smart Cantonments on the line of Central Government's Smart City project. These seven cantonments include: Delhi, Ambala, Ferozpur, Deolali, Pune, Meerut, and Secunderabad cantonments ("Government to Introduce", 2018).

Since the time of British rule in India, Ambala Cantonment is one of the most reputed cantonments, and this research focuses on Cantonment Board of Ambala (CBA)¹ which is the foremost authority for the conversion of Ambala into Smart Cantonment. As stated on CBA's official website, the board has been assigned with several municipal functions such as street lighting, building activity regulation, water supply, sanitation, health, primary education, public safety, and town planning. Besides these regulatory functions, Board also undertakes additional measures under public improvement schemes, and for upgrading the quality of services being provided to the general public. CBA has travelled a long way in accepting the challenges posed by increasing pressure on civic amenities and is making constant efforts to improve the quality of life.

CBA is doing well for making Ambala Cantonment smart, and many initiatives have been completed in this direction. Chaudhuri (2017) mentioned that in phase I, under the Smart Cantonment Project, CBA successfully completed the task to rejuvenate the 3.5-acre dried pond into a lake, and this lake is named Cantonment Board Ambala Lake or CBA Lake. Sharma (2019) further mentioned that under phase II, due to the efforts of CBA, a British era defunct water body on 8-acre land is also converted into a lake which is in use for water harvesting too. Both the works are done near a town of Ambala Cantonment named Topkhana Bazar². Besides, facilities such as a walking plaza, lights, a garden, bio-toilets, outdoor gymnasium for children, open garden theater, outdoor music facility, and a floating fountain are too introduced near the lake areas. The phase III of the project is to integrate the above two water bodies (3.5-acre lake with the 8-acre lake). Also, CBA has established Parks and other facilities in Ambala Cantonment for the people to enjoy.

Smart Citizen

At the outset, it is important to mention that the literature in this field employs different terminologies for people, such as consumers, users, citizens, and stakeholders; however, in this discourse, the term 'citizens' is used. While talking about citizen-centric smart city initiatives, Cardullo and Kitchin (2017) said that the roots of these initiatives are

grounded in stewardship, civic paternalism, and neoliberal conception of citizenship for consumption choices of people to have common good. Shankar (2016) and BW Online Bureau (2019) attempted to define Smart Citizens as fully inclusive, innovative, and sustainable citizens. According to them, Smart Citizens must be law-abiding citizens with basic civic sense. They must obey traffic rules, drive within city speed limits, obey signals by not jumping them, and they respect pedestrians and senior citizens. Concerning parking, Smart Citizens must park at designated spots and not at random locations. Hygiene and cleanliness must be maintained not only at home but also outside. They must throw garbage only inside a bin and should also practice segregation during garbage disposal. Allied with this, BW Online Bureau (2019) also mentioned that Smart Citizens must make conscious use of resources such as water, heat, and electricity. They too use energy-efficient appliances and switch off all electric appliances when not in use. The website of 'bee smart city'³ popularizes the term 'Smartivist'. According to them, this type of citizen can be defined as an individual who steps forward to actively support the process of creating a better place on a voluntary basis. He or she supports the creation of smarter cities as a single expert or by establishing initiatives (e.g. loose project consortiums, new legal entities such as non-profit organizations, associations) to address specific urban, societal or municipal challenges.

Smartness of citizens is amongst one of the prime requirements of a smart city. In this regard, Gupta and Garg (2017) mentioned about six components of smart city from Cohen (2012) in which Smart People are defined as a significant component. Bayar (2017) and Simonofski *et al.* (2017) also elaborate upon the importance of citizens' role in Smart Cities as in their words citizens will be the benefit seekers from Smart City assets and from all utilities that are improved by technological, social, and cultural aspects for a Smart Living. Shelton and Lodato (2019), and Manchester and Cope (2019) said that in response to the mounting criticism of emerging smart cities strategies around the world, a number of individuals and institutions have diverted from discussions of Smart Cities towards a focus on Smart Citizens. Bull (2016), Schuler (2016), Simonofski *et al.* (2017), Nadeem *et al.* (2019), Shelton and Lodato (2019), and Feher (2020) also stressed that smart city is the shared responsibility of Government and citizens, and implementation will be more impactful if citizens and Government envision together. So, owing to the importance of this person famous as 'Smart Citizen', this term has been demarcated next.

The above discussion reveals that the citizens who can be designated as Smart need due consideration if an engaging, effective, and efficient Smart City is to be created, and understanding of factors

that impact citizens and shape their behaviour is important to study. Keeping this backdrop, the paper too emphasizes on this point and questions: when millions of rupees are spent, huge and massive efforts are put in, and cities are to be made smart for the people; are people smarter enough to preserve and maintain the standard which will be provided to them with the development of Smart Cities or Cantonments? The dream can become a reality only when the common citizens understand their responsibility and become active participant for the same. Accordingly, this paper is an endeavour to target Smart Citizens at Ambala Cantonment.

The rest of the paper is organized under five main sections (allied with different sub-sections) namely, review of literature, research methodology, analyses and interpretations, conclusion and discussions, implications, and scope for further research.

REVIEW OF LITERATURE

In this section, research papers and articles which significantly incorporated the concept of Smart Citizens are reviewed, contently analyzed, literature gap has been identified, and objectives of this study have been defined. The mission of Smart Cities in India gained momentum in 2015, so literature from that year (2015) have been searched and are presented here.

Literature Comprehension

With the exploration of literature, it was seen that there is no dearth of literature in this field. However, the authors have confined themselves only to those studies which include concept of Smart Citizens and excluded those studies which only talk about Smart Cities.

Top-Down and Bottom-up Perspectives in Smart Cities

Capdevila and Zarlenga (2015) and Gooch *et al.* (2015) examined 'top-down and bottom-up' approaches related to smart city. Capdevila and Zarlenga (2015) by using case study and interview method analyzed four different smart city aspects: 'smart districts, open collaborative spaces, infrastructures, and open data', and suggested that the 'top-down and bottom-up' perspectives were complementary to each other and their combination could strengthen the association between different city stakeholders. It was also said that 'top-down and bottom-up' initiatives were not opposed forces; but, had a synergistic effect on the innovation capacity of the city. Similar to them, Gooch *et al.* (2015) while studying role of citizens' in urban innovation concluded that innovation is both

‘bottom-up and top-down’. In their work, they too ensured and realized that ‘validation comes not only from top-down expert assessment; but also, bottom-up from the local community’. Incidentally, Zandbergen and Uitermark (2020) mentioned that ‘citizen sensing’ is one of the prime fields which sustains the ideal of smart citizenship and said that ‘smart citizens create a bottom-up antidote to otherwise top-down, controlling, surveilling and nudging forms of smart city techno-politics’.

Citizens’ Role in Smart Cities

Certain authors including Bull (2016), Cardullo and Kitchin (2017), Simonofski *et al.* (2017), Calzada (2018), Nadeem *et al.* (2019), and Feher (2020) talked about citizens’ role in building smart cities in one or the other form. In this line, Bull (2016) questioned about the role of ordinary citizen in smart cities and detailed the concept of smart citizens and smart citizen engagement. Schuler (2016) developed the similar perspective by working on the title ‘Smart Cities + Smart Citizens = Civic Intelligence?’ In the words of the author, the title introduced the relationship of three broad concepts in an algebraic way. The question mark at the end implied that this relationship might not be always true. The basic goal of taking algebra problem was to determine the value of the unknown variable, taken as smart citizens by using the concepts of civic intelligence and smart cities. The author said that ‘it is the value of smart citizens that everybody must learn and then contemplate to ensure that the society has sufficient smart citizens’. Supplementing these views, Cardullo and Kitchin (2017) critically appraised citizens’ participation in the smart city initiatives and demonstrated that ‘stewardship, civic paternalism, and a neoliberal conception of citizenship’ were the ground roots of citizen-centric smart city initiatives. By mentioning the importance of smart citizen, Simonofski *et al.* (2017) stressed that smart cities will not achieve their objectives unless the citizens (the end-users) are involved in their design. For the enforcement of their views, ‘firstly, they performed a literature review from different research fields. Secondly, a framework to compare and evaluate smart cities as enablers of citizen participation is proposed. Finally, the framework was applied to the ongoing smart city design of Namur (Belgium), allowing drawbacks and flaws in citizens’ participation to be discovered and improved’. Calzada (2018) too considered smart citizens as decision-makers instead of data providers. Further, Nadeem *et al.* (2019) stated that the citizens are the real stakeholders of smart cities and there is a challenge in maintaining the living standard of the citizens. They felt that citizen-centric approaches are in great hype in smart cities. Therefore, they emphasized on a need ‘to explore the living standard of citizens of smart city, and the same should be done by using an

effective approach which may be based upon certain parameters like safety, health, education, quality of houses, and so on’.

Next in this line, Feher (2020) after analyzing a corpus of 150 documents (containing ‘mainstream summaries, trend reports, white papers, and visions of business/ governmental/ universities/ research co-operations’) confirmed the fundamental role of human factor in the making of smart cities. It was stressed that smart citizens should not be termed only datasets; but, they should be treated as active participants for making of smart cities’ policies and plans. Certain other class of researchers bifurcated smart citizens from the ordinary citizens. Ferronato and Ruecker (2018) said that every citizen in a smart city cannot be considered as smart citizen. Shelton and Lodato (2019) proposed the two classifications that are ‘the general citizen’ and ‘the absent citizen’. In this line, they argued that the participation of citizens in any democratic governance may be crucial; but, the discussions on smart citizenship often fails to articulate how citizens are actually talked about and linked in the making of policies.

‘Course of Actions’ for Planners of Smart Cities

A novel group of researchers and academicians provided guidelines for planners of smart cities who wanted to include citizens in the development of smart cities. In this regard, Thomas *et al.* (2016) attempted to draw attention on the perspectives of ‘what a smart city should and could be’. It was suggested that citizens’ viewpoints should be used for making resilient cities. Likewise, Manchester and Cope (2019) highlighted a need of a unique model for the same and stressed on the point of citizen learning. They also tried to make the case for smart city initiatives and offered critical and creative learning opportunities. Also, it has previously been mentioned in section one that smart cities can become a reality only after engagement of citizens in decision-making by the planners and policy makers (Bull, 2016, Schuler, 2016, Simonofski *et al.*, 2017, Nadeem *et al.*, 2019, Shelton and Lodato, 2019, and Feher, 2020).

Indeed, in spite of this elaborative work, certain research gaps have been identified which need to be addressed. Next section details about the same and these become the foundation for this research.

Research Gaps and Objectives

A literature comprehension reveals that amongst Smart City literature, the focus and discussions turned towards Smart Citizens as they are the end-users, and researchers do talk about their role in Smart Cities. Authors from literature are also of the view that every citizen cannot

be termed as smart. However, efforts for identifying Smart Citizens are missing in the literature. There are no researches to empirically investigate the segments of these citizens and their profile. It can be a common sense appeal that some citizens may act smartly and others may not, and there may be reasons behind their actions; but on a practical ground, it is necessary to distinguish smart group from the remaining. Further, Indian context is minimally studied in Smart City literature. Accordingly, these two are the significant research gaps. Like so, this paper objectively works in this direction. Specifically, three objectives are worked upon. First objective is to describe citizens' behaviour on the parameters of smartness. Second objective is to present segments of citizens based on the level of smart behaviour. Third objective is about displaying a profile of smart/not-smart citizens according to their specific characteristics.

Reasoning behind first objective is the appeal that all citizens can't behave similar for all types of behaviours. One behaviour may be highly preferred whereas other may not be. Then, owing to behavioural dissimilarities different segments of consumers may be operative which needs to be identified. Lastly, if different segments exist, their distinguishing features can be identified in terms of profile. Now, next section entails on research methodology used to achieve these objectives.

RESEARCH METHODOLOGY

This section is divided into four sub-sections. At the outset, it is shown how smart behaviour is measured. Then, sections for sampling, sample profile, and statistical techniques have been fabricated.

Measurement of Smart Behaviour and Questionnaire Preparation

The measurement of smart behaviour is done keeping in view the meaning of Smart Citizen as already been defined previously. The ground for the measurement of smart behaviour is the responsible actions which are expected to be incorporated into daily actions/decisions by the citizens to have positive or less negative influence on society and environment. In this way, six types of behaviours were measured, and measuring statements were created by the researchers. These statements along with certain socio-demographic features were integrated in the form of a short questionnaire. A five point measurement from 'five to one' is used for the response anchors of 'always true to never true'. The measuring statements with statement identifiers and distribution of responses are shown in Table 1 which reveals that

TABLE 1: MEASUREMENT OF SMART BEHAVIOUR

Statements	Statement Identifier	Always True		Often True		Seldom True		Rarely True		Never True		Total	
		N	%	N	%	N	%	N	%	N	%	N	%
On a railway crossing I remain in my lane to make way for others.	Lane	119	39.7	83	27.7	55	18.3	19	6.3	24	8.0	300	100
After using a product I put the waste into the dustbin.	Waste	130	43.3	69	23.0	69	23.0	24	8.0	08	2.7	300	100
I ensure that my music system should not disturb others.	Music	153	51.0	58	19.3	47	15.7	32	10.7	10	3.3	300	100
While parking I make efforts not to block others' way.	Parking	141	47.0	97	32.3	29	9.7	24	8.0	09	3.0	300	100
While driving I do not use horn unnecessarily.	Horn	87	29.0	86	28.7	63	21.0	25	8.3	39	13.0	300	100
I buy energy efficient products or those products which are safe for the environment.	Energy	152	50.7	72	24.0	39	13.0	18	6.0	19	6.3	300	100

Source: Primary Survey Conducted by authors during April to June 2021.

responses of respondents inclined towards 'always true' category for all the statements. More than 50 per cent respondents perform smart behaviours as highlighted by identifiers 'Music' (% = 51.0) and 'Energy' (% = 50.7). Least percentage (% = 29.0) perform behaviour shown by identifier 'Horn'.

Sample Size and Sampling

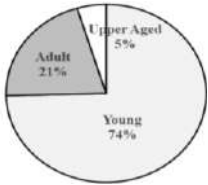
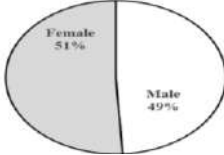
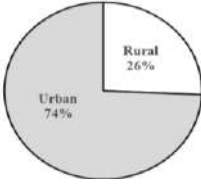
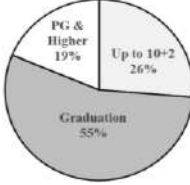
Ambala Cantonment is situated in Haryana State of India. This Cantonment has relevance since the British rule in India and was established in the year 1843. It contains a significant proportion of Indian Army and Air Force. Further, it is an important centre for manufacturing of scientific and surgical instruments and is famous as 'Science City' (Gupta and Garg, 2018).

The study being exploratory, a sample size of three hundred people is considered reasonable (Almanza *et al.*, 1994); likewise, data from three hundred respondents are collected on six parameters (identified earlier). The selection of any respondent in the sample is based on Snowball Sampling Method. As selection was not a problem, any individual could become the part of the sample. In this way, sample is constituted of the residents of Ambala Cantonment itself and also residents from its nearby areas. This composition seemed fruitful because facilities and amenities in a Smart City are not only consumed by residents of a city but also residents of its surrounding areas, villages, and towns, and their behaviour can matter a lot for the maintenance of a city's smartness. In view of this backdrop, profile of sample respondents is analyzed and presented in Table 2 in next section.

Sample Profile

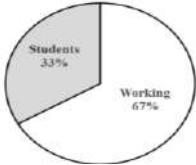
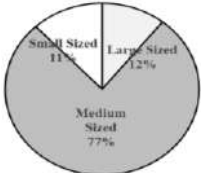
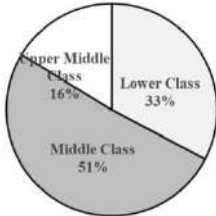
The profile of the sample has been shown in Table 2 in which pie-charts are also visible for getting the percentage shares of different categories. Age wise, sample ranges high for young category. Majority of the respondents are unmarried and belong to urban areas. From educational point of view, the percentage is higher for the graduates. Academic field shows that people from business and management are high in proportion as compared to the fields of social sciences and arts. As far as profession is concerned two-third are working. In size of the family, it is the medium size and middle class families who are high amongst their counterparts. These socio-demographic variables are further utilised in analysis part for gaining the profile of smart citizens.

TABLE 2: SOCIO-DEMOGRAPHIC ATTRIBUTES OF SAMPLE RESPONDENTS

<i>Socio-Demographic Variables</i>	<i>Variables' Categories</i>	<i>Bar Charts showing Percentage Shares</i>
Age	Young (Aged between 15 to 30)	
	Adult (Aged between 31 to 45)	
	Upper Aged (Aged between 46 to 60)	
Gender	Male	
	Female	
Marital Status	Married	
	Unmarried	
Residential Area	Rural Residents	
	Urban Residents	
Educational Qualifications	Up to 10+2	
	Graduation	
	Post-Graduation and Higher	
Academic Field	Business and Management	
	Science and Technical	
	Arts and Social Sciences	

(contd.)

(Table 2 contd.)

Profession	Working	
	Students	
Family Size	Small Sized (Up to 3 members)	
	Medium Sized (4 to 6 members)	
	Large Sized (Above 6 members)	
Family Status	Lower Class (Family Income up to ₹10000 p.m.)	
	Middle Class (₹10001 to ₹50000 p.m.)	
	Upper Middle Class (Above ₹50000 p.m.)	

Source: Primary Survey Conducted during April to June 2021.

Statistical Techniques

For attaining objective 1, descriptive statistics (mean, standard deviation, coefficient of variation) and inferential statistics (z-test for difference between two means) have been used. For objective two, cluster analysis (hierarchical and non-hierarchical: k-means clustering method), inferential statistics (z-test for difference between two means), discriminant analysis and its allied statistics have been calculated. For objective three, contingencies tables are prepared, proportionate shares have been calculated, Chi-Square test, Cramer’s V, and z-test for difference between two proportions have been applied. Besides, diagrammatical presentations have been done wherever deemed suitable. All analyses are completed with SPSS version 20; besides, manual calculations too are done.

ANALYSES AND INTERPRETATIONS

Allied with three objectives, three sub-divisions come under this section.

Description of Smart Behaviour

Table 3 displays statements designed to measure smart behaviour in the first column with the statement identifier in the second column.

TABLE 3: DESCRIPTION OF SMART BEHAVIOUR

Statements	Statement Identifier	Mean ($\bar{X}$)	Standard Deviation (S.D.)	Variance	Coefficient of Variation (CV)	Standard Error of Mean (S.E.)
On a railway crossing I remain in my lane to make way for others.	Lane	3.85	1.239	1.535	32.18%	0.072
After using a product I put the waste into the dustbin.	Waste	3.96	1.107	1.226	27.95%	0.064
I ensure that my music system should not disturb others.	Music	4.04	1.182	1.397	29.26%	0.068
While parking I make efforts not to block others' way.	Parking	4.12	1.070	1.145	25.97%	0.062
While driving I do not use horn unnecessarily.	Horn	3.52	1.335	1.782	37.93%	0.077
I buy energy efficient products or those products which are safe for the environment.	Energy	4.07	1.203	1.447	29.56%	0.069

Source: Authors' own Statistical Analysis on Data Collected through Primary Survey.

Descriptive statistics can be noted in the form of mean, standard deviation, variance, coefficient of variation, and standard error. The high mean value has been obtained for ‘Parking’ followed by ‘Energy, Music, Waste, and Lane’. A lowest mean value has been obtained for ‘Horn’. The coefficient of variation shows highest variations in ‘Horn’ (which has least mean value) and lowest variations in ‘Parking’ (which reflected highest mean amongst all behaviours). However, to know the significance/insignificance of mean differences, z-statistic for difference between two means is also visible in Table 4.

TABLE 4: MATRIX FOR MEAN DIFFERENCES AND Z-TEST FOR DIFFERENCE BETWEEN TWO MEANS

Statement Identifiers	Statistics	Lane	Waste	Music	Parking	Horn	Energy
Lane	M.D.	0	-	-	-	-	-
	S.E. _{M.D.}						
	z						
	Sig.						
Waste	M.D.	0.110	0	-	-	-	-
	S.E. _{M.D.}	0.096					
	z	1.146					
	Sig.	0.126					
Music	M.D.	0.190	0.080	0	-	-	-
	S.E. _{M.D.}	0.099	0.094				
	z	1.920	0.851				
	Sig.	0.027	0.197				
Parking	M.D.	0.270	0.160	0.080	0	-	-
	S.E. _{M.D.}	0.095	0.089	0.092			
	z	2.842	1.800	0.870			
	Sig.	0.002	0.036	0.192			
Horn	M.D.	0.330	0.440	0.520	0.600	0	-
	S.E. _{M.D.}	0.105	0.100	0.103	0.099		
	z	3.143	4.400	5.049	6.061		
	Sig.	0.001	0.000	0.000	0.000		
Energy	M.D.	0.220	0.110	0.030	0.050	0.550	0
	S.E. _{M.D.}	0.100	0.094	0.097	0.093	0.104	
	z	2.200	1.170	0.309	0.538	5.288	
	Sig.	0.014	0.121	0.379	0.296	0.000	

Source: Authors’ own Statistical Analysis on Data Collected through Primary Survey.
Note: M.D. denotes mean difference, S.E._{M.D.} denotes the standard error for mean difference.

Table 4 has been prepared in a matrix form. The diagonal values are put to zero because mathematically mean differences of one variable with itself is zero, and other statistics in that case become reluctant. Analysis is relevant for mean differences of one variable with another. Significant mean differences are noted for the pairs 'Lane-Music, Lane-Parking, Lane-Horn, Lane-Energy, Waste-Parking, Waste-Horn, Music-Horn, Parking-Horn', and Horn-Energy. Likewise, as variable 'Parking' has highest mean value ($\bar{X} = 4.12$) followed by 'Energy' ($\bar{X} = 4.07$), and their mean difference is insignificant, it can be interpreted that both the behaviours are performed by citizens at a similar level. Mean difference of 'Music' and 'Energy' is also inconsiderate; hence, these two are also performed identically. Due to the highest mean values in order, behaviours shown by 'Parking', 'Energy', and 'Music' are the highest preferences of people. Mean difference of 'Waste' and 'Lane' are also not significant, so, these two behaviours can also be termed as similar. Variable 'Horn' has lowest mean ($\bar{X} = 3.52$), and its mean is significantly different from all other behaviours. Accordingly, it can be said that this kind of behaviour is not frequently performed by the citizens, compared to other behaviours.

Thereby, lowest-to-highest mean values, and significant mean differences fulfill first objective, and concludes that certain behaviours may be highly performed by citizens, while others may be least desired. Owing to this behavioural dissimilarity, next analysis is performed for objective two.

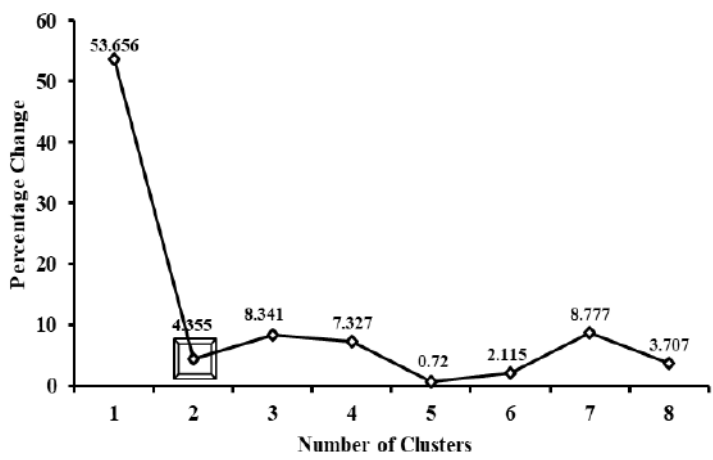
Objective Two – Segmenting Citizens based on Smart Behaviour

Here, at the outset, hierarchical cluster analysis is performed for getting the number of segments. Thereafter, non-hierarchical cluster analysis is used for describing the segments.

Outcome of Hierarchical Cluster Analysis for Number of Clusters

To know the number of clusters, agglomeration schedule (Table 5) and elbow plot (Fig. 1) have been prepared. There were one to 299 stages in agglomeration schedule as there were 300 respondents. But for ease and deciding the number of clusters, last ten stages are shown in Table 5. Column named 'cluster combined' depicts the respondents that are being grouped to make a cluster. As can be seen in stage 291, respondent 1st and respondent 11th are grouped as one in this stage, and similarly in other stages the process continued. 'Stage cluster first appears' displays that before stage 291, respondent 1st was also grouped in stage 290, and respondent 11th was grouped in stage 273. 'Next stage' shows that after stage 291 one amongst 1st or 11th respondents is again

Figure 1: Elbow Plot for Number of Clusters



Source: Authors’ own Statistical Analysis on Data Collected through Primary Survey.

TABLE 5: AGGLOMERATION SCHEDULE FOR NUMBER OF SEGMENTS

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears			Next Stage
	Cluster 1	Cluster 2		% Change	Cluster 1	Cluster 2	
291	1	11	19.775	--	290	273	293
292	41	106	20.508	3.707	283	282	295
293	1	39	22.308	8.777	291	289	294
294	1	12	22.780	2.115	293	288	297
295	41	91	22.944	0.720	292	276	296
296	7	41	24.625	7.327	269	295	297
297	1	7	26.679	8.341	294	296	298
298	1	10	27.841	4.355	297	285	299
299	1	148	42.779	53.654	298	0	0

Source: Authors’ own Statistical Analysis on Data Collected through Primary Survey.

grouped in stage 293. In this way, the process continued till 299 stages. ‘Coefficients’ are the distance between clusters from which ‘Percentage Change’ is calculated to take a decision regarding number of clusters. This ‘Percentage Change’ is used to make an ‘elbow plot’. As an answer to the first objective, a clear cut division of two clusters emerged from Agglomeration Schedule and Elbow Plot. A square has been marked at the elbow point in the figure which shows that after this point the line starts flattening. Accordingly, a two cluster solution can be claimed based on agglomeration schedule and elbow plot.

Naming and Description of Clusters

For naming the clusters, given a two-cluster solution, k-means clustering method under non-hierarchical cluster methods is utilized, and its' outputs in Table 6 and 7, and Figure 2 are interpreted. Table 6 and Figure 2 exhibit that first of the cluster contained 118 (% = 39.33) respondents, and second 182 (% = 60.67) respondents. For describing the clusters, mean and standard deviation is calculated for each of the variable, and z-test for difference between two means is utilized as inferential statistics (Table 7). It can be seen from the mean values that cluster 1 attained low mean values than their counterpart (cluster 2) on all the measurements except 'Horn'. However, z-test further infers that cluster 1 differs from cluster 2 on all the parameters except 'Horn' (where the difference is found statistically insignificant). On this premise, first cluster is named *Sluggish* and second is designated as *Smart*.

TABLE 6: CLUSTER DIVISION **Figure 2: Pie-chart for Cluster Division**

<i>Clusters</i>	<i>Naming</i>	<i>N</i>	<i>%</i>	
Cluster 1	Sluggish	118	39.33	
Cluster 2	Smart	182	60.67	
Total		300	100	

Source: Authors' own Statistical Analysis on Data Collected through Primary Survey.

TABLE 7: STATISTICS FOR DIFFERENCES BETWEEN CLUSTERS

<i>Statement Identifier</i>	<i>Segments</i>	$\bar{X}$	<i>S.D.</i>	<i>S.E.</i>	<i>Mean Difference</i>	$S.E_{\bar{X}}$	<i>z-value</i>	<i>Sig.</i>
Lane	Sluggish	3.03	1.294	0.119	1.34	0.090	14.927	0.000
	Smart	4.37	0.862	0.064				
Waste	Sluggish	3.14	1.072	0.099	1.35	0.076	17.880	0.000
	Smart	4.49	0.749	0.056				
Music	Sluggish	3.25	1.198	0.110	1.30	0.084	15.407	0.000
	Smart	4.55	0.837	0.062				
Parking	Sluggish	3.36	1.196	0.110	1.26	0.077	16.364	0.000
	Smart	4.62	0.590	0.044				
Horn	Sluggish	3.52	1.115	0.103	0.07	0.106	0.659	0.510
	Smart	3.55	1.462	0.108				
Energy	Sluggish	3.49	1.286	0.118	0.95	0.093	10.165	0.000
	Smart	4.44	0.983	0.073				

Source: Authors' own Statistical Analysis on Data Collected through Primary Survey.

Sluggish: The word ‘sluggish’ points to non-alertness, slow respond, and inactiveness of people. Cluster 1 is designated as *Sluggish* because of low mean values on the parameters used to measure Smart Behaviour. So, this segment can be said as a composition of people who are careless, lethargic and inactive. It is good from society’s viewpoint that these people are less in proportion (N = 118; % = 39.33).

Smart: The word ‘smart’ is not unique nowadays and implies having or showing a quick-witted intelligence. Cluster 2 is well named as *smart* since it contains smart people who are energetic, enthusiastic, and lively in their responsible actions. The same is confirmed by their high mean values and significant difference from *sluggish*. Here, welcomed and worth-mentioning point is that smart people are in major proportion (N = 182; % = 60.67).

Validation of Segments

Further, discriminant Analysis is applied to validate the cluster solution (Table 8). One discriminant function has been obtained since dependent variable entails two categories (two segments). Eigenvalue, Wilks’ Lambda, and Canonical Correlation have been shown. Since the p-value for Wilks’ Lambda is less than 0.05 and Eigenvalue is well above 1.00, it can be said that the corresponding function explains the group membership well. Canonical correlation is also noteworthy.

TABLE 8: EIGENVALUE AND WILKS’ LAMBDA STATISTICS
FOR DISCRIMINANT ANALYSIS

Eigenvalue			Wilks’ Lambda Statistics			
Eigenvalue	% of Variance	Canonical Correlation	Wilks’ Lambda	Chi-square	Degrees of Freedom	Sig.
2.315	100.0	0.836	0.302	353.542	6	0.000

Source: Authors’ own Statistical Analysis on Data Collected through Primary Survey.

From Table 9, it can be seen that 98.7 per cent (N = 296) respondents are correctly classified in two clusters; 97.5 per cent respondents (N = 115) in *sluggish* group and 99.5 per cent respondents (N = 181) in *smart* group. Correspondingly, 3 of the respondents from *sluggish* group (% = 2.5) and one out of *smart* group (% = 0.5) are not classified correctly. Hence, these four respondents are not considered and struck out from ‘SPSS data view’ to enquire the third objective, and further analysis of obtaining the profiles of clusters is completed on 296 respondents.

TABLE 9: VALIDATING CLUSTER MEMBERSHIP WITH DISCRIMINANT ANALYSIS

	N	Cluster Number of Case	Predicted Group Membership		Total	Correct-Classification
			Sluggish	Smart		
Original	N	Sluggish	115	3	118	N = 115+181 = 296
		Smart	1	181	182	
	%	Sluggish	97.5	2.5	100.0	% = 296/300 = 98.7%
		Smart	0.5	99.5	100.0	
Cross-Validated	N	Sluggish	113	5	118	N = 113+181 = 294
		Smart	1	181	182	
	%	Sluggish	95.8	4.2	100.0	% = 294/300 = 98.0%
		Smart	0.5	99.5	100.0	

Source: Authors’ own Statistical Analysis on Data Collected through Primary Survey.

Objective Three – Profiling of Segments

For finding out the association of demographic variables with the two segments of citizens (as obtained by previous analysis), Table 10 is visible with Chi-Square as inferential statistics. Along with Chi-square, Cramer’s V establishes degree of association. The table is divided into five main columns. First column ‘variables’ displays the socio-demographic attributes according to which analysis has been done. Second column shows the ‘division categories’. As Chi-Square analysis is performed on observed and expected frequencies, these are shown in third column for two segments. Fourth column portrays ‘percentage share’. These are important to calculate in order to obtain consumer profiles. Because total numbers of consumers are unequally distributed in categories, the observed frequencies cannot be used for profiling. However, these percentages are fully analyzed in Table 11. Last column shows statistical values of Chi-Square and Cramer’s V statistics. Where the variables involve two categories, a 2×2 classification can be seen such as gender, marital status, residential status, and profession. As other variables are categorized into three, contingencies tables with 3×2 classification can be seen.

Fifth column reveals that except gender, all other demographic variables are insignificantly associated with obtained segments. However, gender has highly significant association with segment categories. This significance/insignificance can also be judged with a quick examination of observed and expected frequencies in the third column of the table. Accordingly, it can be said that citizen membership in the *sluggish* and *smart* segments notably differs with regard to their gender. Indeed, the calculated percentages portray a different picture

TABLE 10: SEGMENT MEMBERSHIP ACROSS SOCIO-DEMOGRAPHIC VARIABLES

Variables	Variables' Categories	Observed (O) and Expected (E) Frequencies (Fe)				Percentage (%)			Inferential Statistics (Chi-Square: χ^2)
		Fe	Segments		Total	Segments		Total	
Age	Young	O	86	134	220	39.1	60.9	100	$\chi^2 = 0.105$ df = 2 p = 0.949 Cramer's V = 0.019
		E	86.2	133.8					
	Adult	O	25	37	62	40.3	59.7	100	
		E	24.3	37.3					
	Upper Aged	O	5	9	14	35.7	64.3	100	
		E	5.5	8.5					
Gender	Male	O	67	78	145	46.2	53.8	100	$\chi^2 = 5.874$ df = 1 p = 0.015 Cramer's V = 0.139
		E	56.8	88.2					
	Female	O	49	102	151	32.5	67.5	100	
		E	59.2	91.8					
Marital Status	Married	O	42	70	112	37.5	62.5	100	$\chi^2 = 0.216$ df = 1 p = 0.642 Cramer's V = 0.027
		E	43.9	68.1					
	Unmarried	O	74	110	184	40.2	59.8	100	
		E	72.1	111.9					
Residential Area	Rural Residents	O	35	42	77	45.5	54.5	100	$\chi^2 = 1.714$ df = 1 p = 0.190 Cramer's V = 0.076
		E	30.2	46.8					
	Urban Residents	O	81	138	219	37.0	63.0	100	
		E	85.8	133.2					

(contd.)

(Table 10 contd.)

Education	Up to 10+2	O	28	49	77	36.4	63.7	100	$\chi^2 = 2.389$ df = 2 p = 0.303 Cramer's V = 0.089
		E	30.2	46.8					
	Graduation	O	70	93	163	42.9	48.1	100	
		E	63.9	99.1					
	Post-Graduation and Higher	O	18	38	56	32.1	67.9	100	
E		21.9	34.1						
Academic Field	Business and Management	O	43	59	102	42.2	57.8	100	$\chi^2 = 1.304$ df = 3 p = 0.521 Cramer's V = 0.068
		E	39.4	62.6					
	Science and Technical	O	26	51	77	33.8	66.2	100	
		E	29.7	47.3					
	Arts & Social Sciences	O	38	60	98	38.8	61.2	100	
E		37.9	60.1						
Profession	Working	O	77	121	198	38.9	61.1	100	$\chi^2 = 0.023$ df = 1 p = 0.880 Cramer's V = 0.009
		E	77.6	120.4					
	Students	O	39	59	98	39.8	60.2	100	
		E	38.4	59.6					
	Small Sized	O	13	18	31	41.9	58.1	100	
E		12.1	18.9						
Medium Sized	O	87	143	230	37.8	62.2	100		
	E	90.1	139.9						
Large Sized	O	16	19	35	45.7	54.3	100		
	E	13.7	21.3						
Family Status	Lower Class	O	42	54	96	43.8	56.2	100	$\chi^2 = 2.448$ df = 2 p = 0.294 Cramer's V = 0.091
		E	37.6	58.4					
	Middle Class	O	53	99	152	34.9	65.1	100	
		E	59.6	92.4					
	Upper Middle Class	O	21	27	48	43.8	56.3	100	
E		18.8	29.2						

Source: Authors' own Statistical Analysis on Data Collected through Primary Survey.

about citizen membership into segments, and answers about the socio-demographic characteristics of two segments. For example, percentages for ‘age’ highlight that with 64.3 per cent people from upper-aged category, they can be termed as *smart*. Due to high percentage of adult category in *sluggish* segment, adults can be termed as part of it. But statistically, the variable does not associate significantly, and without knowing the significant/insignificant difference in proportions, one category cannot be favoured over other for membership into segments. So for clearer understanding, z-test for difference between two proportions is also completed for which Table 11 is prepared and analyzed.

TABLE 11: INFERENTIAL STATISTICS FOR VALIDATING SEGMENT MEMBERSHIP

Variables	Variables' Categories	Proportions		Inferential Statistics (z-test: z)	
		Segments		Segments	
		Sluggish	Smart	Sluggish	Smart
Age	Young	0.391	0.609	z = 0.171 p = 0.865	z = 0.171 p = 0.865
	Adult	0.403	0.597		
	Young	0.391	0.609	z = 0.253 p = 0.803	z = 0.253 p = 0.803
	Upper Aged	0.357	0.643		
	Adult	0.403	0.597	z = 0.318 p = 0.749	z = 0.318 p = 0.749
	Upper Aged	0.357	0.643		
Gender	Male	0.462	0.538	z = 2.413 p = 0.016	z = 2.413 p = 0.016
	Female	0.325	0.675		
Marital Status	Married	0.375	0.625	z = 0.462 p = 0.646	z = 0.462 p = 0.646
	Unmarried	0.402	0.598		
Residential Area	Rural Residents	0.455	0.545	z = 1.314 p = 0.190	z = 1.314 p = 0.190
	Urban Residents	0.370	0.630		
Education	Up to 10+2	0.364	0.637	z = 0.956 p = 0.337	z = 0.956 p = 0.337
	Graduation	0.429	0.481		
	Up to 10+2	0.364	0.637	z = 0.515 p = 0.610	z = 0.515 p = 0.610
	Post-Graduation and Higher	0.321	0.679		
	Graduation	0.429	0.481	z = 1.422 p = 0.156	z = 1.422 p = 0.156
	Post-Graduation and Higher	0.321	0.679		

(contd.)

(Table 11 contd.)

Academic Field	Business and Management	0.422	0.578	$ z = 1.143$ $p = 0.254$	$ z = 1.143$ $p = 0.254$
	Science and Technical	0.338	0.662		
	Business and Management	0.422	0.578	$ z = 0.490$ $p = 0.624$	$ z = 0.490$ $p = 0.624$
	Arts and Social Sciences	0.388	0.612		
	Science & Technical	0.338	0.662	$ z = 0.682$ $p = 0.497$	$ z = 0.682$ $p = 0.497$
	Arts and Social Sciences	0.388	0.612		
Profession	Working	0.389	0.611	$ z = 0.149$ $p = 0.880$	$ z = 0.149$ $p = 0.880$
	Students	0.398	0.602		
Family Size	Small Sized	0.419	0.581	$ z = 0.441$ $p = 0.660$	$ z = 0.441$ $p = 0.660$
	Medium Sized	0.378	0.622		
	Small Sized	0.419	0.581	$ z = 0.311$ $p = 0.757$	$ z = 0.311$ $p = 0.757$
	Large Sized	0.457	0.543		
	Medium Sized	0.378	0.622	$ z = 0.893$ $p = 0.373$	$ z = 0.893$ $p = 0.373$
	Large Sized	0.457	0.543		
Family Status	Lower Class	0.438	0.562	$ z = 1.404$ $p = 0.162$	$ z = 1.404$ $p = 0.162$
	Middle Class	0.349	0.651		
	Lower Class	0.438	0.562	$ z = 0$ $p = 1$	$ z = 0$ $p = 1$
	Upper Middle Class	0.438	0.562		
	Middle Class	0.349	0.651	$ z = 1.113$ $p = 0.267$	$ z = 1.113$ $p = 0.267$
	Upper Middle Class	0.438	0.562		

Source: Authors' own Statistical Analysis on Collected Data through Primary Survey.

Table 11 strengthens the above findings that only 'gender differences' are notable, and difference between variable categories for all other variables are not considerable. Here, z-statistic for difference between two proportions is only found relevant for variable 'gender'; so, where *sluggish* comes out as the segment of males, *smart* is the segment of females.

CONCLUSION AND DISCUSSIONS

All in all, it can be concluded for first objective that citizens are not similar on all measurements of smart behaviours. Behaviour related to variable 'Parking' is highly executed while behaviour associated with variable 'Horn' is least performed. In response to second objective, two segments of citizens exist as per performance of smart behaviour. Here, one segment is *sluggish*, and people of this group ignore ethical standards of behaving at public places and in society. It means they are ignorant people and not sensitized to sense that their actions have an impact on environment and society. In this way, they cannot be termed as Smart. On the other hand, second segment of people which itself is named *smart* accumulates those people who behave appropriately and ethically for society and environment. However, sample analysis provides a good indication because *smart* segment is composed of majority of people if compared with its counterpart *sluggish*.

An interesting finding came out that socio-demographic profile of the two segments may be same; however, gender of a person affects his/her membership in *sluggish* or *smart* segment. Where, Sluggish segment contains large number of males, *smart* is the segment of majority of females. Amongst all the socio-demographic characteristics only gender comes out with significant influence. Females in India actually are brought up with the teachings of being compassionate and caretaker of the family; may be this kind of teaching is vigilant for their membership into *smart* segment. Hence, third objective is abided by identifying two statistically different segments of citizens.

So, at the beginning, we have questioned: whether citizens are smarter enough to accommodate the facilities which are being provided to them with the formation of smart cities, the answer probably is Yes, because large number of people originate as caretakers and stewards of society. Indeed, ignorants too exist; but, in least proportion.

IMPLICATIONS

Based on the findings, one implication is for the public policy makers that they can provide infrastructure and other facilities under Smart City or other mission/ projects; but, a class of careless people does exist who first needs education on the ethical and civic issues of the society. Their conscience needs to be aroused so that they too start turning into smart people. Certain kinds of awareness programmes, campaigns, shows, etc. can be organized for the same. Involvement of citizens in the decision-making is a sign of good and transparent governance. The citizens who make decisions about what Smart Cities should look like are far less in

number than citizens who actually will utilize the offerings of a Smart City. However, common citizens are disconnected from the plans being made by companies and even Governments on their behalf. Because of no/less involvement of common citizens, plans and policies many a times result into failure. Hence, for Government and policy makers, there is an urgent need to start working with everyday citizens. Visionary questions should be invited from citizens' side and solutions should be developed for the problems they raise. As majority of females perform Smart Behaviour, they should be targeted for spreading awareness and motivating the sluggish citizens. They should also be included in decision making processes for realizing smart cities. Also with this paper, common citizens are being motivated to work smartly with the active involvement in order to make the vision of 'Smart Bharat' a reality.

SCOPE FOR FURTHER RESEARCH

The study has been conducted on Ambala Cantonment with limited measures of Smartness and the population defined is only the Ambala Cantonment and its nearby areas. So, the results cannot be generalized to a larger extent on all the cities or cantonments. However, where the sample characteristics match with this study, the results can be contrasted. This paper offers several guidelines for further research. Gender came out the noteworthy influencer of citizens' behaviour, it points towards the issue of 'gender differences'. So, further studies can be conducted in this area. One agenda for further studies may be: how the people who actually are sluggish can be converted into smart? Also, different parameters of measuring the smart behaviour may be taken and results can be contrasted. A large sample with enhanced measurement scales can further give more embellished results. In this paper, smart behaviour is measured to the ground level and only with the basic and simple behaviours. This may be a restriction for generalization of results. Future studies can be operative toward developing the scales to measure smart behaviour. In this way, external validity of research findings can too be enhanced. Large and country-wide samples can be utilized in further studies.

REFERENCES

1. Almanza, B. A., Jaffe, W. and Lin, L. (1994). Use of the service attribute matrix to measure consumer satisfaction. *Hospitality Research Journal*, 17(2), 63-75. DOI: 10.1177/109634809401700207
2. Bayar, D. Y. (2017, September). *Smart citizens – Smart cities from a different point of view*. Paper presented at the INSPIRE Conference 2017, Strasbourg, France. Retrieved from https://inspire.ec.europa.eu/sites/default/files/presentations/INSPIRE_2017_Smart_Citizens_V5.pdf

3. Bhagat, R. B. (2015). Smart city: Concept and strategies. *Yojna*, 59, 7-9.
4. Bull, Richard (2016). Smart citizens for smart cities: Participating in the future. *Energy*, 169(3), 93-101. DOI: 10.1680/jener.15.00030
5. BW Online Bureau (2019). *How smart citizens can help make a smarter city*. BW Smart Cities. Retrieved from bwsmartcities.businessworld.in/article/How-Smart-Citizens-Can-Help-Make-A-Smarter-City/06-02-2019-166884/
6. Calzada, I. (2018). (Smart) Citizens from data providers to decision-makers? The case study of Barcelona. *Sustainability*, 10(9), 3252. DOI: 10.3390/su10093252
7. Capdevila, I. and Zarlenga, M. I. (2015). Smart city or smart citizens? The Barcelona case. *Journal of Strategy and Management*, 8(3), 266-282. DOI: 10.1108/J SMA-03-2015-0030
8. Cardullo, P. and Kitchin, R. (2017). *Being a 'citizen' in the smart city: Up and down the scaffold of smart citizen participation* (The Programmable City Working Paper 30). Retrieved from National University of Ireland Maynooth, County Kildare, Ireland website: <https://osf.io/preprints/socarxiv/v24jn/download>
9. Chaudhuri, P. (2017, May 09). *Ambala Cantonment Board transforms dumping ground into a perennial lake*. The Logical Indian. Retrieved from <https://thelogicalindian.com/exclusive/ambala-lake-water-conservation/>
10. Cohen, B. (2012). *6 key components for smart cities*. UBM's Future Cities. Retrieved from http://www.ubmfuturecities.com/author.asp?section_id=219&doc_id=524053
11. Feher, K. (2020). *Expected participation and mentality of smart citizen in smart cities* (Cornell University Report No. KOPOP 2.1.2-VEKOP-15-2016-00001). Retrieved from Cornell University website: <https://arxiv.org/ftp/arxiv/papers/2003/2003.02910.pdf>
12. Gooch, D., Wolff, A., Kortuem, G. and Brown, R. (2015). Reimagining the role of citizens in smart city projects. In *Adjunct Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2015 ACM International Symposium on Wearable Computers* (pp. 1587-1594). New York: Association for Computing Machinery.
13. Government to introduce smart solutions in 7 cantonments (2018, January 03). *The Economic Times*. Retrieved from <https://economictimes.indiatimes.com/news/defence/government-to-introduce-smart-solutions-in-7-cantonments/articleshow/62356447.cms>
14. Gupta, K. and Garg, I. (2017). Defining 'four C's' on smart city: Concept, components, challenges, and clarifications. *International Journal of Research*, 7(1), 40-49.
15. Gupta, K. and Garg, I. (2018). Product management practices: a study of scientific goods industry in Ambala. *Apeejay Journal of Management and Technology*, 13(2), 27-36.

16. Manchester, H. and Cope, G. (2019). Learning to be a smart citizen. *Oxford Review of Education*, 45(2), 224-241. DOI: 10.1080/03054985.2018.1552582
17. Nadeem, M. W., Hussain, M., Khan, M. A. and Awan, S. M. (2019). Analysis of smart citizens: A fuzzy based approach. In *Proceedings on 2019 International Conference on Electrical, Communication, and Computer Engineering (ICECCE)*, Swat, Pakistan. New York: IEEE. DOI: 10.1109/ICECCE47252.2019.8940632
18. Ferronato, P. and Ruecker, S. (2018). Smart citizenship: Designing the interaction between citizens and smart cities. In C. Storni, K. Leahy, M. McMahon, P. Lloyd, and E. Bohemia (Eds.), *Design as a catalyst for change – DRS 2018 International Conference 2018* (pp. 1884-1893). Limerick, Ireland: Design Research Society. DOI: 10.21606/drs.2018.480
19. Pune Municipal Corporation (2015). *Smart Pune: Creation of a vision community* [Brochure]. Retrieved from <https://www.pmc.gov.in/sites/default/files/project-glimpses/Smart%20Pune-Creation%20of%20a%20Vision%20Community.pdf>
20. Schuler, D. (2016). Smart cities + smart citizens = civic intelligence? In G. Concilio & F. Rizzo (Eds.), *Human smart cities: Rethinking the interplay between design and planning* (pp. 41-60). Switzerland: Springer International Publishing.
21. Shankar, A. (2016, May 20). Why smart cities need smart citizens. *The Hindu*. Retrieved from <https://www.thehindu.com/features/homes-and-gardens/why-smart-cities-need-smart-citizens/article8625075.ece>
22. Sharma, N. (2019, February 02). A lake to be born in Ambala soon. *The Tribune*. Retrieved from <https://www.tribuneindia.com/news/archive/haryanatribune/a-lake-to-be-born-in-ambala-soon-722705>
23. Shelton, T. and Lodato, T. (2019). Actually existing smart citizens. *City*, 23(1), 35-52. DOI: 10.1080/13604813.2019.1575115
24. Shishodia, P. K. (2018). Centre to introduce smart solutions in seven cantonments.
25. Simonofski, A., Asensio, E. S., De Smedt, J. and Snoeck, M. (2017). Citizen participation in smart cities: Evaluation framework proposal. In *Proceedings of 2017 IEEE 19th Conference on Business Informatics (CBI)*, Thessaloniki, Greece (pp. 227-236). New York: IEEE. DOI: 10.1109/CBI.2017.21
26. Thomas, V., Wang, D., Mullagh, L. and Dunn, N. (2016). Where's wally? In search of citizen perspectives on the smart city. *Sustainability*, 8, 1-13. DOI:10.3390/su8030207
27. Zandbergen, D. & Uitermark, J. (2020). In search of the smart citizen: Republican and cybernetic citizenship in the smart city. *Urban Studies*, 57(8), 1733-1748. DOI: 10.1177/0042098019847410

Endnotes

1. Cantonment Board of Ambala (CBA) has been active in Ambala since pre-Independence period specifically 1843, and is a statutory body under the

Cantonment Board Act, 2006. The official website of CBA is: <http://cbambala.org>.

2. Topkhana Bazar was developed in British period, and today it is one of the main areas covered under CBA. It is also known as R.H.A or R.A. Bazar, enunciated as Royal Horse Administrators Bazar.
3. *bee smart city* is 'the leading global smart city network and community with more than 15,100 members from 170 countries, featuring 710+ smart city solutions implemented in over 1,000 cities and communities across the globe. Its mission is to empower smart sustainable cities by facilitating the global exchange of best practice solutions and lessons learned'. Its official website is: <https://www.beesmart.city/>.

Management of Bio-Medical Waste during the COVID-19 Pandemic in Raipur City

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ABSTRACT

The COVID-19 pandemic had led to a significant surge in bio-medical waste (BMW). Due to the contagious nature of diseases, the safe treatment and disposal of BMW became a significant challenge during the pandemic. The study entirely relies on secondary data and primarily focuses on the generation and management of BMW in Raipur city in the recent past. The study suggests that due to the countrywide lockdown, the amount of BMW initially decreased; however, it increased significantly when the COVID-19 cases increased in the city. The management of BMW has been outsourced to the SMS-Water Grace Enviroprotect Pvt. Ltd., which is responsible for the collection, transportation and safe disposal of BMW generated in the city. This public-private partnership (PPP) model has ensured the effective management of solid waste in the city.

Keywords: Bio-medical Waste, Solid Waste, Bio-medical Waste Management, COVID-19, Raipur City, Sustainable Development Goals.

INTRODUCTION

Municipal Solid Waste (MSW) refers to a heterogeneous collection of waste material produced in urban areas, increasing daily due to the ever-increasing population and rapid shift in lifestyle and food habits (Amasuomo & Baird, 2016; Kumar & Agrawal, 2020). Solid waste can create significant health problems and a very unpleasant living environment (WHO, 2005). If not correctly disposed off, waste

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may increase the likelihood of disease transmission. Poor sanitation and Solid Waste Management (SWM) are linked to the transmission of diseases and a resultant reduction in human well-being. Sustainable Development Goal target 6.2 calls for adequate and equitable sanitation for all (WHO, 2019).

Clinical waste or bio-medical waste is used for wastes produced on healthcare premises. BMW comprises of the waste generated during the diagnosis and treatment of patients, excluding the general waste (Dehal et al., 2022). It is generated by operations in healthcare, research, and diagnostic institutes, which include one or more of the following: diagnosis, treatment, immunisation of humans and animals, and the synthesis or testing of biological materials (WHO, 2017).

BMW differs from general municipal waste and poses various health hazards. BMW management rules 2016 and the Amendment Rules 2018 are the latest guidelines from the Ministry of Environment, Forest & Climate Change to regulate the handling of BMW activities in the country (MoEFCC, 2016). India is the second-most populous country after China and the second worst-hit nation by COVID-19 after the United States of America. According to the WHO dashboard on COVID-19 trends, worldwide, 514 million cases have been registered until May 8, 2022, while 43.1 million cases were recorded in India. Urban centres, particularly metropolitan cities, have faced higher cases of COVID-19 (Pethe & Sharma, 2020). Due to the flawed bio-medical waste management system and lack of resources, India faces severe consequences during COVID-19. Untreated and improperly managed BMW is a potential source of infection (Ramteke & Sahu, 2020). The diligent handling and management of BMW can prevent hospital-acquired infection and lower the rates of disease transmission (Chand et al.). The COVID-19 pandemic has resulted in the massive generation of BMW, and this sudden spike in BMW has created challenges to the existing waste management infrastructure (Dehal et al., 2022).

Compared to other municipal solid wastes, BMW has acute management and risk concerns. The management of BMW is not up to the mark, particularly in many developing countries (Shammi et al., 2021). The improper disposal and management system leads to significant environmental and health-associated risks to humankind. The COVID-19 pandemic has worsened the situation far ahead. The generation of BMWs has increased manifold across the globe. According to the World Health Organization, 85 per cent of the total healthcare waste is non-toxic, and only 15 per cent is toxic (WHO, 2018), but the present pandemic has changed the scenario completely. Highly

populated countries exhibited more strenuous situations. India had a 46 per cent gross increase in BMWs in April and May 2021 (CSE, 2021).

In line with the United Nations Environment Program to ensure sustainable waste management, guidelines for curbing the spread of COVID-19 through waste management include the treatment of residual waste (Patnaik & Jena, 2021). Sound planning and management reduce waste generation and manage overall waste management spending. The scientific disposal of bio-medical waste requires the continued involvement of long chains of people such as doctors, nurses, ward boys and cleaning staff. Therefore, all staff need to know what they are expected to do and why. It is essential to act according to the instructions given. The experience of BMW management in this global crisis could be a lesson for authorities to develop a well-equipped system for safe disposal in Post-COVID 19 scenarios (Vanapalli et al., 2021).

While urban solid waste has attracted the attention of town planners, environmental activists and civic administrators, there is a lack of concern towards any special sources of waste and its management. One such waste is bio-medical waste generated primarily from health care establishments (Babu et al., 2009). Biomedical Wastes Management and Handling Rules, 1998 categorizes BMW into ten categories and issues a guideline for its proper treatment and disposal (Table 1). Ministry of Environment, Forest and Climate Change amended the existing rules in March 2016. In new rules, colour codes have been declared for the classification of BMW for its management. Earlier categories described in Table 1 have been merged into four colour categories for disposal and treatment. These new rules have simplified and improved segregation, transportation and disposal methods for the management of BMW. These four colour categories are also presented in Table 1. The category-wise identification and segregation of BMW at source is the most significant task that needs to be performed sincerely for the sustainable management of BMW.

The recent guideline (5th revision) of CPCB for 'Handling, Treatment and Disposal of Waste Generated during Treatment/ Diagnosis/ Quarantine of CoviD-19 Patient' thoroughly discussed the measures need to follow for the management of BMW at the institutional level as well as at household level by ULBs. The CPCB guideline emphasises creating awareness among citizens regarding the segregation of COVID-19 BMW and treating it differently than general MSW. The guideline indicates that the rapid antigen test kits used to detect COVID-19 should be classified as red waste and deposited through common bio-medical waste treatment facilities (CBWTFs) or manufacturers attached. Along with this, the guideline instructed the

TABLE 1: BMW CATEGORIES AND COLOUR CODES FOR
TREATMENT AND DISPOSAL

<i>Category</i>	<i>Description of Waste category</i>	<i>Treatment and Disposal</i>	<i>Colour Codes for Treatment and Disposal</i>
1	Human Anatomical Waste: (human tissues, organs, body parts)	Incineration/ deep burial	Yellow
2	Animal Waste: (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal houses).	Incineration/ deep burial	Yellow
3	Microbiology and Biotechnology Waste: (wastes from laboratory cultures, stocks of specimens of microorganism live or attenuated vaccines, human and animals cell culture used in research, infectious agents from research and industrial laboratories, wastes from the production of biological, toxins, dishes and devices used for transfer of cultures)	Autoclaving/ microwaving/ incineration	Yellow, Red
4	Waste Sharps: (needles, syringes, scalpel, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment/ autoclaving/ microwaving) and mutilation/ shredding	Yellow, Blue
5	Discarded Medicines and Cytotoxic Drugs: (wastes comprising outdated contaminated and discarded medicines)	Incineration/ destruction of drugs disposal in secured landfills	Yellow, Black
6	Solid Wastes: (items contaminated with blood and body fluids, including cotton, dressings, soiled plaster casts, linens, beddings, and other materials contaminated with blood)	Incineration/ autoclaving/ microwaving	Yellow, Red

(contd.)

(Table 1 contd.)

7	Solid waste: (wastes generated from disposable items other than the waste sharps such as tubes, catheters, intravenous sets etc.)	Disinfection/ autoclaving/ microwaving and mutilation/ shredding	Red, Blue
8	Liquid Waste: (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection/ Discharge into drains	Black
9	Incineration Ash: (ash from incineration of any bio-medical waste)	Disposal secured landfill	Black
10	Chemical Waste: (the chemical used in the production of biologicals, chemicals used in disinfection, as insecticides, etc.)	Chemical treatments and discharge into the drain for liquids and secured landfill for solids.	Black

Source: Biomedical Wastes Management and Handling Rules, 1998 and 2016.

manufacturer of the COVID-19 antigen kit that the instruction concerned with the deposition of the antigen kit must be written on it.¹

In this study, the trends and patterns of bio-medical waste generation in Raipur city have been analysed. The study also describes bio-medical waste management, including collection, treatment, and disposal of BMW in Raipur city. The study relied on secondary data from Chhattisgarh Pollution Control Board, Chhattisgarh Environment Conservation Board, Raipur Municipal Corporation, and SMS Water Grace Enviroprotect Pvt. Ltd. The study has few limitations concerned with the nature of the data. For instance, the BMW data of 2021 also included the waste from food items provided to the COVID-19 patients. Similarly, the BMW generated from homes during the quarantine period is not included in the BMW. The management of MSW and BMW is conducted by two different agencies that have created the problem of data synchronisation and compatibility.

COVID-19 BMW GENERATION IN INDIA

According to the data published by the Central Pollution Control Board (CPCB) in the year 2018, the total amount of BMW generated in India was 517/day in the year 2016 and around 501/day in the year 2015, out of which about 4-5 per cent remains untreated. The annual report 2018/2019 released by CPCB showed the generation of 557/day BMW in 2017, out of which 517/day was treated. However, the

situation drastically changed in India after the spread of COVID-19 as a different type of BMW emerged, which is more infectious. Tons of COVID-19 contaminated wastes are generated worldwide, and its sound management became essential to break the disease transmission.

The safe and sustainable management of COVID-19 contaminated biomedical waste (BMW) is a social and legal responsibility. Unsound management of this waste could cause unforeseen “knock-on” effects on human health and the environment (Behera, 2021). During COVID-19 crisis, the approach of CPCB had also changed, and they published separate data of BMW generated from the COVID-19. The average daily amount of COVID-19 BMW generated since June 2020 is presented in Table 2.

On December 31, 2019, China informed the World Health Organization (WHO) about cases of pneumonia of unknown aetiology detected in Wuhan city, Hubei province of China, while on January 27, 2020, (confirmed later on January 30, 2020), the first suspicious case of COVID-19 was diagnosed in Thrissur, Kerala in India (Andrews et al.). After that, COVID-19 increased manifolds; however, the record of COVID-19-related BMW was unavailable for a few initial months. The NCRB has published COVID-19 BMW data from June 2020 onwards. The COVID-19 biomedical waste consists of PPE kits, masks, shoe coverings, gloves, human tissues, blood-contaminated objects, bodily fluids such as dressings, plaster casts, cotton swabs, blood-contaminated bedding, needles and syringes. Since then, the number of COVID-19 patients has fluctuated during the first, second, and third pandemic waves. With the increase in cases, COVID-19 BMW has also increased. The correlation between the monthly average confirmed cases and the monthly average of COVID-19 BMW is +0.49. The correlation value (+0.49) indicates a definite increase in the amount of COVID-19 BMW with the growth in confirmed cases. However, the growth of COVID-19 BMW is not proportionate to the rise in confirmed cases.

CPCB has also reported the same fact. According to CPCB, “as per the information submitted by State Pollution Control Boards/Pollution Control Committees and daily data received from the COVID-19 BMW Tracking App, the average quantity of COVID-19 related bio-medical waste generation during May 2021 is about 203 tonnes per day (TPD). Peak generation of BMW (about 250 TPD) was reported on May 10 2021. The earlier peak generation in 2020 was in the range of 180 – 220 TPD. Despite an additional number of COVID-19 patients, there is no proportional growth in the quantity of COVID-19 bio-medical waste generated, mainly due to proper waste segregation”.²

TABLE 2: AMOUNT OF COVID-19 BMW AND CONFIRMED CASES OF COVID-19 IN INDIA (JUNE 2020 TO MARCH 2022)

<i>Year</i>	<i>Month</i>	<i>Amount of BMW* (TPD)</i>	<i>No of Covid Cases**</i>
2020	June	91.67	384697
	July	132.92	1072030
	August	154.07	1982375
	September	156.85	2604518
	October	159	1911356
	November	138	1294572
	December	129.35	834983
2021	Jan-2021	75	466457
	February	53	363600
	March	75	1052604
	April	139	6613641
	May	203	9284558
	June	164	2315314
	July	72.8	1251145
	August	55.56	1154887
	September	49.1	971100
	October	32.3	533320
	November	24.67	314522
	December	23.02	250982
2022	January 2022	38.41	6463636
	February	33.11	1621690
	March	9.87	100310

Source: *<https://cpcb.nic.in/covid-waste-management/>

** <https://covid19.who.int/region/searo/country/in>

The generated amount of COVID-19 BMW is unevenly distributed among the states. From June 2020 to December 2020, Maharashtra produced the highest COVID-19 BMW (5,367 tonnes), followed by Kerala (3,300 tonnes), Gujarat (3,086 tonnes), Tamil Nadu (2,806 tonnes), Uttar Pradesh (2,502 tonnes), Delhi (2,471 tonnes), West Bengal (2,095 tonnes), and Karnataka (2,095 tonnes). State-level data indicates that different states have recorded the peak of COVID-19 cases at different months. It is also found that they have generated the highest waste in the same month.

GENERATION OF BIO-MEDICAL WASTE IN RAIPUR CITY

The CPCB has systematically published the data on biomedical waste generated due to COVID-19 (Table 1). However, comprehensive data on biomedical waste (non-covid BMW) has not been published by CPCB for the post-COVID-19 period. Contrary to it, Raipur Municipal Corporation and SMS Watergrace Enviroprotect Pvt. Ltd have provided separate

data for both COVID-19-related waste as well as general BMW. Table 3 depicts the pre and post-COVID-19 situation of bio-medical waste in the city from 2019 to 2021.

The first confirmed corona virus case in Chhattisgarh was reported on March 19, 2020, in Raipur, where a woman returning from London tested positive (*Hindustan Times*, 2020). Later the city turned into the epicentre of the COVID-19 pandemic in Chhattisgarh. Despite the lack of synchronised and systematic data, it is widely recognised that the city has carried a disproportionate burden of diseases. It has taken the burden of the local patients and non-residents of the city. The availability of quality healthcare infrastructure has become the prime concern for everyone. In the first wave of the pandemic, the All India Institute of Medical Sciences, Raipur, had become one of the country’s most crowded hospitals. In the initial stage of the pandemic, AIIMS, Raipur was the only hospital taking care of COVID-19 patients. Even later, during the subsequent waves of COVID-19, the AIIMS, Raipur has provided excellent quality services and worked as a nodal agency to decide COVID-19 treatment protocol in the state. Raipur city has taken the disproportionate burden of COVID-19 BMW. Table 3 depicts the overall BMW generated in the city from 2019 to 2021 and COVID-19 BMW generation is discussed subsequently.

TABLE 3: TREND OF BIO-MEDICAL WASTE GENERATION
IN RAIPUR (2019 TO 2022)

Month	2019		2020		2021	
	Daily Average (Kg)	Total (tonnes)	Daily Average (Kg)	Total (tonnes)	Daily Average (Kg)	Total (tonnes)
January	3413	106	2551	79	6229	193
February	3809	107	2586	75	5463	153
March	3817	118	2358	73	5611	174
April	3803	114	1805	54	6925	208
May	3898	117	2042	61	6176	191
June	3689	111	2762	83	5286	159
July	4388	136	3221	100	5457	169
August	4665	140	3655	110	5192	161
September	4651	140	4283	128	4968	149
October	4551	137	4410	137	4851	150
November	5390	162	3600	108	4801	144
December	5390	162	3774	117	5261	163
Total	4457	1548	3256	1125	5687	2015

Source: Unpublished data of RMC and website of SMS Watergrace Enviroprotect Pvt. Ltd.

Table 3 indicates that in 2019, 1548 tons of BMW were generated in Raipur city, having an annual average of 4457 kg per day. The total amount of BMW declined to 1125 tons and an annual daily average of 3256 kg per day in 2020. The decline of more than 25 per cent in a year is phenomenal and ensued primarily due to the prolonged nationwide lockdown declared from March 25, 2020, as a preventative measure against the COVID-19 pandemic in India when the numbers of recorded cases were only 519, with nine reported deaths (Raman et al., 2021). Given that 70 per cent of the healthcare in India is provided by the private sector and most only provided minimal services during the lockdown, the immediate consequences of lockdown was on healthcare provisions and a negative impact on the general health of the population (Verma & Mishra, 2020). Reduced capacity due to social distancing and other restrictions after relaxation also caused interruptions to healthcare provision. The combined effect of these things came in the form of a substantial decline in biomedical waste in Raipur city in 2020 (Table 3).

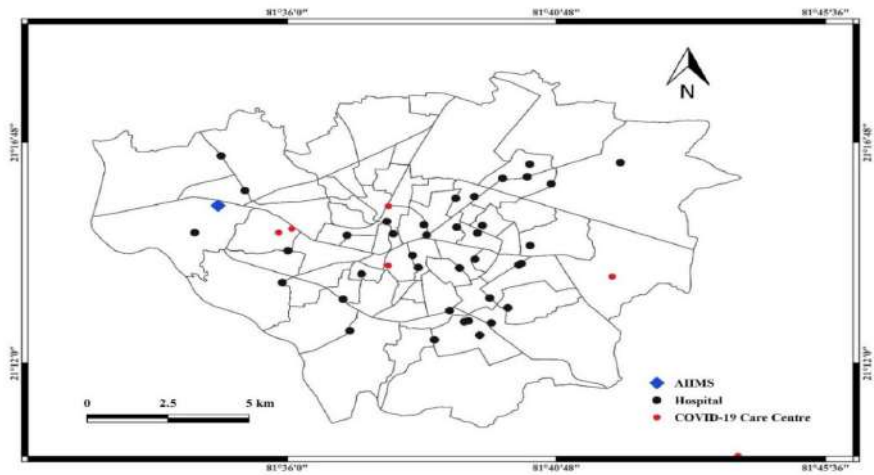
Compared to 2020, in 2021, the amount of biomedical waste in the city increased drastically. Table 3 indicates that in comparison to 2020, about 80 per cent growth in BMW statistics was registered in 2021 mainly due to two reasons. First, the restrictions imposed due to the COVID-19 lockdown were relaxed phase-wise, and regular healthcare services were restored in 2021. Second, the peak of COVID-19 cases in the city were also observed in 2021. These two combined effects led to a drastic increase in the BMW generation in the city.

HOTSPOTS OF COVID-19 BIO-MEDICAL WASTE GENERATION IN THE CITY

In the year 2021, from March onwards, the country has witnessed a massive rise in the cases of COVID-19 and the resultant breakdown of the healthcare system. The government has opted for many emergency measures to control the situation. An immediate extension in the existing healthcare facilities was made by converting non-Covid healthcare centres/hospitals into Covid Care Centres and opening up the Covid Care Centres in non-medical premises such as schools and colleges. The higher number of such centres indicates the severity of the situation in a particular place.

Figure 1 presents the location of COVID-19 Care Centres and hospitals engaged in treating COVID-19 patients in the city from May 2021 to December 2021. The densely populated central part of the city is dotted with many such centres. It indicates the severity of the COVID-19 in the city's core. These hospitals and COVID-19 Care Centres have become the city's primary source (hotspots) of BMW generation.

Figure 1: Centre of Bio-medical Waste Generation in Raipur City (March to December 2021)



Source: Based on SMS-Watergrace Enviroprotect Pvt. Ltd. Data, 2021

Table 4 indicates that until February 2021, only one hospital (AIIMS, Raipur) was engaged in treating COVID-19 patients, but by March, 2021, number was increased to 18. By April 2021, total of 53 hospitals were involved in treating COVID-19 patients. In April and May 2021, almost every eligible hospital was engaged in treating COVID-19 patients. As the situation improved, the number of hospitals treating COVID-19 patients decreased and was reduced to only five at the end of the year. During emergency, a few COVID-19 Care Centres were also installed in April and May 2021 to avoid additional pressure on hospitals. These Covid Care Centres were primarily used as quarantine centres, and primary healthcare facilities were installed there during the emergency that started from March onwards (Table 4).

The generation of BMW increased considerably during the peak situation of COVID-19 centres. In April 2021, the amount of COVID-19 BMW was about 55 tonnes which significantly increased to 84 tonnes in May 2021. The share of COVID-19 BMW was about 28 per cent at the beginning of the year, reaching its peak (50%) in May. Since then, it has again declined considerably. In 2021 from September onwards, the amount and total share of COVID-19 BMW declined sharply. This sharp decline is partially due to a decrease in COVID-19 cases and mainly due to a change in methodology (Table 3). Earlier all kinds of waste, including food wastage and clothes generated by COVID-19 patients, have been treated as COVID- 19 waste. However, the classification scheme has changed considerably from August onwards. Change in the

TABLE 4: MONTH-WISE CHANGE IN HEALTHCARE INSTITUTIONS
AND BMW IN RAIPUR CITY (2021)

<i>Month</i>	<i>No. of Active Hospitals</i>	<i>Active COVID-19 Care Centres</i>	<i>COVID-19 BMW (in Tonnes)</i>	<i>Total BMW (in Tonnes)</i>	<i>Share of COVID-19 BMW (%)</i>
January	1	-	54.0	193	27.97
February	1	-	44.2	153	28.89
March	18	1	55.5	174	31.92
April	53	7	84.3	208	40.51
May	52	8	96.0	191	50.28
June	29	3	68.3	159	42.98
July	8	1	39.0	169	23.06
August	6	-	16.1	161	10.03
September	5	-	10.3	149	6.93
October	5	-	8.6	150	5.72
November	4	-	8.1	144	5.61
December	5	-	5.8	163	3.55
Total			490.2	2015	24.33

Source: Compiled from unpublished data of Raipur Municipal Corporation (RMC).

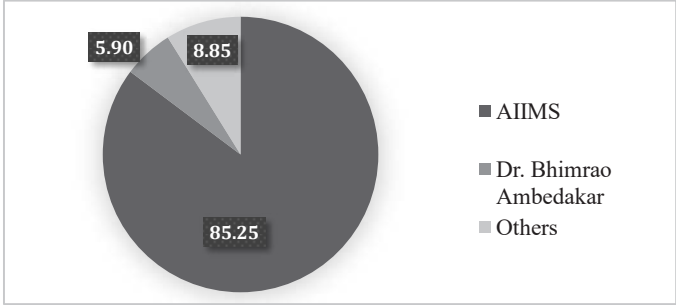
classification scheme led to a considerable decline in COVID-19 BMW. Because of the mid-year change in the classification scheme, these data are very general and may not reveal the actual state of COVID-19 BMW generated in the city.

BIO-MEDICAL WASTE MANAGEMENT IN THE RAIPUR CITY

Generation of COVID-19 BMW in the city was unevenly distributed as different centres (hotspots) have a differential share of COVID-19 BMW. AIIMS, Raipur has treated the highest number of patients and generated the highest amount of BMW. In 2021, 85 per cent of COVID-19 BMW in the city was generated from the AIIMS, while Dr Bhim Rao Ambedkar Memorial Hospital generated another six per cent waste. All other hospitals and COVID-19 Care Centres in the city shown in Fig. 2 have generated a mere nine per cent of the total COVID-19 BMW.

Before discussing the core issue in the management of BMW, it is worth mentioning that at the household level, the management of BMW is performed by the different agencies and RMC. They segregate the solid waste into organic, recyclable, and inert waste and generally do not separate the BMW from MSW. It was reported in the field visit that during the peak of the COVID-19 crisis in the city, general sanitation workers collected the household waste separately for those households affected by the COVID-19. However, no systematic data on generated

Figure 2: Contribution of Hospitals and COVID-19 Care Centres in COVID-19 BMW Generation



Source: Based on SMS-Watergrace Enviroprotect Pvt. Ltd. data, 2021

amount and management of BMW at households is available. Henceforth, this discussion on the management of BMW is confined only to the management of BMW at the healthcare institutions. This discussion does not consider the generation and management of BMW at the household level.

As mentioned earlier, the categorisation and segregation of BMW at source is the most significant task in the management of BMW. Table 5 represents the category-wise generation of BMW from 2019 to 2021. The concerned agency does not provide category-wise data for 2021; subsequently, extrapolated data for the different categories are used for 2021. Table 5 evinces that the collective share of yellow and red waste is about 90 per cent of the total BMW. However, the proportion of yellow waste in the total BMW has drastically increased after the COVID-19 pandemic in 2020.

TABLE 5: CATEGORY-WISE GENERATION OF BMW (2019-21)

Category of BMW	2019		2020		2021 (Estimated)	
	Amount (Tonnes)	Share (%)	Amount (Tonnes)	Share (%)	Amount (Tonnes)	Share (%)
Yellow	920.1	59.44	852.5	75.78	1527.0	75.78
Red	485.8	31.38	174.0	15.46	311.5	15.46
Blue	126.4	8.16	89.8	7.99	161.0	7.99
White	15.7	1.01	8.7	0.78	15.7	0.78
Total	1,548	100	1125	100	2015	100

Source: Unpublished data of RMC and website of SMS Watergrace Enviroprotect Pvt. Ltd.

The majority of healthcare establishments in Raipur city are located in the densely populated central part of the city (Fig. 1). Therefore, the proper management of infectious biomedical waste needs immediate

attention. The waste management system of these healthcare institutions involved the management of general solid waste generated during the day-to-day functioning and the management of BMW generated during the treatment of patients. The general solid waste generated from these healthcare institutions is managed by the RMC, while the management of BMW has been outsourced to SMS-Watergrace Enviroprotect Pvt. Ltd. Henceforth the BMW management of Raipur city is conducted through the Public-Private Partnership (PPP) model.

The SMS-Watergrace Enviroprotect Pvt. Ltd. uses GPS-enabled vehicles to collect and transport already segregated BMW. A total of nine such vehicles are engaged in the transportation of BMW. They transport the collected BMW from the institution to the specially designed treatment plant. The general solid waste management facility of Raipur city is located in Sakri and Sarona. The BMW disposal plant in the city was developed by the SMS-Watergrace Enviroprotect Pvt. Ltd. and is located in Siltara village, located about 18 km away from the city. This incinerator plant is compatible with the Biomedical Waste Rules 2016 and has an online monitoring system. The BMW disposal plant has been extended to an area of about 1.5 acres. This treatment features a 250 kg/hr incineration capacity, a 1000 lit/batch autoclaving capacity, a 100 kg/hour shredding capacity, and a 5 KLD Effluent Treatment Plant (ETP) with zero discharge.

CONCLUSION

The ongoing COVID-19 pandemic has led to a significant surge in bio-medical waste. The highly infectious nature of diseases created a panic situation where the management of COVID-19 BMW became a significant challenge. Initially, the BMW in the city decreased due to the lockdown imposed by the government. During the subsequent waves of COVID-19, the amount of BMW generated in the city has also increased significantly. The BMW had mainly generated from healthcare institutions and COVID-19 care centres. Apart from it, the households with COVID-19 patients also contributed to the generation of BMW. The BMW waste is collected and segregated separately by general workers engaged in SWM at the household level. It is observed that the CPCB guidelines regarding the segregation and disposal of COVID-19 BMW at the household level need more effective implementation by the concerned stockholders. At the institutional level (from hospitals and clinics), the SMS-Watergrace Enviroprotect Pvt. Ltd performs the task of BMW management. The company performed the task of transportation through GPS-enabled vehicles and an incinerator plant. The transported BMW is treated scientifically in the incinerator plant located in Siltara Village.

The pandemic turned into havoc during its peak, and posed myriad challenges to every institution working in our society. Similar challenges arrived in the form of effective management of BMW. The city has accepted the challenges and reformed the BMW collection and management system. Now, after two years of the onset of the COVID-19 pandemic, Raipur city has become more efficient in SWM and management of BMW.

REFERENCES

1. Amasuomo, E. and Baird, J. (2016). The concept of waste and waste management. *J. Mgmt. & Sustainability*, 6, 88. (Retrieved on October 1 2021, from https://researchonline.gcu.ac.uk/ws/files/26876389/64728_232860_1_SM_1_.pdf)
2. Andrews, M. A., Areekal, B., Rajesh, K. R., Krishnan, J., Suryakala, R., Krishnan, B., Muraly, C. P. and Santhosh, P. V. (2020). First confirmed case of COVID-19 infection in India: A case report. *The Indian journal of medical research*, 151(5), 490-492. https://doi.org/10.4103/ijmr.IJMR_2131_20
3. Babu, B. R., Parande, A. K., Rajalakshmi, R., Suriyakala, P. and Volga, M. (2009). Management of biomedical waste in India and other countries: a review. *Journal of International Environmental Application & Science*, 4(1), 65-78.
4. Behera, B. C. (2021). Challenges in handling COVID-19 waste and its management mechanism: a review. *Environmental nanotechnology, monitoring & management*, 15, 100432.
5. Chand, S., Shastry, C. S., Hiremath, S., Joel, J. J., Krishnabhat, C. H. and Mateti, U. V. (2021). Updates on biomedical waste management during COVID-19: the Indian scenario. *Clinical Epidemiology and Global Health*, 11, 100715.
6. CPCB, (2018). Central Pollution Control Board. Annual Report 2017/2018. Ministry of Environment, Forest, and Climate Change; 2018: 1-153. (Retrieved on April 20 2022, from <https://cpcb.nic.in/openpdf.php?%20id=UmVwb3J0RmlsZXNmOTIyXzE1NjQwMzg5OTFfbWVkaWFwaG90bzE0Mjg2LnB%20kZg==>)
7. CPCB, (2022). *Generation of COVID19-related Biomedical Waste in States/UTs*. (Retrieved on May 12 2022, from https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/COVID19_Waste_Management_status_Jan_Mar_2022.pdf)
8. CPCB, (2022). *Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/ Quarantine of COVID-19 Patients (5th Revision)*. (Retrieved on July 13 2022, from https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW-GUIDELINES-COVID_2.pdf).
9. CSE, (2021). Forty-six per cent increase in COVID-19 biomedical waste generation in India in April- May 2021, Down to Earth (June 12, 2021), Centre for Science and Environment, New Delhi. (Retrieved on May 12 2022, from <https://www.who.int/news-room/fact-sheets/detail/health-care-waste>).

10. Dehal, A., Vaidya, A. N. and Kumar, A. R. (2022). Biomedical waste generation and management during COVID-19 pandemic in India: challenges and possible management strategies. *Environmental Science and Pollution Research*, 29(10), 14830-14845.
11. Hindustan Times, (2020). Coronavirus: First case of Covid-19 infection reported in Chhattisgarh, March 19, 2020, Raipur Edition. Retrieved on April 20 2022, from <https://www.hindustantimes.com/india-news/coronavirus-first-case-of-covid-19-infection-reported-in-chhattisgarh/story-UETZX1YjdbyeUHi3OQqfL.html>
12. Kumar, A. and Agrawal, A. (2020). Recent trends in solid waste management status, challenges, and potential for the future Indian cities–A review. *Current Research in Environmental Sustainability*, 2, 100011.
13. MoEFCC, (2019). The Gazetteer of India, Extraordinary, Part-II, Sec. 3, Ministry of Environment, Forest and Climatic Change, Notification, 1st March 2019. (Retrieved on April 20 2022 from https://cpcb.nic.in/uploads/hwmd/March_Amendment_HOWM.pdf).
14. Patnaik, D. and Jena, B. (2021). Impact of improper biomedical waste disposal on human health and environment during the covid-19 pandemic. *European Journal of Molecular & Clinical Medicine*, 8(3), 4137-4143. Ministry of Environment, Forest, and Climate Change. New Delhi: Biomedical waste management rules; March. 2016:1-63.
15. Pethe A. and Sharma R., (2020). Urbanization, Slums and Incidence of COVID-19: Undertaking Reforms, *Nagarlok: Quarterly Journal of Urban Affairs*, Vol. 52, pp. 1-16.
16. Raman, R., Rajalakshmi, R., Surya, J., Ramakrishnan, R., Sivaprasad, S., Conroy, D., ... and Netuveli, G. (2021). Impact on health and provision of healthcare services during the COVID-19 lockdown in India: a multicentre cross-sectional study. *BMJ open*, 11(1), e043590.
17. Ramteke, S. and Sahu, B. L. (2020). Novel coronavirus disease 2019 (COVID-19) pandemic: considerations for the biomedical waste sector in India. *Case Studies in Chemical and Environmental Engineering*, 2, 100029.
18. Shammi, M., Behal, A. and Tareq, S.M.: The escalating biomedical waste management to control the environmental transmission of COVID-19 pandemic: A perspective from two South Asian countries. *Environ Sci Technol* 55, 4087–4093 (2021). <https://doi.org/10.1021/acs.est.0c05117>
19. Vanapalli, K. R., Sharma, H. B., Ranjan, V. P., Samal, B., Bhattacharya, J., Dubey, B. K. and Goel, S. (2021). Challenges and strategies for effective plastic waste management during and post COVID-19 pandemic. *Science of The Total Environment*, 750, 141514.
20. Verma, S. and Mishra, A. (2020). Depression, anxiety, and stress and socio-demographic correlates among the general Indian public during COVID-19. *International Journal of Social Psychiatry*, 66(8), 756-762.
21. WHO, (2005). Management of solid health-care waste at primary health-care

- centres: A decision-making guide. (Retrived on May 1 2022, from <https://apps.who.int/iris/bitstream/handle/10665/43123/9241592745.pdf>)
22. WHO, (2017). Safe Management of Waste from Healthcare Activities: A Summary, World Health Organization, Geneva. Retrieved on May 1 2022, from <https://apps.who.int/iris/bitstream/handle/10665/259491/WHO-FWC-WSH-17.05-eng.pdf>)
 23. WHO, (2018). Healthcare Waste, Fact Sheet. (Retrieved on May 1 2022, from <https://www.who.int/news-room/fact-sheets/detail/health-care-waste>)
 24. WHO, (2019). *Sanitation: key facts*. World Health Organization. (Retrieved on October 20 2021, from <https://www.who.int/news-room/fact-sheets/detail/sanitation>)

Footnotes

1. https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW-GUIDELINES-COVID_2.pdf
2. https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/COVID19_Waste_Management_status_June_2021.pdf

APPENDIX-I

List of Abbreviations

AIIMS	All India Institute of Medical Science
APP	Application
BMW	Biomedical Waste
CBWTF	Common Biomedical Waste Treatment and Disposal Facility
CPCB	Central Pollution Control Board
ETP	Effluent Treatment Plant
GPS	Global Positioning System
KLD	Kilo Litre Per Day
MOEFCC	Ministry of Environment, Forest and Climate Change
PPE	Personal protective equipment
PPP	Public-Private Partnership
RMC	Raipur Municipal Corporation
SWM	Solid Waste Management
TPD	Tonnes Per Day
UNEP	United Nations Environment Programme
WHO	World Health Organization

A Study on Municipal Bonds as a Source of Revenue for Municipal Corporations in India

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ABSTRACT

Though the 74th Constitutional Amendment Act (CAA) gave autonomy to local governments, equivalent devolution of financial autonomy is absent. Municipal Finances in India are identified by the mismatch between the funds and functions of local governments. The investment requirement of urban infrastructure over the years is increasing with the increase in population. Prior to 1990, urban infrastructure was financed largely through grants and Plan funds of governments. After 1990, the concept of municipal bonds has evolved. The present study focuses on the overview of municipal bonds in India, trends, process of issuing municipal bonds using secondary data. And it concludes that the municipal bond market has grown drastically over the years.

Keywords: Credit Rating, Financial Autonomy, Municipal Finance, Municipal Bonds

INTRODUCTION

The confined means of income to the local bodies lead to fund their developmental projects through issuance of municipal bonds in India. Municipal bond market in India is in a nascent stage whereas in most of the developed countries, it is very vibrant (Devender Kumar Pant, 2001). The 74th Amendment paved the way for the issuance of municipal bonds in India. It mainly focused on decentralisation of urban local bodies and gave them autonomy.

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Later in the year 1996, the Government of India had set up the Rakesh Mohan Committee for commercialisation of infrastructure in India which endorsed private sector participation and access of capital markets. Municipal bodies were permitted to issue tax-free municipal bonds through the amendment of Section 10(15)(viii) of the Income Tax Act, 1961, by the Ministry of Finance under certain specific guidelines in the year 2001. And again Ahmedabad Municipal Corporation was the first to issue tax-exempt municipal bonds in India.

In the year 2015, the Securities Exchange Board of India restructured the eligibility criteria for issuing and listing of municipal bonds. The municipal corporations which are planning to issue municipal bonds have to ensure that the following criteria is fulfilled: (a) It should have no negative net worth in the previous three fiscal years; (b) It should have no prior default in debt repayment in the previous year; (c) It must possess a minimum investment grade rating of Better Business Bureau (BBB); and (d) RBI's wilful defaulters list should have no mention of municipal entities, their group companies, promoters or directors.

Review of Literature

Brad Johnson & Chetan Vaidya (2001) described the groundwork prepared for the bond issue, the conception and financing pattern of the project and the issue of municipal bonds. The authors argue that the technical framework set up for the Ahmedabad Municipal Corporation bonds can act as a blueprint for future development initiatives.

Chattopadhyay (2006) delineated the problems and prospects related to the municipal bond market along with recent initiatives to propel the development of a viable and vibrant municipal bond system in India.

Chandrasekaran and Katayama (2012) stated that municipal development projects benefiting the public often get impeded by the political and institutional framework of the Central Government. In many cases in India, a major constraint is financing these projects. According to the 12th Finance Commission Report, most of the infrastructure initiatives have been stalled due to financial constraints. For instance, the shortfall in finances to achieve the water and sanitation sector goals in India's Tenth Plan is estimated at INR 179 billion. Without the discretion to issue municipal bonds, municipalities are often dependent on transfers from the Government of India (GoI). Chandrasekaran and Katayama described municipal bonds as an avenue for financing urban infrastructure along with the overview of size and structure of municipal bond market in India.

Ramakrishna Nallathiga (2015), explained in detail about the

operation of Municipal bonds and highlighted the list of taxable and non-taxable municipal bonds. Lastly he concluded that municipal bonds can play the role of financing the development of infrastructure in smart cities. Nallathiga suggested for certain changes in the institutional capacity towards management of finances in Urban Local Bodies.

Objectives of the Study

- (i) To study the overview of municipal bonds in India;
- (ii) To understand the process of raising money through municipal bonds in India; and
- (iii) To analyse the trend of municipal bonds issuance in India.

Research Methodology

To study the overview of municipal bonds and understand the process of raising money through municipal bonds, descriptive research method is employed. Analytical research method is used to analyse the trend in municipal bonds issuance in India. Secondary data is collected from sources such as Government of India and other institution(s) or agencies reports such as CARE, Indian Urban Infrastructure and Services, Working papers and websites such as National Stock Exchange (NSE), Bombay Stock Exchange (BSE), city finance, C bonds, INDmoney were used to collect the relevant data for undertaking this study. Trend of municipal bonds issuance in India is analysed using Bar graph. The present article confines to study municipal bond market in relation to Indian municipal corporations and their bonds.

Overview of Municipal Bonds in India

Municipal bonds are the debt instruments and issued by the local bodies to raise funds for their developmental projects that would require huge capital expenditure. Municipal bonds can be termed as the loan taken by the local body from the investors. The investors get interest which is tax free as return on their investment. The categorisation of municipal bonds is done in two ways – The General Obligation Bonds (used for funding general infrastructure projects and are repaid from government funds or taxes) and the Revenue Bonds (used for funding specific projects and are repaid through revenues or taxes generated by these specific projects). Until 2017, the only issuances in India have been of general obligation bonds and as the SEBI guidelines mandate, these bonds have been sold via private placement route. Public offers can be made only for revenue bonds (Kothari Consultants & Ltd, 2019).

Risks involved in Investment of Municipal Bonds

- **Call Risk** – It is a risk associated with interest rates. If interest rates decline, the potential to repay bond before maturity date by the issuer increases and vice-versa.
- **Credit Risk** – It is a risk associated with financial problems of the issuer that may make it difficult to repay interest and principal amount.
- **Interest Rate Risk** – It is a risk relating to the inverse relationship between the bond's market price and the interest rates.
- **Inflation Risk** – Municipal bonds are not suitable to overcome inflation.
- **Liquidity Risk** – It is a risk associated with lack of market for municipal bonds which doesn't enable the investors to buy and sell bonds.
- **Political Risk** – The fund raising project may get affected due to change in the political scenario of the State government and the local government.

Process of Raising Money through Municipal Bonds in India

Generally the projects for which municipal corporations tend to raise money through bonds are infrastructure projects that require huge capital expenditure. The municipal corporations can choose between the general obligation bonds and revenue bonds. Total project cost is evaluated considering various factors. Any municipal corporation wishing to raise funds through bonds have to obtain investment grade rating from any of the recognised credit rating agencies (Credit Rating Information Services of India Limited (CRISIL), Investment Information and Credit Rating Agency of India (ICRA) and others) in India. An Escrow Account has to be opened in order to make debt payments to the investors which acts as a third party between the municipal corporation and the investors until the completion of a Project/Plan. Financial and other information is disclosed as per the Securities Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015. Completion of all these requirements enables a municipal corporation to raise money either through public issue or a private placement.

Interpretation: The highest amount of Rs. 413.19 crores was raised through municipal bonds in the year 2010 followed by Rs. 400 crores in the year 2018 by Hyderabad and Ahmedabad municipal corporations

Trend of Municipal Bonds Issuance in India

TABLE 1: MUNICIPAL ISSUANCES IN INDIA SINCE 1997
(Rupees in crores)

Sl. No.	Name of the Municipal Bonds Issued	Year of Issue	Purpose of Issue	Amount Raised
1	Bengaluru	1997	City Roads/ Street Drains	125
2	Ahmedabad	1998	Water Supply and Sewerage	100
3	Ludhiana	1999	Water Supply and Sewerage	10
4	Nasik	1999	Water Supply and Sewerage	100
5	Indore	2000	Improvement in City Roads	10
6	Madurai	2001	City Road Project	30
7	Nagpur	2001	Water Supply	50
8	Ahmedabad	2002	Water Supply and Sewerage	100
9	Nasik	2002	Underground Sewerage scheme and storm water drainage	50
10	Tamil Nadu Water and Sanitation Pooled Fund	2002	Water and sanitation projects of 13 ULBs	30.41
11	Hyderabad	2003	Road Construction and Widening	82.5
12	Hyderabad Metropolitan Water Supply and Sewerage Board	2003	Drinking water	50
13	Chennai Water Supply and Sewerage Board	2003	Water supply augmentation project	42
14	Ahmedabad	2004	Water Supply, Storm water drainage, roads and bridges	58
15	Vishakhapatnam	2004	Water supply Project	20
16	Vishakhapatnam	2004	Water supply	50
17	Karnataka Water and Sanitation Pooled Fund	2005	Water supply Project of a Greenfield project for 8 ULBs	100
18	Chennai Metropolitan Water Supply & Sewerage Board	2005	Water Supply	50
19	Chennai	2005	Roads	45.8
20	Ahmedabad	2005	Roads and water supply	100
21	Nagpur Metropolitan Water Supply & Sewerage Board	2007	Water Supply	21.2

(contd.)

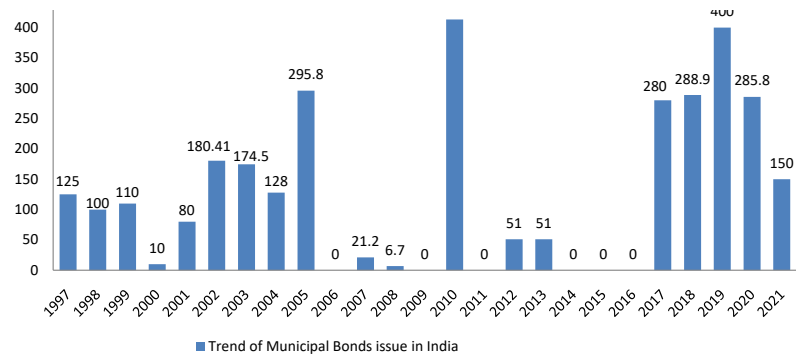
(Table 1 contd.)

22	Tamil Nadu Water and Sanitation Pooled Fund	2008	-	6.7
23	Vishakhapatnam	2010	Water Supply	30
24	Tamil Nadu Water and Sanitation Pooled Fund	2010	-	83.19
25	Karnataka Water and Sanitation Pooled Fund	2010	Lending to ULBs through Directorate of Municipal Administration	300
26	Tamil Nadu Water and Sanitation Pooled Fund	2012	-	51
27	Tamil Nadu Water and Sanitation Pooled Fund	2013	Municipal Administration and Water Supply	51
28	Pune	2017	Water metering project	200
29	Tamil Nadu Water and Sanitation Pooled Fund	2017	-	80
30	Indore secured	2018	Development of infrastructure	113.90
31	Bhopal	2018	Implementation of projects defined under AMRUT	175
32	Ahmedabad	2019	Development projects under AMRUT	200
33	Hyderabad	2019	Strategic Road Development Plan	200
34	Lucknow	2020	Infrastructure project	285.80
35	Ghaziabad	2021	Sewage Treatment plant	150

Source: <https://cityfinance.in/borrowings/municipal-bond> , <https://cbonds.com/bonds/>, <https://www.indmoney.com/bonds>

of Rs. 200 crores each. The years 2005, 2017, 2018 and 2020 witnessed the municipal bond issuances of more than Rs. 200 crores while the years 1997 to 2004 and 2021 except 2000 and 2001 had more than Rs. 100 crores municipal bonds. Less than Rs. 80 crores bonds were issued in the years 2000, 2001, 2007, 2008, 2012 and 2013 while the years 2006, 2009, 2011 and 2014-2016 had no municipal bond issues. Ahmedabad Municipal corporation has raised highest amount of Rs.558 crores in the form of municipal bonds since 1997-2021. And Bengaluru Municipal Corporation was the first to issue Government guaranteed municipal bonds of Rs.125 crores in the year 1997 while Ahmedabad with no Government guarantee of Rs. 200 crores in the year 1998.

Diagram 1 - Trend of Municipal Bonds issue in India (Rs in crore)



CONCLUSION

Raising finance through municipal bonds for financing the infrastructure projects of Municipal Corporations in India assumed greater importance in the recent times. Some of these bond issues are backed by the Government guarantee and while others are not. Municipal bonds act as an important source of finance for municipal corporations in India and can have a vast market when backed by government guarantee and are offered with handsome interest making them tax-free.

REFERENCES

1. Brad Johnson and Chetan Vaidya. (2001). Ahmedabad Municipal Bond: Lessons and Pointers. *Economic and Political Weekly*, 36(30), 2884-2891. <https://www.jstor.org/stable/4410921>
2. Chandrasekaran, P. and Katayama, R. (2012). Municipal Bonds : Is India ready for more? *ASCI Journal of Management*, 42(1), 1-19.
3. Chattopadhyay, S. (2006). Municipal Bond Market for Financing Urban Infrastructure on Journal Storage (JSTOR). *Economic and Political Weekly*, 41(26), 2787-2791. <https://www.jstor.org/stable/4418407>
4. Devender Kumar Pant (2001). Credit Rating and Municipal Bond Market—*The Economic Times*.
5. Ramakrishna Nallathiga. (2015). Municipal Bonds As a Source of Finance for Urban Infrastructure Development in India. Ramakrishna Nallathiga :: SSRN. *Nagarlok*, XLVII(3), 57-72. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2930028
5. Samal, M. (2021). Rethinking the Concept of Municipal Bonds to Improve Urban Governance in India: *Journal of Infrastructure Development*, 13(1), 44-52. <https://doi.org/10.1177/09749306211023623>

Websites

https://vinodkothari.com/wp-content/uploads/2019/11/Municipal-Bonds_Way-Forward.pdf

<http://mohua.gov.in/upload/uploadfiles/files/POOLED%20FINANCE%20DEVELOPMENT%20FUND04.pdf>

<https://pahleindia.org/pdf/publication/Municipal-Bond-Market-in-India.pdf>

<https://www.bseindia.com/stock-share-price/debt-other/scripcode/929003/929003/>

Empowering Poor by Leveraging Physical Planning

JIT KUMAR GUPTA*

INTRODUCTION

Poverty remains the greatest curse ever perpetuated on humanity and human beings on this planet earth. Majority of growth and developmental ills and maladies facing human settlements have genesis in the existence of poverty. Poverty has numerous connotations and existence of multiple implications for human living and quality of life. Major implications are —

- Poverty invariably leads to lowering the human dignity.
- Poverty is known to adversely impact and compromise with the quality of life.
- Poverty is known to be promoter of criminalisation in the society.
- Poverty degrades and makes human beings helpless and hopeless.
- Poverty adversely impacts the human psyche and mental health.
- Poverty makes human beings face exclusion from society and community.
- Poverty lowers the capacity and capability of individual / family to become a better human beings/social unit.
- Poverty marginalises the human capacity to take care and manage basic human needs, essential for human living.
- Poverty invariably lands human beings in the slums in search for appropriate shelter.
- Poverty transforms and makes human- inhumane.
- Poverty negates the sense of social, physical and economic values in human living.
- Majority of crimes/criminals in society have their roots embedded in poverty.

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- Poverty and development remain inversely related.
- Poverty and education are also negatively co-related.
- Poverty and health remain anti-thesis to each other.
- Drugs and human trafficking have its genesis in prevailing pattern of poverty.
- Poverty turns and makes human being a liability instead of asset for the society.
- Personal hygiene remains divorced when human beings are faced with poverty.

Factors causing Poverty

Poverty is, primarily and essentially, a human problem. It follows humanity like a shadow. Accordingly, it has dedicated origin and destination. Poverty can be caused by numerous factors. Poverty may be by outcome of where one is born or due to the circumstances, environment and place in which one is placed which are known to cause poverty. Majority of factors causing/perpetuating poverty remain beyond human controls. The factors are:

- Poverty can be caused by nature- *nature-led*;
- It can also be the outcome of community in which man is born- *community-led*;
- Poverty can also be the outcome of the family to which one belongs- *family-led*;
- It can also be the outcome of the caste to which one belongs- *caste-led*;
- It can also be caused by the neglect of the place where one lives *place-led*;
- Poverty is also caused by conflicts/riots between nations and communities- *conflict-led*;
- Few nations/states are known for their poverty due to low level of development/resources- *Nation/state-led*;
- Poverty can also be the outcome of adverse circumstances in which one is forced into- *Circumstances-led*; and
- Planning is also known to be responsible for causing poverty among the human beings – *Planning-led*.

Different forms of Poverty

Generally, poverty is understood and linked to lack of adequate financial resources needed for meeting the basic essentials required for human beings including food, clothing and shelter. But poverty has numerous other connotations including; poverty of thoughts, poverty of ideas, poverty of action, poverty to experiment/innovate/ explore; poverty of leadership, poverty of networking, poverty to co-operate and collaborate, etc. These typologies have their own role in perpetuating poverty on the masses and communities. Accordingly, poverty of any kind has its adverse implications on human beings.

Empowering Poor through Urban Planning

Looking at the entire global context, it can be observed that poverty remains widespread, cutting across all man-made boundaries. It is not a local phenomenon but a curse adversely impacting all nations. As already defined, large number of factors are involved in causing and supporting poverty and as long as this poverty is there, humanity cannot be at peace and planet Earth cannot become sustainable and achieving SDGs will be a distant dream. Accordingly, it is important that all nations should pool their resources, come on the same platform to co-operate, collaborate and evolve rational and realistic strategies to eradicate poverty. Eliminating poverty should be the one point agenda, which should be pursued vigorously and sincerely by all nations. However, it needs to be appreciated that poor should not be treated as a liability but as an asset, which has lot of potential and capacity to contribute to the local/national economy and employment, when fully exploited.

Poverty continues to be undefined in absolute terms and remains dynamic, ever evolving, ever devolving, never static and never finite. Despite the fact that India, as a nation is developing rapidly and its economy is growing fast, poverty still remains a major challenge. According to an International Monetary Fund paper, extreme poverty, defined by the World Bank as living on US 1.9\$ less than 2 USD in Purchasing Power Parity (PPP) terms in India, was as low as 0.8 per cent in 2019 and the country managed to keep it at that level in 2020 despite the unprecedented COVID-19 outbreak. According to World Bank, extreme poverty has reduced by 12.3 per cent between 2011 and 2019 from 22.5 per cent in 2011 to 10.2 per cent in 2019. A working paper of the bank said rural poverty declined from 26.3 per cent in 2011 to 11.6 per cent in 2019. The decline in urban areas was from 14.2 per cent to 6.3 per cent during the same period. The poverty level in rural and urban areas went down by 14.7 and 7.9 percentage points, respectively. According to United Nations Development Programme

administrator Achim Steiner, India lifted 271 million people out of extreme poverty in a 10-year time period from 2005-2006 to 2015-2016. A 2020 study from the World Economic Forum found, “Some 220 million Indians sustained on an expenditure level of less than Rs 32/ day – the poverty line for rural India – by the last headcount of the poor in India in 2013. (As per Wikipedia). According to Global MPI Reports 2019 and 2020, 21.9 per cent of the population was poor in the India where the number of poor were pegged at 269.8 million. According to World Poverty Clock in 2021, roughly six per cent or 86,799,498 (86.8 million) of the Indian population is living in poverty. Accordingly, challenge of poverty facing India, as a nation, remains both formidable and well pronounced to be tackled on priority.

Role of urban planning in causing poverty has never been realistically, rationally and objectively studied, understood, appreciated and analysed. It is generally understood in the planning parlance that planned development being people centric, invariably leads to promoting universal public good and focus on achieving and promoting improved human living. But looking objectively at the the manner in which urban planning is viewed, practiced and made operational, it can be seen and observed that Urban planning, as a process and approach, has major role to play in aggravating poverty in the urban context. Current urban planning practices, tools and methodologies invariably are based on catering to riches of the society and exclusion of the marginalised sections of the society. Accordingly, it will be appropriate that existing approach to urban planning is both critically and objectively reviewed, revised and redefined to involve and empower the poor in urban settlements. Accordingly urban planning should revolve around and should lead to:

- ***Eliminating Poverty:*** All urban development policies and programmes evolved at national, state and local levels, must remain poverty-centric and should aim at minimising the challenges faced by the poor and empowering them in the urban space.
- ***Promoting Co-operative cities:*** Cities must be planned on co-operative basis to create joint ownerships for all the citizens so as to eliminate the monopoly of urban resources, facilities and amenities by few elites/riches in the city.
- ***Making Urban Planning poor centric:*** Unfortunately, poor have faced exclusion in the urban development process despite constituting substantial portion of urban population. This has invariably led to making urban planning and

development irrational and illogical for majority of the urban settlements. Making poor people an integral part of city planning and development process while preparing Master plans/Development Plans/Local area plans shall help in understanding, and providing all basic amenities, services and spaces essentially needed by the poor, for making both their living and work qualitative. This approach to urban planning, besides minimising poverty will go a long way in achieving the universal objectives of planned development.

- ***Earmarking dedicated Commercial space:*** Earmarking, acquiring and developing adequate dedicated commercial space for the urban poor to do business by evolving and defining appropriate norms and standards, will help them to contribute to the employment and economy of the city on a large scale.
- ***Earmarking dedicated Residential space:*** Earmarking, acquiring and developing dedicated space for housing the poor in the urban context by evolving and defining appropriate norms and standards would help in minimising growth of slums and shanty towns in urban areas and promote rational residential development.
- ***Skilling Poor:*** Skilling remains major issue and prime reason for causing poverty among the large number of rural migrants, opting to make cities as their preferred place for living and working. Opening large number of skill centers for skilling the urban poor for employment in the urban context will help in empowering them.
- ***Service Centres:*** Opening large number of service centres in the city for providing manpower involved in services related to plumbing, electrification, vehicle repairs, driving, healthcare, households work, landscaping, horticulture, garbage disposal, etc. is essential to overcome poverty in urban areas. Creating space for setting up of such service centres should be made an integral part of urban planning process.
- ***Creating Day Markets:*** Permitting the organisation of the day-markets in different parts of the cities, on rotation basis, for poor to market their products and sell goods required for meeting the day-to-day needs of urban residents, will help in generating employment and creating opportunities for better earning for the poor in the city.

- **Permitting multiple use of formal urban spaces:** Planning for permitting poor to use prime urban spaces in the city, after the closure and before the opening of the formal markets, to create space for doing business by the poor will be a game changer in alleviating poverty in the urban areas.
- **Developing Motor markets:** Planning dedicated markets for carrying out repairs of the motor vehicles in different parts of the city, will help in creating number of opportunities for employment of the poor having skill in the repair of the automobiles/vehicles etc.
- **Registering Poor:** Mechanism of registering poor needs to be introduced in each city, in order to realistically quantify and understand the need and demand for such section of the community for undertaking planning for them in rational and realistic manner. Such an approach will help in targeting right beneficiaries for all poor oriented programs.
- **Leasing Space:** Space earmarked for poor should be made available on lease basis with period varying with daily/weekly/monthly /yearly basis , depending upon the nature of the space allocated and activities permitted to be carried out. No ownership of the space allocated for poor should be ever permitted. Adequate checks and balances need to be created within the system to eliminate speculation / misuse/abuse of spaces allocated to poor.
- **Promoting Circular Economy:** Cities planned, designed and developed following the circular pattern of economy, have great potential, capacity and capability to minimize poverty by optimising the use of available resources and converting enormous waste being generated by them into wealth using different options . Accordingly, cities creating large opportunities/ options for converting waste into wealth by making products which can be used /consumed locally, can help in lowering the graph of poverty.
- **Involving Poor in Planning:** For rationally understanding the basic requirements and empowering the poor, it will be appropriate to make poor integral part of the urban planning, development and management process. Involving poor in the planning and designing of urban spaces can help in not only making urban planning process more rational, equitable and objective but will go a long way in eliminating large number of ills facing the urban settlements.

- **Using Technologies:** Technology has enormous potential in optimising resources, empowering people, promoting operational efficiency, making innovations, promoting start ups, creating employment opportunities, creating correct data base, effectively monitoring the implementation of welfare schemes, connecting communities etc. It is important and critical to make technology an integral part of all the policies and programs put in operations for empowering poor.
- **Promoting Cross-subsidisation:** Making the mechanism of cross-subsidisation an integral part of the planning process will always help in generating revenue/ resources and creating space for the urban poor while planning/ granting permission for different projects/schemes launched by the private sector in the city.
- **Prioritising Regional Planning:** Urban planning remains the focus of all the planners in the present context leading to exclusion of the large number of rural settlements and major proportion of population living in the rural areas of the country (placed at 68.9 per cent, as per Census 2011). This has led to lopsided development of the country besides perpetuating poverty on large scale in the urban areas. Poverty remains a human problem but it has unfortunately been reckoned as urban problem because rural poverty gets concentrated in urban areas due to large scale rural- urban migration. Prioritising regional planning will help in not only synergising but also making optimum use of strength, resources, manpower and opportunities available both in rural and urban areas, helping in empowering the poor in the rural settlements by providing them with appropriate infrastructures, services and creating opportunities for better employment locally. Regional planning can then be followed by urban and rural planning to address the development issues and challenges facing the poor at the settlement level.

BOOK REVIEW

A.K. Jain, Urban and Regional Planning – A Practical Guide, Delta Book World, 2022, New Delhi, ISBN 978-81-955519-1-0, Rs. 4,500/-, p. xvi + 480.

India's around 8,000 cities and towns with around 380 million population are the engines of its development and socio-economic transformation. However, the cities are threatened by poor infrastructure services and transport, shortage of housing, increasing carbon emissions and deterioration of urban environment. Continuing poverty and unemployment, backlogs of the basic services as water, sanitation, electricity, education and healthcare are the common urban symptoms. The urban poor, children, elderly, women, disabled and the homeless constitute the most vulnerable groups of people. The 74th Constitutional Amendment Act, 1992 has assigned a greater role to the local bodies in urban planning and governance. These underline the importance of local action in urban development which is inextricably linked with the political and governance system.

According to A.K. Jain, there are conflicts among spatial planning and sustainability due to chronic peripheralization, increasing pollution, transport, energy, land and water consumption. It needs relooking at the repertoire and processes of urban development which should shift from fossil fuel era to the circular concepts of urban planning, renewal, recycling and conservation of natural resources.

The book, *Urban and Regional Planning...* states that since 2014, the Government of India has launched several new urban missions, viz. Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Pradhan Mantri Awas Yojana, Historic City Development and Augmentation Yojana (HRIDAY) and Swachh Bharat Mission (SBM). The SBM 2.0 and AMRUT 2.0 continue to operate with effect from October 2021. The plans for these missions including 500 cities under AMRUT have adopted the technique of Geo-database Creation, GIS-based Master Plan Formulation and Capacity Building. An MoU has been signed between National Remote Sensing Centre (NRSC), Department of Space and Ministry of Housing and Urban Affairs for Geo-database Creation.

These missions aim at low carbon urbanisation and the provision of core infrastructure services like water supply, sanitation and solid waste management, efficient urban transport, affordable housing for the poor, 24x7 power supply, IT connectivity and e-governance. These missions emphasize upon participatory planning and governance,

livelihoods, connectivity and providing better education, healthcare, urban safety and smart services, which are intelligent, interconnected and instrumented.

According to the author, in this digital age, all round disruptions are happening. In India, the 20 year model of Master Planning was adopted during the 1950s which does not address the emerging problems of climate change, air and water pollution, public health, employment and disasters. It is also incongruent with the objectives of speed, scale and sustainability. It is necessary that urban and regional plans are prepared for a five year horizon, while their vision may extend to 20 years.

In this pursuit, the city planning should focus upon an integrated approach towards ecology, the conservation of the natural resources and sustainable urban development, including the services like drainage, water supply, air, sewerage, solid waste management, transportation and energy. Accordingly, the planning process can be segregated as per the domain (Government, Development Authorities, Municipal Government, PPP, etc.), levels (Local, Zonal, Master Plan, Policy Plan/ Regional Plan), time frame (short, medium and long term). According to the author, at every stage public and institutional participation is necessary for a sustainable, resilient and low carbon development. This involves the following:

- Local Economic Promotion and Jobs
- Reducing urban Footprint
- Biodiversity, Greenery and Amenity Spaces
- Urban Heat Mitigation
- Water Conservation and Management
- Decentralised and Intelligent Services
- Air Quality Management
- Clean Transport and Transit-Oriented Development
- Green Energy
- Green and Resilient Buildings
- LIFE- Lifestyle for the Environment

The present land use pattern in India indicates shortfall of land under forests and greens, while the lands under agricultural use are being increasingly converted for the highways, airports and settlements. It is estimated that an additional two to three million hectares would be required for human settlements during next 10 years. Sacrificing agricultural land for habitation implies reduction of land for producing

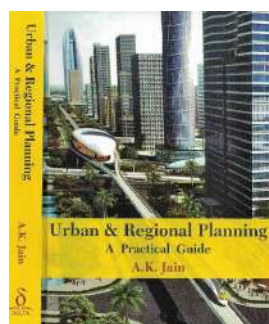
food. The lands that sustain agriculture, biodiversity, surface water and groundwater, fragile and sensitive areas, coastal zones, etc. need protection and conservation.

According to A.K. Jain, the author, urban transport contributes nearly two-thirds of the total suspended particulate matter and 18 per cent of carbon emissions. It is time to think of sustainable modes of transit. It may be necessary to provide Integrated Transit Corridors (ITC) integrating BRT, Metro and trains together with pedestrian and cycle lanes. These can be flanked by public, semi-public, high-density developments. Metro, trains, sub-way and primary roads can run underground for easy bike and pedestrian traffic on the grade. Multi-modal integration, last mile connectivity and e-governance are the pillars of sustainable urban mobility. River/water transport and ropeways can be explored which are almost pollution free and cost-effective. Besides controlling growth of private vehicles, it is necessary to explore parking space in stilts, multi-level puzzle/skeleton structures, on roofs and in underground spaces. Seamless multimodal public transport system comprising bus rapid transit and rail-based mass transport system would work better by adoption of single ticketing and restructuring of land uses by transit-oriented development. Subterranean garages near commuter destination reduce the need for ground parking. Digital parking meters send signals to mobile phones when a space opens up, reducing traffic caused by drivers trolling for space. The concept of walk to work should be the basis of urban structure and city size.

The book explains how to plan a resilient and low carbon city. It comprises smart and green transport, energy, water and buildings with net zero carbon emissions. It produces surplus energy from renewable sources that compensates for all carbon emissions associated with the transport, construction, industries and buildings. Net zero urban development creates an environmental benefit by decarbonisation. Such a city promotes creation of jobs, urban variety, gender equity, digital planning and governance, adoption of micro-climatic design approach and intelligent services. Optimum use of land and natural resources, lifestyle for environment and new partnerships are critical elements of a resilient, low carbon habitat.

All the above has been deliberated upon in nearly 500-page book '*Urban and Regional Planning – A Practical Guide*' by A.K. Jain. The author has reviewed the urban policies and their linkages with the sustainable development goals, socio-economic, environmental and technological contexts. The author also dwells on the issues of climate change and the endeavour to halve the carbon emissions by 2030, which necessitates that the cities shift to cleaner fuels, renewable energy and green technologies.

These demand a new set of strategies of urban and regional planning, which focus on local areas, digital analytics, pollution control, sustainable development and climate resilience. The author has explained various concepts in a simple language. The book in its 24 chapters provides useful information and ideas to build a new perspective of urban and regional planning.



JDS Sodhi
Ex Director, DDA

National Level Activities during July - September, 2022

K K PANDEY*

Emerging Focus on Cities/Urban Areas

The third quarter of current fiscal has witnessed special mention on role of cities and urban area in the Amrit Mahotsav (75-100 years) of Independence at highest level of decision making. Hon'ble Prime Minister on 30th September emphasised, while inaugurating first phase of metro in Ahmedabad, that cities will shape India's vision to become a developed nation in next 25 years. It was also indicated that cities need to be reoriented in a regular manner as per changing times. Twin cities should be developed. Further cities should be built in line with global business demand, Gati Shakti National Master Plan, Logistics Policy and focus on speed with e-vehicle policy.

The address by Prime Minister reveals a direction in which cities are expected to move to drive the growth in next 25 years. It will be spelt out in terms of policies, missions, programmes and schemes at the intergovernmental level in due course.

Specific Events

Specific events during the quarter include: Swachh Bharat, City Infrastructure, Services & Housing, Digital Governance and Capacity Building

SWACHH BHARAT

1. Swachh Survekshan has been completed with coverage of 4354 ULBs including 90441 wards, 17000 commercial areas and around 25000 residential areas. The awards shall be announced and conferred in a special ceremony on 1st October, 2022. The Survekshan brings state of cleanliness in 90000+ wards in the country. (MoHUA, 30th September, 2022)
2. MoHUA organised tech Exhibition to display home grown technologies and provide answers to ever increasing dimensions of sanitation and Solid Waste Management (September 29, 2022)
3. The vision of Garbage Free Cities under Swachh Bharat Mission - U

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can be achieved by eliminating hazardous dumpsites in the cities. In this regard, the 'Lakshya Zero Dumpsite' furthers the eradication of garbage landfills within the cities under the mission goals of SBM - U 2.0 (MoHUA September 7, 2022)

4. SBM has facilitated safe sanitation services to a large number of urban population 70 lakhs. In-house/community toilets have been constructed keeping in view the requirements of women, transgender community and physically challenged persons (September 2, 2022)
5. Hon'ble LG Delhi, Shri V.K. Saxena flagged the sale of refuse-driven fuel to the JK Cement Industry by providing 05 trucks with 100 MT of RDF. The sale will further the effective elimination of garbage dumps from hazardous landfills and also generate revenue for the MCD (Municipal Corporation of Delhi). (September 1, 2022)

CITY INFRASTRUCTURE, SERVICES & HOUSING (SCM, AMRUT & HFA)

1. 'United Nations- Smart Solutions and Inclusive Cities Awards 2022' was conferred by Shri Hardeep S. Puri, Hon'ble Minister, MoHUA, Govt of India. Joint Secretary, SCM, Shri Kunal Kumar, Mr. Shombi Sharp the UN Resident Coordinator in India & others were also present at the award ceremony. (September 1, 2022)
2. Urban Housing conclave will be organised in October 17-19 in Rajkot, Gujarat to have seven specific sessions on Slums, Private Sector, Innovative Construction Technologies, Enabling Eco System etc. (MoHUA September 30, 2022)
3. 1st Regional Workshop on 24x7 Water Supply Systems was organized by MoHUA, Govt. of India and CPHEEO at Puri. (September 29, 2022) The workshop deliberated on models and process used for 24x7 Water Supply.
4. Acclaimed beauty is source of life for numerous lives at Fateh Sagar Lake Udaipur being protected under National Mission-AMRUT. (MoHUA- September 28, 2022)
5. Kodaikanal Lake is another spot being renovated under Atal Mission for Rejuvenation and Urban Transformation (AMRUT). (September 27, 2022)
6. Jal Survekshan is conceptualised to assess and rank cities on quality of water in 485 AMRUT cities. (September 27, 2022)
7. Tiruchirappalli river front (2.6 km long canal) has undergone

redevelopment and has added tourism and attraction and safe environment in the vicinity. (September 27, 2022)

DIGITAL GOVERNANCE

1. The national urban digital mission aims to strengthen the capacity of India's States & UTs to leverage digital technology & e-governance to address critical urban challenges & facilitate online delivery of common municipal services across all Urban Local Bodies (ULBs) in India. (September 28, 2022)
2. National Urban Digital Mission (NUDM) covered 19 states under tripartite MoU for implementation of NUDM (MoHUA September 28, 2022)
3. Smart cities strive to improve citizen services and enhance the quality of life of the public. Indore, in the regard, will have all the addresses in the city in digital form.
4. PM SVANidhi is giving special focus on digital transactions with incentives. It will benefit formalisation of street Vendors and also support growth of urban economy. (September 2022)

CAPACITY BUILDING

1. Representatives from IIT Indore and National Institute of Disaster Management visited smart city Ujjain under community outreach programme to see the projects and understand the concept of smart city at ground level. (MoHUA, September 29, 2022)
2. Indo-French Seminar on sustainable urban Development was organised on September 27, 2022 to deliberate on managing waste, behaviour change and shared responsibility between govt. and citizen. (MoHUA September 27, 2022)
3. National Workshop covering twenty urban sector academic institutions on scaling up training for Climate Capacities was organised at Pride Plaza Hotel by GIZ, MoHUA and NIUA under Smart Cities Mission on 28th September, 2022. The workshop deliberated on follow-up on material developed under the mission through training of trainers, networking and customised training courses.
4. The workshop preceded two-day conference held on 26-27 September, 2022 on Mainstreaming Climate Action in Urban areas – Moving towards Climate Smart Cities. The conference of training institutions examined the manuals and other publications of GIZ/ NIUA project to adapt them in the training curriculum.

Redevelopment of Chandni Chowk, Shahjahanabad, Delhi

KUSUM LATA*

The Chandni Chowk, one of the largest and oldest markets of the Walled City in Delhi is currently being remodelled by the Shahjahanabad Redevelopment Corporation (SRDC), the nodal agency executing the Chandni Chowk pedestrianisation and redevelopment project. Structure of this column flows from Shahjahanabad's evolution from Mughal Empire to current Master Plan for Delhi-2021, constitution of SRDC and the status of Chandni Chowk pedestrianisation and redevelopment project.

Shahjahanabad's Evolution

Old Delhi / Purani Dilli / Shahjahanabad, the Seventh City of Delhi was founded by the Mughal emperor Shah Jahan, who laid its foundation in 1639 and it was completed in 1648. Shah Jahan located on the western bank of the River Yamuna and it was near Silk Road. The city became a self-contained walled city with mansions of nobles and members of the royal court, common people, along with markets, religious buildings and magnificent gardens. Shahjahanabad remained the capital of the Mughal Empire until its fall in 1857, when the Britishers took over as supreme power in India. Its condition deteriorated, and quality of life also degenerated, and Britishers started developing new habitats further south-west. Old Delhi still has magnificent built heritage with splendour architecture, rich cultural heritage, traditional art, craft, bazars, cuisines, etc. All these contribute to area's potential as a tourist destination of national and international tourists.

The main axes of Shahjahanabad were the two major boulevards connecting the fort to the city gates, important one was Chandni Chowk/'Moonlit Square' running from the Lahori Gate of the Fort to the Fatehpuri Masjid (mosque) (Map 1). Chandni Chowk road was forty yards wide and contained 1500 shops of a uniform design. Second major boulevard was Faiz Bazaar running north-south from the Akbarbadi gate of the Fort to Delhi gate. These two main axes had well stocked shops of even imported goods. Many other markets flourishing since the time of Shah Jahan are Khari Baoli, Dariba Kalan,

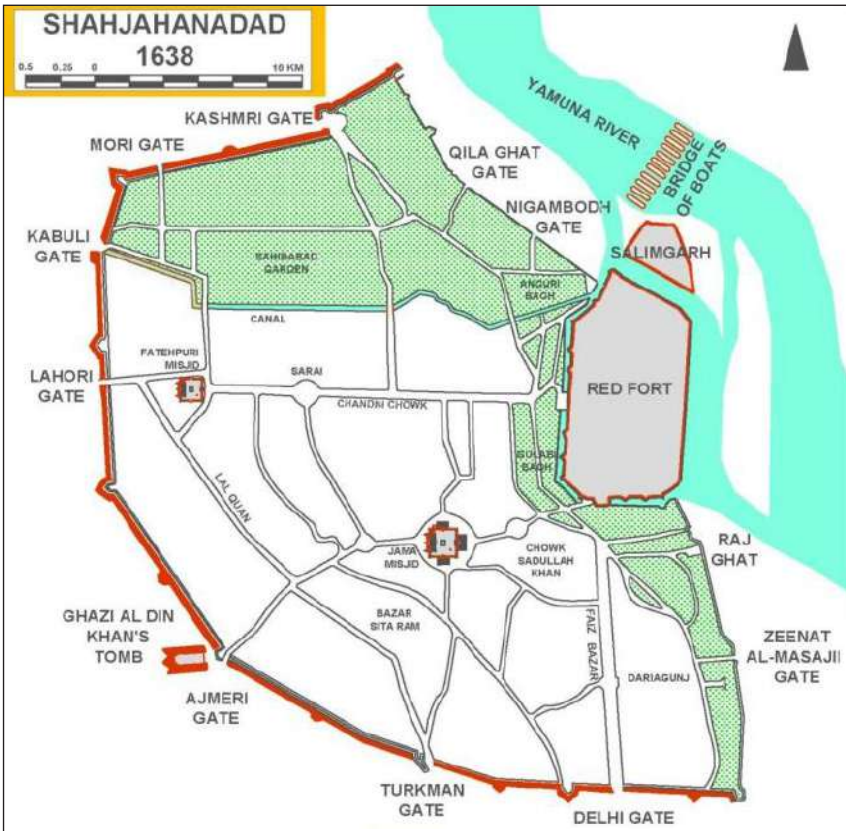
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Chawri Bazar, Daryaganj, Urdu Bazar, Nai Sarak, Churi Walan, Sadar Bazar, Ghantelwala street etc. A few wholesale markets which opened in Colonial time period were the hardware market in Chawri Bazar in 1840; dry fruits, spices and herbs market at Khari Baoli, in 1850; Phool Mandi (Flower Market) of Daryaganj in 1869.

Havelis reproduced a scaled down version of the Palace complex and were self-contained. These Havelis with their spill-over dependants building around them formed the nucleus of the residential areas. Several locality names (Teliwara, Malliwara, Katra Nil, Farash khana, Ballimaran, Khari Baoli, etc) have survived till date.

Shahjahanabad is fast changing its residential character to non-residential use, but still has a residential component. The non-residential uses of varying degrees have developed with time depending on their location, related with accessibility and the established trade.

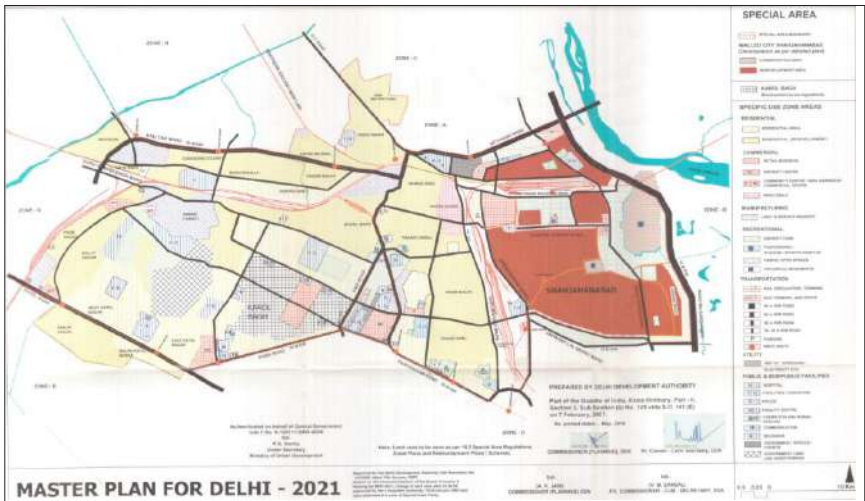
Map 1. Shahjahanabad



Source: http://www.kamit.jp/02_unesco/20_delhi/xcityp_eng.htm

Vision of the Master Plan for Delhi (MPD)-2021, approved and notified by the Central Government on 7th February 2007, is to make Delhi a global metropolis and a world-class city, where all the people would be engaged in productive work with a better quality of life, living in a sustainable environment. Of the 8 objectives formulated two most relevant to Old Delhi are to preserve Delhi’s heritage and blending it with the new and complex modern patterns of development; and doing all this within a framework of sustainable development, public-private and community participation and a spirit of ownership and a sense of belonging among its citizens. The Plan will continue till the MPD-2041 is notified. MPD-2021 recognizes Shahjahanabad as a component of Special Area comprising of Zone-A (Walled city) consisting of Sub-Zones A-13 to A-26, A-28 (i.e. part of Railway Station and Railway Yard) and Sub-Zones C-1 (Map 2.). The Special area is usually characterized by a mix of different land uses and have similarities in compact built form, narrow circulation space and low-rise high-density developments, mainly accommodating residential, commercial – both retail or wholesale and industrial uses. The plan proposes that ‘Special Development Plans’ be formulated for these notified buildings and precincts, by the agencies concerned with the protection of Delhi’s built heritage such as the Archaeological Survey of India (ASI), Government of National Capital Territory of Delhi (GNCTD), Department of Archaeology, Municipal Corporation of Delhi (MCD), New Delhi Municipal Council (NDMC), Cantonment Board and Delhi Development Authority (DDA).

Map 2. Special Area having Shahjahanabad as Redevelopment Area



Source : SRDC, GNCTD 2015, Revitalization of Shahjahanabad =Project Concept Proposal

The Zonal Plan A and Part C identified Areas of Conservation i.e. for conservation of monuments/buildings within the Walled City of Shahjahanabad. The population of the walled city declined steadily from 0.42 million in 1961 to 0.25 million in 2001 (MPD-2001) to 0.16 million in 2011. This has been mainly due to movement of people away from the central core. This was, however, accompanied by a reverse process of increase in the other activities and working population, which had further put pressure on civic amenities and cultural heritage of walled city. In absence of heritage bye-laws or Conservation Management Plan (CMP), various old Havelis have been turned into workshops or manufacturing industries for various products, like legalized handicraft industries, as well as dangerous chemical which can cause fires and accidents in the dense settlement. With improved accessibility of MRTS, this area has become more prone to commercialization.

Constitution of Shahjahanabad Redevelopment Corporation

The idea of revamping Chandni Chowk first came up in 2004 and after four years, in 2008, the then Hon'ble Chief Minister of Delhi, Mrs. Sheila Dikshit, constituted a special purpose vehicle, Shahjahanabad Redevelopment Corporation (SRDC).

The initial mega facelift project was to be built across 550,000 sq.ft comprising of 24 buildings that include an emporium, a museum, a sacred kitchen, a Vedic library, a centre to store ancient scriptures, a city gallery, and a food court – all built around the temple that is visited by about seven million pilgrims annually. Phase I of the project comprising of facelift of Chandni Chowk, Phase II of the project involves façade improvement of buildings along the 1.5km-long Chandni Chowk main market and the improvement of six adjoining roads namely Nai Sarak, Bali Maran Road, Gali Qasim Jan Road, Rodgran Road, Farash Khana, and Lal Kuan Main Road.

Chandni Chowk redevelopment project, was approved in August 2018 and work commenced in December 2018 with completion target of March 2020. The project got delayed due to the coronavirus pandemic, and its deadline was extended twice - December 2020, April 2021. Finally on 13th September 2021, Hon'ble Chief Minister of Delhi, Sh. Arvind Kejriwal, dedicated the revamped stretch to the public, and announced that the entire area will be transformed into a tourist hub and street food joints will be allowed to operate till midnight.

Status of Chandni Chowk pedestrianisation and redevelopment project

In the Phase I of the project 1.4 km stretch of the Chandni Chowk market has been redeveloped with following features :

- “no traffic zone” for motorised vehicles between 9 am and 9 pm,
- pedestrian-friendly corridor with 2.5 metre wide footpath,
- dangling wires have gone underground
- 197 electric poles and 124 CCTV cameras installed
- facilities like unisex toilets, water ATMs and dustbins for pedestrians to walk without inconvenience
- ramps for people with disabilities, also has tactile flooring to make it ‘divyang’ friendly
- red granite stone, decorative lights, plants and street furniture makes it beautiful and aesthetically appealing
- Four earthen and sandstone signages have been installed on which information has been given in Hindi, English, Urdu and Punjabi.

In addition to redevelopment of the Chandni Chowk stretch, the transformation of the whole area to a tourist hub for tourists coming for heritage shopping, food and tourism destination. The parking project was conceived in 2013, and in 2018 City court pulled the North Delhi Municipal Corporation for the project’s delay. NDMC floated the multi-level parking project on PPP mode and Omax Ltd was awarded the project. Chandni Chowk, being one of Asia’s largest and busiest wholesale and retail hubs, had insufficient parking in the form of Gandhi Maidan parking, situated adjacent to the Chandni Chowk Metro Station, which could accommodate only 650 cars. The multi-level parking cum commercial project spread over 4.5 acres will accommodate 2100+ cars and 81 tourist buses in five floors of parking – 3 underground and 2 over-ground and three floors dedicated for retail spaces and a food court. The corporation gave September 2021 as the deadline but there has been a delay as construction work halted due to Covid and further deadline extended to January 2022. The facility will benefit traders in nearby markets such as Chawri Bazar, Kinari Bazar, Khari Baoli, Nai Sarak and Dariba Kalan.

After the completion of Phase I of the project, PWD was scheduled

to begin the work for the Phase II in December 2021 but, got delayed due to lack of funds. In Phase II, all buildings on the 1.4-km Chandni Chowk stretch will get a facade uplift. Further, apart from the restoration of facades of the aged buildings on the boulevard, the internal lanes in the areas like Ballimaran, Shyama Prasad Mukherjee Road, Netaji Subhash Road and the precincts of Jama Masjid will be restored. ()Oct 23, 2021,

In 2020, PWD had proposed to make the Chandni Chowk stretch greener having only 90 trees, by planting 150 native ornamental trees. In August 2021, Hon'ble Minister for Urban Development, Sh. Satyendar Jain, approved the ITC group proposal of plantation in the Chandni Chowk stretch under CSR initiative.

A recent memorandum submitted to Hon'ble LG of Delhi, Sh. V.K. Saxena, by the residents and shopkeepers of Chandni Chowk, requests for construction of a dedicated fire station; at entry points installation of boom barriers, as per the original redevelopment plan, instead of boulder barricades that obstruct the entry of emergency vehicles; measures to prevent waterlogging; dedicated rickshaw stands; more public toilets for women; and extension of timings for commercial vehicles to load and unload goods. Various stakeholders – government, public and private need to work together to maintain the features of the revamped Chandni Chowk intact.

This article is based on Revitalization of Shahjahanabad = Project Concept Proposal of GNCTD, 2015, MPD-2021 and articles from various e-newspapers.

News from States: Urban Flooding in India

SACHIN CHOWDHRY*

Problem

Earlier people looked forward to monsoons- farmers in rural areas for their cropping and city dwellers for getting relief from sweltering heat. But now people living in the urban areas dread even the thought of it, as we are now witnessing cases of urban flooding across the country, year after year. The situation is worst in metros like Delhi, Mumbai or Chennai. Mumbai this year got 45% excess rainfall in July. Santa Cruz weather station of the India Meteorological Department (IMD) recorded 1244.6 mm of rain against the normal of 855.7 mm. In July 2021, the city had recorded 1122.6 mm of rain.¹ Many parts of the city remained inundated in waist deep water, throwing city life out of gear.

Notably, Delhi which received less than normal rain, also faced the problem of waterlogging. The Safdarjung observatory of IMD recorded 189.6 mm of rainfall, between June 1 and July 22 this year, which was less than normal of 201 mm. Flooding has been reported in many cities some of which are mentioned below:

- Indian Express on August 25th, 2022 reported water logging causing traffic jams in some parts of Chennai city.
- The Hans India reported on 4th May 2022 that Upper Basthi in Sithaphalmandi faced chaos after rains. The roads, shops and houses were filled with drainage water, which destroyed people's belongings and items in their shops. The residents face such situation every year.
- NDTV reported on 16th August 2019 that 35 crocodiles were rescued from Vadodara city as Vishwamitri river entered several localities. The city and its adjoining areas had received nearly 500 mm of rainfall in a day for many days. On 1st August 2019, a cop in Vadodara city had carried 2 year old in tub on his head in neck deep water.

It has been a persisting problem over the past several years whereby major cities in India have been severely affected. The most notable

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¹Hindustan Times 2022. City got 45% excess rainfall in July, next active spell around August 5, New Delhi: HT.

amongst them are Hyderabad in 2000, Ahmedabad in 2001, Delhi in 2002 and 2003, Chennai in 2004, Mumbai in 2005, Surat in 2006, Kolkata in 2007, Jamshedpur in 2008, Delhi in 2009 and Guwahati and Delhi in 2010. Experts say climate change has made rains exceptionally fierce and less predictable in recent years, and unchecked urban development often leads to flooded streets and homes and causes traffic snarls (BBC, 2022).

Defining the Problem

As a policy issue, the government defines urban floods as ‘the submergence of a usually dry area by a large amount of water that comes from sudden excessive rainfall, an overflowing river or lake, melting snow or an exceptionally high tide. In the Standard Operating Procedure on Urban Flooding, the policy document notes that ‘increasing trend of urban flooding is a universal phenomenon and poses a great challenge to city administration and urban planners word over’. Its impact can be widespread, resulting in cities being inundated from a few hours to several days, leading to temporary relocation of people, damage to civic amenities, deterioration of water quality and risk of epidemics.

Causes

The experts attribute the phenomenon to overburdened drainage, unregulated construction, no regard to natural topography and hydro geomorphology. The other causes include unplanned waste dumping and continuous disregard for natural recharge structures like ponds, wetlands and tanks (Parichha, 2022). A June 2020 Climate Change Assessment Report of the Ministry of Earth Sciences noted that the increased frequencies of heavy rainfall had enhanced flood risk all over India, particularly in urban India. Untreated sewage and toxic chemicals can pose significant threats to public health and water supply.

Resolving the Problem

As a part of its mandate, the National Disaster Management Authority (NDMA) has made efforts to prepare the National Guidelines on Management of Urban Flooding. However, attempts to tackle the problem have faced the challenge of project completion. For example, Brihanmumbai Stormwater Disposal System Project to overhaul the city’s old stormwater drainage system was proposed after the 1985 floods. However, the work finally started after 2005 deluge. The project included building 8 major pumping stations. but it is yet to be completed.

Similarly, in Delhi in 2022 the drainage system is operating under the drainage master plan of 1976. Delhi’s drainage system is now proposed to be redeveloped by 2025. In Bangalore, Comptroller and Auditor

General report highlighted that the Bruhat Bengaluru Mahanagara Palike (BBMP) had not removed 714 encroachments out of the 2626 identified near water bodies. Of the 23 significant encroachments, 16 were not even on BBMP's list (Kumar & Gera, 2022). Ministry of Urban Development came out with SOP for managing the urban floods.

Objectives of Standard Operating Procedures (MoUD, 2017)

- To minimize the loss of life and damages to property and to ensure restoration and rehabilitation.
- To illustrate a concise chart, listing major executive actions required in response to urban flooding
- To list necessary tasks for preparedness, response relief and restoration required to be undertaken by the line agencies and departments involved.
- To ensure effective integration of tasks/events of each department at every stage of the disaster management process and enable continuous coordination of all actions.
- To enable reporting of actions taken by each agency / department for further review and updating of the existing SOP from past learnings.

Wherever required, teams of the National Disaster Response Force - a specialised force that responds to life-threatening disasters in the country - are deployed in the city as a precautionary measure.

NDMA has decided to address urban flooding as a separate disaster, delinking it from floods. While it may not be easy, multi-pronged efforts need to be made with multi-agency convergence and coherent Action Plans.

REFERENCES

1. BBC (2022) Mumbai: Heavy rains bring Indian city to a standstill, July 6, BBC News.
2. Kumar, Bhaswar & Ishaan Gera (2022) That sinking feeling: Why urban India gets flooded every monsoon, July 21, New Delhi: Business standard.
3. Ministry of Urban Development (2017) Urban Flooding: Standard Operating Procedure. New Delhi: Government of India.
4. Parichha, Mayank Jain (2022) Explained: How Unplanned Development And Disregard To Natural Water Bodies Cause Urban Flooding. New Delhi: Outlook.
5. Singh, Mitashi & Varnika Upmanyu (2019) Urban flooding: The case of drowning cities and rising vulnerability. New Delhi: Down to Earth.

Climate Change Mitigation and Adaptation through Nature Based Solutions - Select Case Studies from Indian Cities

AMIT KUMAR SINGH*

Climate change is a global phenomenon with several ramifications, including sea level rise, increase in extreme weather events such as floods, droughts and storms, air pollution and the spread of tropical diseases. Right now almost half of the world's population lives in urban areas. They consume three fourth of the energy production and account for almost equal share of global CO₂ gas emissions. In case of India, urban areas contribute to nearly 44% of India's carbon emissions, driven by transport, industry, building and waste¹. Since, most of the cities are densely populated and located either in coastal or floodplain areas, rise in sea level or frequent floods have huge impacts on cities' basic services, infrastructure, housing, human livelihoods and health. At the same time, most of the cities are dependent on distantly located water resources, even a small drought creates water crises for cities. The other consequences of climate change are urban heat island effect and air pollution which has increased the risk of health hazards in cities.

Past experiences suggest that there are no shortcut solutions for climate change. Therefore, government across the countries, states and cities are devising innovative and nature based approach to mitigate the negative impact of climate change. They have recognized the role and contribution of urban areas to achieve its climate commitments and improve climate resilience, like decentralized waste management, smart mobility, reducing GHG, energy efficient equipments, green buildings; biodiversity, green cover, installation of solar panels, etc. Similarly, India's National Climate Action plan (NDC) aims to reduce Green House Gas emissions by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030².

Since last few years, many of the city governments have prepared nature-based comprehensive plans for climate change mitigation and adaptation. Based on those plans few initiatives have already been

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taken in many cities. In this article, we will discuss following two **‘Nature Based Solutions’** projects which have been prepared by our city governments.

1. Blue-Green Masterplan of Delhi
2. Rajkot City Climate Change and Environment Action Plans

1. Blue-Green Masterplan of Delhi

Improving the Blue-Green Infrastructure (BGI) in cities is now becoming an important component for climate change mitigation at city level. BGI aims to enhance the ecosystem services, biodiversity and water management in urban and rural environments. The blue-green infrastructure is relatively a new approach and primarily focuses on sustainable urban living and planning.

As defined by the European Commission, BGI is a multifunctional planning approach to address the challenges of Climate change both at local level and global level³. It focuses both on the blue (water) or the green (vegetation) elements. The Green-based projects aim to increase the vegetation density (such as trees, parks, gardens, playgrounds and forests) in urban areas including the growing sector of greening buildings. In blue-based projects emphasis is given on sustainable water management through water conservation and waste water treatment in the cities.

Keeping in view the future environmental and developmental challenges of National Capital Region, Delhi Development Authority (DDA) has recently drafted a Master Plan of Delhi (MPD)-2041⁴. This Draft Report aims to build a sustainable “green and blue’ infrastructure in the national capital to curb local sources of pollution such as dust from construction sites and vehicular emissions, as well as redeveloping the city’s forest and green cover and its water bodies. According to this green and blue concept, water bodies and land are interdependent and grow with the help of each other while offering environmental and social benefits⁵, which are currently missing in Delhi. Notably, the environmental strategies cannot be treated in isolation with other segments; instead, they align with transport, heritage and industries to address overall environmental issues. The new MPD recognizes the existing voids in environmental strategies. As per new strategy, rejuvenating of river Yamuna floodplains includes creating greenways along the drains’ buffer and sensitively converting those into public waterfronts along water bodies previously neglected.

MPD draft has comprehensively laid out strategies to redevelop,

enhance and preserve the green-blue assets in the city. Few of them are as follows:

1. Comprehensive framework to treat green and blue assets (natural and planned) as green-blue infrastructure to facilitate better continuum and strategies for tackling pollution.
2. Protection and enhancement of natural assets with public interface.
3. Creation of new city-level assets - greenways along natural drains, repurposing underutilised sites and wastelands as green-blue assets.
4. Greening of plots/buildings and introduction to Green-Blue Factor (GBF) for plan approval.
5. Improvement of parks and provision for special abilities parks.
6. Dedicated Green Development Area for incentivizing large-scale implementation of green economies, clean energy generation and promoting green developments.
7. Unified institutional framework for mobility management.
8. Transit-oriented development aligned with mass transit.
9. Identification of strategic mobility corridors.
10. Focus on improving walking and cycling.
11. Encouraging mainstreaming electric vehicles and other green mobility options.
12. Variable parking norms linked to availability of public transport, earmarking space for electric vehicles, parking and parking management.
13. Multi-modal integration (including development of multi-modal hubs) and facilitation of first and last mile connectivity.
14. Integrated water resource management (combined policy for water supply, wastewater management and storm water management) for long term water security.
15. Rationalisation of supply norms for water INF1 Norms for decentralisation of wastewater treatment, recycling of wastes and maximum reuse of recycled water and solid waste.
16. Production and use of clean energy.

17. Provision for community level water harvesting and aquifer recharge facilities.

2. Rajkot City Climate Change and Environment Action Plans

Rajkot is one of the important cities in the western state of Gujarat. As in the many parts of the Globe and India, the average temperature is rising in Rajkot. Increase in temperature due to climate change is affecting the health, livelihoods and productivity of the vulnerable population in Rajkot city. Therefore, it is critical for the city government to adapt a comprehensive action plan to reduce/mitigate the consequences of rising temperature. This year Rajkot District has prepared a comprehensive Climate Change and Environment Action Plan (CCEAP)⁶. With this Rajkot is emerged as an important climate player amongst Indian cities. The CCEAP of Rajkot has been developed in collaboration with the Climate Change Department, Government of Gujarat and Gujarat Ecological Education and Research (GEER) Foundation, Forests and Environment Department, Government of Gujarat.

The CCEAP bring forth a comprehensive set of recommendations for various climate-relevant sectors and environmental issues of the districts, along with case examples and estimated mitigation potential. The main objectives are as follows:

- Reducing energy consumption by;
 - (a) Increasing the share of RE generation in the district by advancing on-grid and off-grid solar rooftop, ground-mounted installations and other RE installations;
 - (b) Encouraging faster penetration of energy efficient, star-labeled fixtures and upgrading existing power-grid infrastructure to advanced metering infrastructure (in public, institutional and commercial setups);
 - (c) Promoting energy efficiency in the residential sector by encouraging the incorporation of ECBC in the building bye-laws, implementation of India Cooling Action Plan, 2018, etc.; and
 - (d) Promoting energy conservation in the industrial sector by introducing measures such as a “cap and trade” system for MSMEs at the district level, encouraging industries to follow the Gujarat Industrial Policy, 2020, etc.
- Adopting a holistic approach to water conservation and wastewater management, including conservation techniques such as rainwater harvesting, net zero water infrastructure,

minimising losses in water supply, installing water-efficient fittings, water metering and adoption of inclusive and sustainable water governance.

- Developing extensive infrastructure to monitor air pollution and suggestions on interventions for preventive measures.
- Restricting methane emissions by reducing landfill disposal of waste and managing wastewater
- Reducing GHG emissions from them through measures such as:
 - (a) Reducing waste at source;
 - (b) Proper segregation, collection and channelisation of different categories of waste (including bio-medical waste and e-waste) for recycling and treatment;
 - (c) 100 percent conversion of organic waste to compost and gas management of composting units;
 - (d) Recycling, recovery and reuse of 100 percent inert waste (plastic, construction waste, etc); and
 - (e) Setting up of centralised aerobic wastewater treatment plants with closed sewer networks and periodical sludge removal facility.

REFERENCES

1. Climate Resilient City Action Plan – Nagpur: https://urban-leds.org/wp-content/uploads/2022/02/Summary-Climate-Resilient-Cities-Action-Plan_Nagpur.pdf, Accessed on 10th Oct, 2022
2. <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1847812#:~:text=As%20per%20the%20updated%20NDC,based%20energy%20resources%20by%202030>, Accessed on 10th Oct, 2022
3. <https://jncc.gov.uk/our-work/blue-green-infrastructure/#:~:text=BGI%20is%20a%20defined%20by,wide%20range%20of%20ecosystem%20service>, Accessed on 10th Oct, 2022
4. DDA Master Plan of Delhi, 2041: https://dda.org.in/pdf/july13/Final%20MPD%202041%20-%20e%20Gazette_%20English.pdf, Accessed on 10th Oct, 2022
5. <https://www.downtoearth.org.in/blog/environment/the-state-of-india-s-urban-wetlands-and-why-they-need-to-be-protected-urgently-78456>
6. Rajkot City Climate Change and Environment Action Plans <http://www.vasudha-foundation.org/wp-content/uploads/Full-Action-Plan-Rajkot.pdf>

ABOUT CUS

In 1966, Centre for Training and Research in Municipal Administration (CTRMA) was established in IIPA with the support of Ministry of Health and Family Planning, Government of India, the then nodal ministry on urban local bodies. The Centre was created with specific objectives to operate as a knowledge centre and think tank on urban sector issues and an apex institution at national level. CTRMA was rechristened as CUS (Centre for Urban Studies) in 1974-75.

Director General, IIPA is the Director of CUS and chairperson of the Steering Committee. A faculty of CUS is nominated as Coordinator CUS, who becomes the Member-Secretary of the Steering committee. CUS has an interdisciplinary team of faculty members from Economics, Public Administration, Urban Planning and Civil Engineering background. In addition other faculty members of IIPA drawn from environment, disaster management, social development and e-governance background provide their professional input to CUS on case to case basis.

Objectives of CUS

The precise objectives of CUS are :

- (i) Organize suitable training courses for municipal and state officials concerned with Municipal Administration in order to improve the technical and professional character of municipal services;
- (ii) Hold seminars for the elected leaders of urban local authorities for the purpose of facilitating awareness of problems facing the local bodies and encouraging communication between the technical experts and the popular leaders;
- (iii) Arrange special conferences and study groups on contemporary problems of municipal administration,
- (iv) Help other States and regional training and research centres on municipal administration that might be established;
- (v) Promote research on various governmental problems of urban and metropolitan growth in India;
- (vi) Develop an efficient and up-to-date information centres and documentation services in municipal administration in India and abroad; and

- (vii) Provide suitable consultancy service to the various public bodies on municipal administration and to represent India in international conferences.

Outreach

In accordance with its objectives, the Centre during the last 55 years has carried out research, training and advisory services. The Centre has developed and strengthened its national and international outreach and coverage of stakeholders. CUS extends India's urban agenda to (a) Institutions and agencies of Government of India, (b) state government agencies, (c) ULBs (Urban Local Bodies) and para-municipal agencies dealing with specific services, programmes and schemes of Government of India and respective state governments.

Research

Recent Research activities include policy research to Government of India and states and major ULB's, Action research for functionaries at cutting edge level and evaluation of specific scheme and programmes. Research is also used to develop contents for capacity building programmes and disseminate information through a range of publications. CUS also carries out documentation of best practices on specific urban innovations.

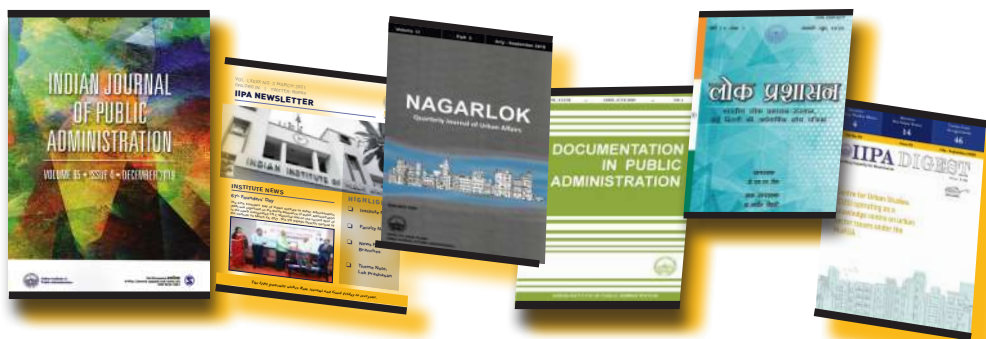
Digital Training Initiatives

Since July 2020, CUS started first of its kind digital training programmes in the country to build capacities of middle and senior level urban functionaries through online training. These programmes also tend to seek lessons from Mission Karmayogi launched by the NDA government in September, 2020. Modules developed by CUS include.

- (i) Urban Governance and Administration
- (ii) Urban Finance and Revenue
- (iii) National Urban Livelihood Mission
- (iv) Integrated Urban Water Management System
- (v) Participatory Governance for Urban Management

The above programmes have a duration of 3 to 5 days and cover senior officers from urban local bodies and para-statal/para-municipal agencies dealing with various aspects of urban development.

(Refer CUS at <https://www.iipa.org.in/cms/public/page/centre-for-urban-studies> for its activities details)



PUBLICATIONS

The Institute disseminates information, analyses, viewpoints and knowledge related to public administration, governance, policy and development through its regular publications viz., monthly digital editions of IIPA e-Newsletters, quarterly editions of Indian Journal of Public Administration (IJPA) in association with Sage Publications, quarterly editions of Nagarlok, quarterly editions of Documentation in Public Administration (DPA), biannual editions of Lok Prashashan (Hindi Journal) and quarterly editions of IIPA Digest.

So far IIPA has published more than 500 books, monographs, reports, working papers, and compendiums in spheres of governance and public administration. A few of the books authored by renowned authors including IIPA faculty members are also available for purchase.

INDIAN JOURNAL OF PUBLIC ADMINISTRATION (IJPA)

(Quarterly since 1955)

Flagship refereed UGC CARE listed journal of IIPA, IJPA in collaboration with SAGE Publications publishes manuscripts covering topics related to Public Administration, Public Policy, Good Governance, Bureaucracy, Leadership, Environment, Law, Social Welfare, etc. Research articles, case studies, book reviews, essays, notes and documents related to themes authored by experts are regularly featured in IJPA. The author of the best article every year is conferred with the prestigious late Shri TN Chaturvedi Award by the Hon'ble Vice President of India.

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