Intensity of Use of Land in Urban Residential Areas

Hariharan Ramachandran

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Hariharan Ramachandran[*]

[***Abstract***: *The present study is an attempt to analyse (a) the proportion of area occupied by urban settlements in India and across different states and union territories between 1991 and 2011, (b) trend in urban population growth vis-à-vis growth in urban area in India during the same period, (c) some correlates of urban population density in the context of state level data, and (d) intra-city variations in population densities of National Capital Territory of Delhi (2001) as a case study. The basic argument is that although India is a land starved country (with relatively high population density at the global level, and a growing population), the impending urban growth is unlikely to put much pressure on land resources and, by extension, on food security. This argument is based on the fact that urban population densities in many Indian cities are still low compared to international benchmarks, as much as the assumption that land productivity in agriculture will increase in India.]*

1. Introduction

In India, density of population is one the indicators used for a human settlement to qualify as an Urban entity as defined by the Census of India. Scanning available literature on urban population densities leads us to the conclusion that variation in population density within a city has attracted a lot more attention as compared to intercity comparisons. This is largely because of town planning interests in Floor Space Ratio and land values. More recently there is also an emerging debate about the size of urban growth and its impact on agricultural land and food security. In this context, this paper is an attempt to analyse (a) the proportion of area occupied by urban settlements in India and across different states and union territories between 1991 and 2011, (b) trend in urban population growth vis-à-vis growth in urban area in India during the same period, (c) some correlates of urban population density in the context of state level data, and (d) intra-city variations in population densities of National Capital Territory of Delhi (2001) as a case study. The basic argument is that although India is a land starved country (with relatively high population density at the global level, and a growing population), the impending urban growth is unlikely to put much pressure on land resources and, by extension, on food security. This

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argument is based on the fact that urban population densities in many Indian cities are still low compared to international benchmarks, as much as the assumption that land productivity in agriculture will increase in India.

2. Urban Population Density as an Indicator of Land Use Intensity

Land use in urban areas is usually classified into the following categories of uses: residential, industrial, commercial, transport, and open spaces (such as parks, stadia and water bodies). Of these, the use of land for residential purposes occupies the largest proportion of urban land—somewhere between 40 to 50 per cent. However, the distribution of land between the above uses is a function of city size, historicity, and city function (such as industrial, administrative and commercial). The intensity of use of urban land for residential purposes can be measured in terms of gross population density of the city, that is, population of the city upon area of the city—the city boundary defined as in municipality, municipal corporation, *nagar palika*, etc., and the population contained in it. Another variant of this could be residential density, that is, population of the city upon residential area. The intensity of use of residential land as well as commercial land is also influenced by land values—an expected positive relationship—the higher the land value, the higher the intensity of use of land. High income residents do occupy more land per capita, therefore such areas have lower population densities.

In fact, among the attributes used to classify a human settlement as urban is the population density (a minimum of 400 per sq km) as per Census of India. As city population grows, it accommodates the additional population either through urban sprawl (physical expansion by eating into land in surrounding rural areas), or through vertical expansion (a higher floor space area), or both.

3. The Extent of Urban Area

Of the total area of the country, urban India occupied about 2 per cent in 1991, which increased to 3.19 per cent by 2011 (*Table 1*). The areal expansion of urban area was much slower during 1991–2001 as compared to 2001–2011. The entire areal expansion in urban area is not only through horizontal sprawl of existing cities, but also includes areas occupied by new towns added during the inter-census period. For example, in 1991 the urban area spanned 4,615 towns whereas in 2001 there were 5,161 towns. This number increased to 7,935 in 2011.

While the decennial urban population growth remained more or less the same during 1991–2001 and 2001–2011 (31.5 and 31.8 per cent respectively), urban area during the corresponding decades grew at 20.86 and 30.9 per cent with a substantial jump in the growth of urban area between 2001 and 2011.

Table 1: India – Number of Towns, Area under Rural and Urban Settlements* (1991–2011)

	2011	*2001*	*1991*
Urban Area (sq kms)	102220.6	78091.61	64613
Rural Area (sq kms)	3101505.41	3118309.39	3101801
Per cent Urban to Total Area	3.19	2.44	2.04
Number of Towns	7935	5161	4615

*Urban area includes area under Urban Local Bodies (ULBs) and rural area includes abadi land and agricultural land.

Source: Primary Census Abstract, Census of India 1991, 2001 and 2011.

The growth in urban area and population between 2001 and 2011 was not uniform across states. Some, such as Andhra Pradesh, Haryana, Gujarat, Kerala, West Bengal and Chhattisgarh among larger states, had increased their urban area substantially as compared to the growth of urban population. Among the smaller states, Delhi and Tripura also increased their urban area—much more than the growth in urban population (*Table 2*). Urbanisation through infilling appears to have taken place in hill states like Uttaranchal and Himachal Pradesh as well as in larger states like Tamil Nadu, Uttar Pradesh, Karnataka and Madhya Pradesh and among smaller states like Manipur and Mizoram.

Table 2: Interstate Variation in Urban Area and Urban Population (2001–2011)

States	*%Urban area/Total area (2011)*	*% Urban area/Total area (2001)*	*%Urban area growth (2001–11)*	*% Urban Population Growth (2001–11)*
INDIA	3.191	2.44	30.90	31.80
J&K	0.561	0.43	31.13	36.42
Himachal Pradesh	0.486	0.43	12.04	15.61
Punjab	4.993	4.13	20.98	25.86
Chandigarh	96.079	69.60	38.05	26.96
Uttaranchal	1.686	1.49	13.20	39.94
Haryana	4.470	2.90	54.34	44.59
Delhi	81.959	62.35	60.38	26.83
Rajasthan	1.938	1.59	22.13	29.01
Uttar Pradesh	3.139	2.72	15.31	28.82
Bihar	2.469	1.92	28.82	35.43
Sikkim*				156.52
Arunachal Pradesh*				39.27
Nagaland	1.415	0.89	59.25	66.76
Manipur	0.804	0.64	24.74	44.83
Mizoram	2.784	2.78	0.01	29.65

States	*%Urban area/Total area (2011)*	*% Urban area/Total area (2001)*	*%Urban area growth (2001–11)*	*% Urban Population Growth (2001–11)*
Tripura	3.737	1.33	181.12	76.17
Meghalaya	1.246	0.10	23.15	31.12
Assam	1.606	1.23	31.00	27.89
West Bengal	5.768	3.75	53.98	29.72
Jharkhand	2.821	2.25	25.47	32.36
Orissa	2.278	1.79	27.11	26.94
Chhattisgarh	2.501	1.38	81.25	41.84
Madhya Pradesh	2.513	2.26	11.27	25.69
Gujarat	3.773	0.27	41.63	36.00
Daman & Diu	49.207	21.66	125.14	218.84
Dadra & Nagar Haveli	9.308	3.50	166.16	218.24
Maharashtra	2.952	2.39	23.50	23.64
Andhra Pradesh	2.760	1.67	59.77	35.61
Karnataka	3.132	2.69	16.26	31.54
Goa	21.579	13.82	56.13	35.23
Lakshadweep	73.167	33.09	107.27	86.64
Kerala	19.558	8.37	133.68	92.76
Tamil Nadu	10.481	9.63	8.84	27.05
Pondicherry	31.543	27.85	15.85	31.47
Andaman & Nicobar Islands	0.460	0.32	43.96	23.49

Source: Computed on the Basis of Primary Census Abstract, Census of India Census of India, 2001 and 2011.* Area data are not available.

4. Gross Population Density by Size Class of Cities and Towns

Most of the smaller towns have a shorter history, with land values much lower compared to big cities (although the gaps in land values are reducing in many of the small resort towns) as well as low land use intensity. In *Table 3*, we have brought out the fact that the intensity of land use increases with city size. In other words, urban land is more intensely used in large cities. Population density is defined here as aggregate city population of each size class of town divided by the total urban area of towns in that size class.

The general trend of increasing intensity of urban land use can be noted in almost all states (*Table 4*), barring minor discrepancies in the trend in some of the smaller states where the number of towns in some of the size classes are too few, thus affecting the mean value of the population density.

Table 3: India – Gross Population Density (2001) by City Size Class

City Size Class	*Population Density (per sq km)*
<10,000	1127
10,000 – 20,000	1462
20,000 – 50,000	2100
50,000 – 100,000	3294
100,000 – 500,000	5300
500,000 – 1 Million	5929
1 Million +	20713

Source: Census of India 2001. Data pertaining to 2011 was not available for all towns.

Table 4: Town Population Density (per sq km) by Size Class of Towns and States (2001)

	<10,000	*10,000–20,000*	*20,000–50,000*	*50,000– 1 Lakh*	*1 Lakh–5Lakh*	*5 Lakh–1 Million*	*Million+*
Haryana	1596	3205	3413	3935	6462	-	5312
Himachal Pradesh	1533	2248	3659	-	5001	-	-
Jammu & Kashmir	1047	2275	1798	2235	3902	-	-
Punjab	1508	2207	2548	3435	6168	-	-
Uttaranchal	979	2073	1956	6549	9411	-	-
Chhattisgarh	958	1264	1829	2132	2970	6166	-
Madhya Pradesh	635	1059	4059	4059	3396	5909	6460
Uttar Pradesh	1603	2597	3952	6098	8490	7863	8777
Goa	783	1092	1827	2507	-	-	-
Gujarat	996	1054	1393	2900	5661	5689	11434
Maharashtra	1245	1599	2287	3873	7446	6080	11038
Rajasthan	1355	1182	1602	2363	3287	4456	4792
Andhra Pradesh	696	1322	2215	3279	4883	9856	13098
Kerala	1293	1710	1829	2269	3300	3300	-
Karnataka	1438	1563	1960	3140	3726	4755	19012
Tamil Nadu	767	1046	1829	2437	6576	8359	24969
Bihar	2703	2340	2504	4507	8479	-	13220
Jharkhand	1944	1780	2766	4171	3567	6159	-

	<10,000	*10,000–20,000*	*20,000–50,000*	*50,000– 1 Lakh*	*1 Lakh–5Lakh*	*5 Lakh–1 Million*	*Million+*
Orissa	1548	1063	1353	1930	2851	4013	-
West Bengal	3150	3237	3607	5214	7086	-	23572
Assam	2109	3445	4696	6929	5405	3767	-
Arunachal	1467	2011	2173	-	-	-	-
Manipur	2271	3106	6794	-	5598	-	-
Meghalaya	982	1137	1506	3223	12825	-	-
Mizoram	276	556	767	-	1769	-	-
Nagaland	-	2016	1603	3609	-	-	-
Tripura	1177	3088	4379	-	11867	-	-
ALL	1127	1462	2100	3294	5300	5929	20713

Source: Primary Census Abstract, Census of India 2001.

Interstate variation in gross urban population density is much smaller among large cities than among smaller ones, as brought out by the coefficient of variation (*Table 5*). The larger variation in smaller towns is mainly because many of these towns are new towns (reclassified from villages to towns) and their densities depend upon the municipal boundaries.

Table 5: Coefficients of Variation in Gross Population Densities by Size Class of Towns (2001)

Size Class of Towns	*Coefficients of Variation in Gross Population Densities*
< 10,000	2.34
10,000 – 20,0000	2.19
20,000 – 50,000	0.50
50,000 – 100,000	0.37
100,000 – 500,000	0.47
500,000 – 1,000,000	0.31
>1,000,000	0.51

Source: Computed on the basis of Data from Primary Census Abstract, Census of India, 2001.

5. Intra-city Variations in Population Densities

While population and human settlements are classified as urban and rural, a high degree of heterogeneity and wide disparities within the urban population in a city is a basic feature. City plans in India, as in many other countries, are essentially land use plans—

earmarking areas for residential, commercial, industrial, institutional, recreational and transportation land use. Residential land use is the anchoring feature that occupies the largest proportion of a city's land, and residents and their living conditions are the focus of city plans. Residential layouts planned by the Development Authorities attempt to accommodate disparities among the city population in planned residential areas by earmarking residential land for four categories: high income, middle income, low income and economically weaker sections. Obviously, residential densities increase with decreasing income level with highest densities among the economically weaker sections and the lowest in the case of the high income group. However, slums which do not come under the ambit of urban plans, in many instances, are low rise, low density with dwelling units as small as 150 sq ft.

The increasing demand for residential space in cities is accommodated by increasing densities—vertical growth or urban sprawl—eating into the agricultural land in the peripheral villages. Vertical growth in already established urban areas places stress on the system of services that were planned for lower densities. Increasing capacities is expensive, and the costs of such capacity expansion are borne by the government, while the profits accruing from increased density go to the property owners. Outward city sprawl is often a combination of leapfrogging and infilling processes and result in eating into usually irrigated agricultural lands that are often highly productive.

"Building regulations vary considerably across cities, and often widely within the same city. Apart from ensuring that your neighbour will have adequate light and ventilation, and that there is a sufficient gap between buildings to ensure that fire cannot spread from one building to the next, building regulations also generally make sure that the number of residents in a locality is not in excess of the capacity of that locality's infrastructure. Water and sewage lines must be adequate to sustain the expected load; and street widths sufficient to support travel demands of the local population. The minimum building setback lines from plot boundaries are usually specified (to manage light and ventilation and the fire hazard), as well as building heights (to limit the volume of construction on a plot), with the indirect objective of thus limiting the number of occupants to what the locality's infrastructure can bear" (Patel, 2013).

"Density also depends on how much public ground area per person is available on roads, footpaths, schools, hospitals, police stations etc. In India, this should take into account the needs of small traders and hawkers. In Manhattan, public ground area per person is an average of 24.6 sq m. In Mumbai, it is around 6.5 sq m per person. If one accepts 20 sq m per person as the norm then density will depend on how much built up area per person is provided. If we consider 6 sq m per person as adequate in one of the most crowded wards of Mumbai then density should be 385 persons per hectare. With a built up area of 20 sq m per person, the density would be 250 persons per hectare" (Parikh, 2015).

6. Urban Population Densities in Delhi

In the background of the preceding sections one would expect a dipping density gradient with increasing distance bands from the city core(s). For a variety of reasons, the Delhi scene is more or less a reverse of this. New Delhi came up when the capital was shifted from Calcutta to Delhi. Lutyen's layout for this—symbolised by the Bungalow zone—was planned as a low density sprawling area. This part of Delhi had around 25 persons per hectare in the year 2011. Whereas with the advent of the Delhi Development Authority (late 1950's) and its real estate development activities since the 1970's, many high-rise, high-density areas were planned at the periphery such as Patparganj and Mayur Vihar in East Delhi, Rohini-Pitampura in the north and Dwarka in the South West. Low-rise developments also took place for housing of government officers and employees, and many layouts came up in Kidwai Nagar, Sarojini Nagar, Kaka Nagar, Moti Bagh, Chanakya Puri, most of them with ground + 1 floor buildings.

Despite sharp variation in the intensity of use of residential land recorded in *Table 6*—varying between 4,000 and 36,000, these values hide many features of the use of residential land in Delhi that come out when specific residential localities are analysed.

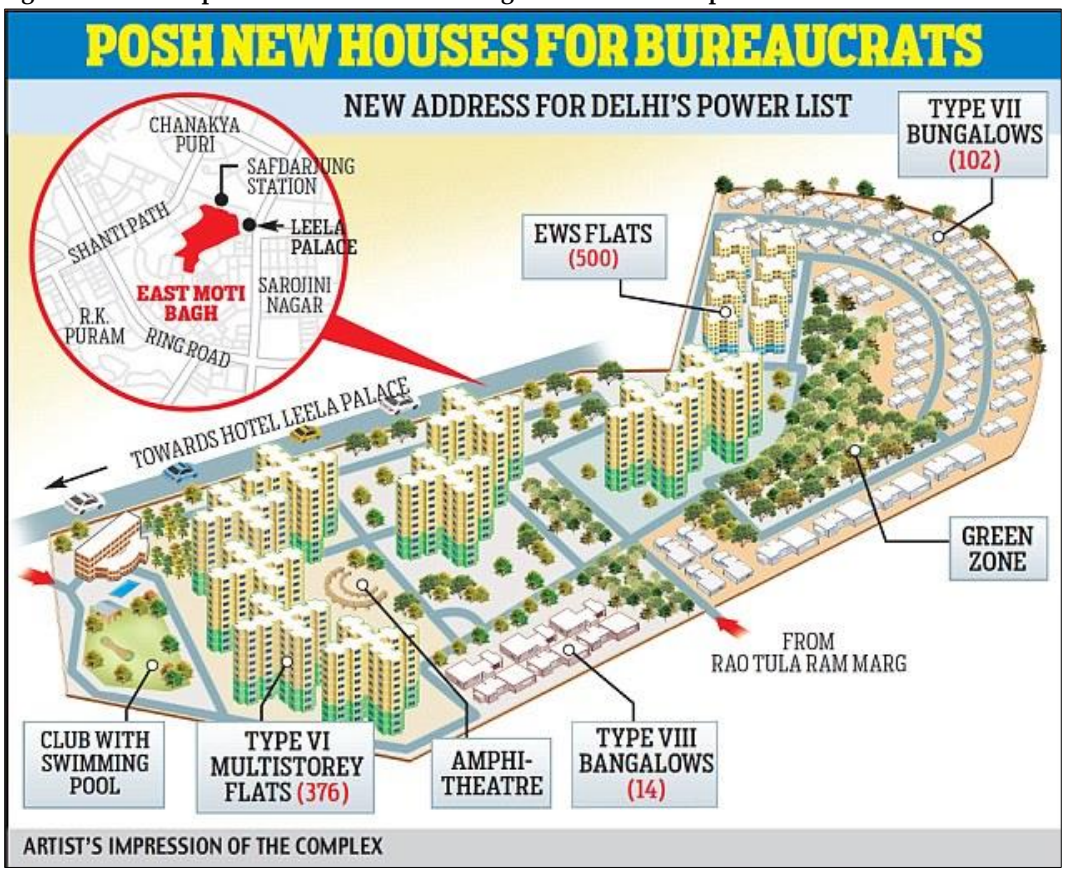
Table 6: Urban Population Densities in NCT Delhi (2011)

District	*Urban Area sq Km*	*Urban Population*	*Density per sq km.*
North West District	443	3442589	8254
North	61	8,70,232	14557
North East	62	2220097	36155
East	63	1705816	27132
New Delhi	35	142004	4057
Central	21	582320	27730
West	130	2536823	19563
South West	421	2149282	5446
South	247	2719736	11060
All Districts	1483	16368899	11320

Source: Census of India, 2001, Primary Census Abstract, Data Highlights, NCT of Delhi.

The mind-set of low intensity use of urban land continues even today, despite the huge growth in the population of cities like Delhi. An artist's image of such a development that came up as recently as 2012 and where work is still in progress, is the case of New Moti Bagh (*Figure 1*). In order to raise resources to develop this complex, a three-acre government lot was auctioned to a private party (See *Box 1*). Population density in this complex works out to 70 persons per hectare of land.

Figure 1 Artist's Impression of the New Moti Bagh Residential Complex



Source: Babu luxury: http://www.dailymail.co.uk/indiahome/indianews/article-2145528/ 16 May 2012

Box 1: New Moti Bagh Project

New Moti Bagh is a gated, high security, low density, government-built luxury residential colony made for the exclusive use of senior civil servants, judges, and high-ranking politicians. New Moti Bagh occupies an area of 143 acres, in the exclusive New Delhi Municipal Council (NDMC) area of New Delhi. It is located in South Delhi, near the original Moti Bagh, adjoining Chanakyapuri, one of Delhi's most expensive areas, where land rates vary from 10 lakhs to 12 lakhs a sq yd. "Living in New Moti Bagh" according to a senior Government official is "next best thing to living in a Lutyens bungalow."

To raise funds for construction of New Moti Bagh, a three-acre parcel of land contiguous to the project was sold to the Leela Group, a hotel chain, for Rs 650 crore, or about Rs 216 crores an acre, which works out to about US$ 35 million an acre at the exchange rate of Rs 62 to a US dollar. At this rate, the total land value of the 143 acre New Moti Bagh town ship, called colony in Delhi, at current market rates, works out to about Rs 31,000 Crores or about 5 billion US Dollars.

Source: https://en.wikipedia.org/wiki/New_Moti_Bagh

While reasonable range in population densities associated with income are expected, this stretches in the case of Delhi, for example, from less than 50 persons per sq km in the Lutyen's Bunglow zone in central Delhi to over 40,000 per sq km in areas like Paharganj. It is also clear that the per capita costs of providing urban infrastructure (such as sewage lines, water pipes and electrical connections) would decrease with increasing densities. Conversely, environmental conditions (congestion, crowding, etc.) deteriorate with increasing densities beyond a point. Thus, there is a trade-off between urban residential density and per capita infrastructural and environmental costs (Malini, 1988; Cali, 2009). Generally, it is the high-cost, low-density, high-income areas that have better urban services.

7. Concluding Observations

Despite earmarking residential land in city plans for different economic strata, such planned layouts are grossly inadequate to meet the demand—particularly of the lower middle income groups and the poor. The inadequacy of planned layouts results in the mushrooming of unplanned residential areas, which often account for a larger proportion of residential area than the planned layouts. It is such unplanned areas that accommodate the poor and the lower middle class urban population. The moot question is: Where would the low income population occupying unplanned areas go, if cities are fully planned devoid of unplanned areas?

Economic and social churning is taking place on a large scale in villages located in the fringe areas of large cities in terms of increasing heterogeneity in the village population, sudden change in lifestyle through enormous cash inflows from the selling of now high-priced agricultural land, and increasing youth unemployment.

The not-so-inclusive urban planning in so far as low income population is concerned is not limited to the housing issue, but extends to the provision of transportation facilities that promote high-speed personalised transport, without any space for slow moving non-motorised vehicles, pedestrians, etc. It has also been shown that even in the provision of open spaces (parks), in Delhi, as in many other urban centres, high density areas record much fewer green spaces than low density areas (Gandhi, 2013).

However, the current approach to urban residential planning that merely carves out areas required for high, middle and low income as well as the economically weaker sections, and leaves out perhaps more than 50 per cent of the people living in urban areas, must change radically. At present, this unserved segment of the city population occupies unplanned areas—both legitimate and encroached—with very poor basic services. As Patel (2014) notes,

"They call for the preparation of an existing land use plan, followed by forecasts of what the situation will be 20 years from now: population growth, migration, job growth and what kind of jobs, incomes and income distribution, travel demand and by what mode of

transport. Based on this anticipation of what the future holds, the planner draws up a land use plan showing residential, commercial and industrial areas, open spaces, schools, hospitals and other amenities. The development plan is, thus, essentially a land use plan designed to fit a particular imagined future. It is presumed that this kind of land use regulatory control is all that is needed to make that future happen. Unbelievable as it may seem, it is drawn up without reference to any kind of transportation plan. That is someone else's responsibility.

And naturally, it is no surprise that the anticipated future doesn't happen. Invariably, after repeated cycles of such plans, every country has found that the reality, 20 years down the line, is far from what was anticipated. No wonder, the planners have an impossible task. There are too many parameters outside their control. They have no way of anticipating how the world around them will change - how the economy will develop, what differences new technology will bring, or how larger policy changes will impact development." The practice of raising floor space index without reference to infrastructure, crowding and pressure on amenities defeats the very purpose of city planning. Patel (2014) further observes, "… another significant flaw is the exclusion of large tracts of land from the purview of the plan. Slums are excluded—3,404 hectares of slum areas form 8.2 per cent of Greater Mumbai's total land area, and 32.9 per cent of its residential area. ...The goals in our development plans should focus on what people want, not what planners want."

A slightly varying view is that of Parikh (2015), who observes: "To reduce energy used for transport, it is important to have cities with high density, with cycle paths and public transport. ...Density can be controlled by controlling floor area ratio and number of family units. The use value of a piece of urban land depends on access to facilities, jobs, recreation, education and health institutions. This depends on how the city infrastructure develops and has little to do what the owner of a piece of land does by herself. It is public investment that brings value to the property. This accretion of value when public facilities are provided should be captured by the city government. This can be done by increasing the permissible floor area ratio and auctioning what is additional. This can help generate resources for further development of infrastructure." However, as pointed out in the previous paragraph, ad hoc increase in Floor Space Index has its own negative implications.

"Large Indian cities have high population density. However, FSI in these cities are low compared to many smart cities in the world. This results in low per capita availability of urban space. Strategic densification of cities through higher FSI has numerous advantages: it makes the cities compact and efficient and frees space for accommodating more people as well as for providing urban amenities. Pricing of higher FSI also generates resources for funding urban infrastructure projects. In Manhattan, as well as in other international best practice examples, FSIs vary by location and land use density zones are typically small and are determined by street width and capacity as well as land use patterns. Commercial and office districts typically have higher FSIs than residential districts. FSIs are set in

conjunction with the formulation of development and strategic plans. Optimising infrastructure and density is a central element of urban planning" (Planning Commission, 2013). Adequate attention to the trade-off between density and infrastructure in urban sprawl areas and in greenfield urban development is required as much as in medium-sized towns. This would avoid periodic and often arbitrary increase in FSIs.

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Industrialization: Industrial policy, manufacturing sector, MSMEs, technology development, production networks, industrial clusters/corridors, SEZs, land acquisition, natural resources, regional development, entrepreneurship, sustainability, etc.

Internationalization: Cross-border flows of capital flows, FDI, technology transfer, IPRs, balance of payments, trade and investment agreements, etc.

Corporate Sector: Ownership and control, finance and governance, financial institutions, company law, securities legislation, regulatory bodies, M&As, business groups, public enterprises, public-private partnership, business ethics, CSR, etc.

Labour and Employment: SEmployment growth and structural transformation; labour force; skill development; quality of employment, labour flexibility; differentiations and disparities; informal sector and un-organised workers; etc.

Public Health: Social, cultural and economic determinants of health; structure of health systems; research and capacity building in the areas of pharmaceuticals, medical devices and healthcare sectors; IPRs and other areas of industry-health interface, etc.

Media & Communication: Studies in the area of media, communication and advertising.

ISID has being maintaining databases on corporate and industrial sectors in particular and other areas of developmental and social and economic issues in general. Its Online Reference Services includes On-Line Index (OLI) of 230 Indian Social Science Journals as well as 18 Daily English Newspapers Press Clippings Archive on diverse social science subjects which are widely acclaimed as valuable sources of information for researchers studying India's socio-economic development.

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