

A Step towards Smart Cities and it's Units:

The Sustainable Approach

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Introduction

Studies have predicted that 90% of the world's urban population growth will take place in developing countries, with India taking a significant share of that. The global experience is that a country's urbanization up-to a 30% level is relatively slow but the pace of urbanization speeds up thereafter, till it reaches about 60-65%. By 2050, India is projected to add 404 million urban dwellers, China 292 million and Nigeria 212 million. While the urban population is currently around 31% of the total population (MoUD), it is expected to reach 40% by 2030.

While the urban population is currently around 31% of the total population, it contributes over 60% of India's GDP. It is projected that urban India will contribute nearly 75% of the national GDP in the next 15 years. It is for this reason that cities are referred to as the "engines of economic growth". Thus Indian Government mission of smart cities is the need of the hour to cater the needs of the increasing urban population in a smart and sustainable way. The smart city concept can be looked upon as a framework for implementing a vision of advanced and modern urbanisation. This vision envisages achievement of three goals, social equitability, economic viability, and environmental sustainability. Governments across the globe have created strategies for transformation to smart cities in order to improve operational efficiencies, maximise environmental sustainability efforts, and create new citizen services.

Concerns

This rapid surge in population has steered up many issues which our government and ULB's have constantly failed to answer completely. The country's cities are characterised by strained infrastructure which manifests itself in terms of power cuts and water shortages, high cost of living, and unaffordable real estate, leading to urban sprawl and rise of slum areas, high volume of traffic, resulting in pollution and delays. Urban resources and infrastructure are already stretched beyond capacity. As a result, they are plagued with issues such as air pollution, waste management, poor water and electricity supply, ageing infrastructure, resource scarcity and traffic congestion. Despite this impending surge in demand, 25 per cent of India's urban population lives in slums. In the cities of Mumbai, Vishakhapatnam, Meerut, Vijayawada and Jabalpur this is above 40 per cent. Despite the fact that 380 million people live in urban India, it is estimated that only half of the urban population in India is served by

essential urban services that meet current standards. For example, a study of wastewater profiles in 71 Indian cities, conducted by the Centre for Science and Environment (CSE) revealed that less than 30 per cent of the nation's officially recorded sewage is treated as per acceptable standards. In terms of air quality, the World Health Organisation (WHO) claims that 13 out of the 20 most polluted cities in the world are in India.

The reasons for such problems as enlisted above is majorly unplanned migration and insufficient infrastructural development. As cities came into existence, more and more people started to move towards cities in search of better economic opportunities. This led to unplanned surge in urban population which further encouraged to the growth of peri-urban areas and slums around the cities as cities were not economically viable for the low income population. This has resulted into a situation of over-crowdedness of cities, insufficient infrastructure, social inequality and environmental pollution.

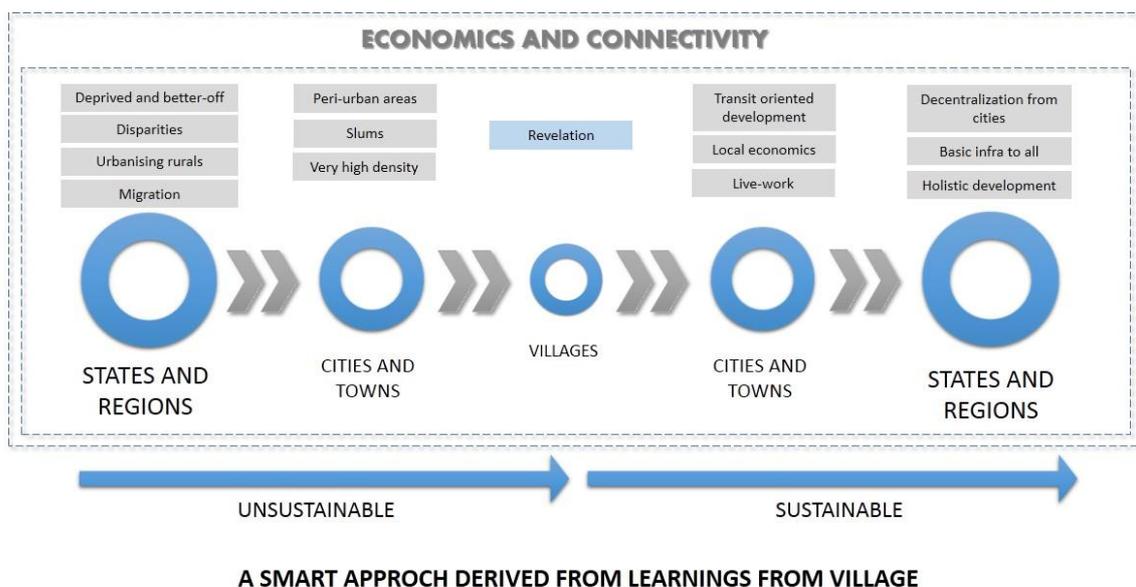
When we build smart cities, we will be faced with a massive surge of people who will desire to enter these cities. This will lead to increase in pricing and the notion that they will be low cost is flawed.

Even though urbanisation is the trend of the day majority of the population is still expected to live in the villages for next few decades. The majority i.e. 70% of the total population still resides in the villages. The father of our nation once stated that "I would say that if the village perishes India will perish too. India will be no more India. Her own mission in the world will get lost". In 2000, over 50% of the rural families who are not able to meet essential needs fall under the category of the poor. According to the census of 2011, 53.1% (63.6% in 2001) of the households in India do not have a toilet, with the percentage being as high as 69.3% (78.1% in 2001) in rural areas and 18.6% (26.3% in 2001) in urban areas. People tend to move from rural areas to urban areas in search of better income opportunities, physical and social infrastructure which includes basic amenities like sanitation, health, water, power, primary education etc. This is the root cause of migration which needs to be taken care of.

Thus in this paper an attempt has been made to define an approach for holistic development where on one hand we will make our cities smart and sustainable and on the other hand we develop our village economy in a sustainable manner.

Methodology

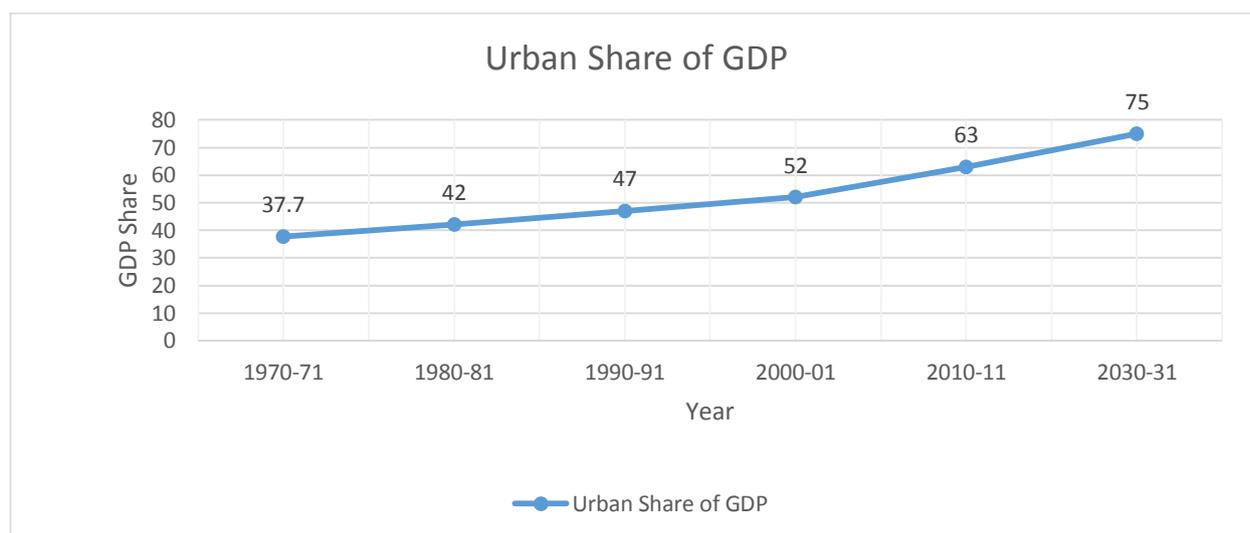
The following methodology is derived and applied on this paper to sync economics, connectivity and sustainability to derive indigenous smartness. The approach can be understood in two broad parts of unsustainability and sustainability under two major themes of economics and connectivity. The first part describes the existing condition of regions and cities and the cause of this condition. It highlights the effect of growth in terms of disparities, migrations, slums and growth of peri-urban areas. While narrowing down the scale of settlements, the discussion reaches a sustainable revelation point which is a village. In the second part, the understandings and principles of a village are consciously replicated on cities and regions as a module to sustainable growth.



Condition of Regions & need for smartness in Indian condition

After more than 300 years of dependent conditions offered by Britons, India saw a morning of independence. It was concerned about the first step towards growth and development and this was the time from where it perpetuated the wheels for indigenized development by developing Industrial centres and Economic centres. Cities have been the driving force for economic development in past few years as can be seen from the graph below.

Figure: Trend of Urban share of GDP



Source: Ministry of Urban Development, GOI

Since then we have grown and evolved ourselves rapidly to become one of the World's largest economies. The Indian economy is the world's seventh-largest by nominal GDP and third-largest by purchasing power parity (PPP).

The rate of development is compared with other nations on parameters such as GDP (Gross domestic product), HDI (Human development index), HPI (Happy Planet Index), EPI () and many others.

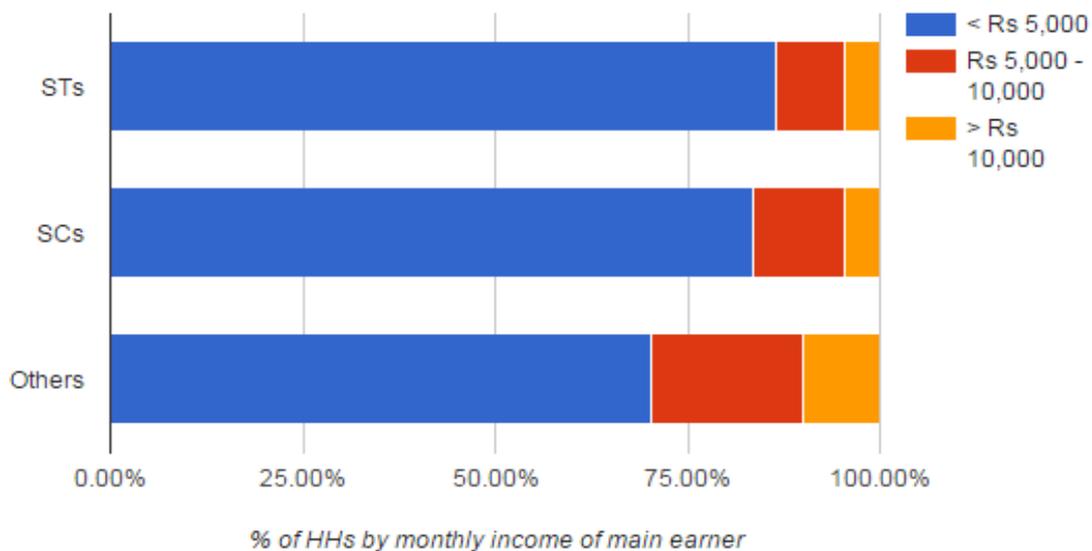
GDP is a measurement of economic activity of a nation and is not necessarily a projection of development status of a nation. The Human Development Index (HDI) is a composite statistic of life expectancy, education, and per capita income indicators, which is used to rank countries into four tiers of human development. The EPI ranks how well countries perform on high priority Environmental Issues in two broad policy areas: protection of human health from environmental harm and protection of ecosystems. The above stated indexes do not just refer to development but rather they infer to parameters of sustainable development.

Table: India’s ranking in various development Index

Name of Index	India’s Ranking
GDP Growth rate	43
Human Development Index (HDI)	135
Environmental Performance Index (EPI)	155

Thus it can be realized from the above table that India has grown at a greater rate economically but have not developed sustainably enough.

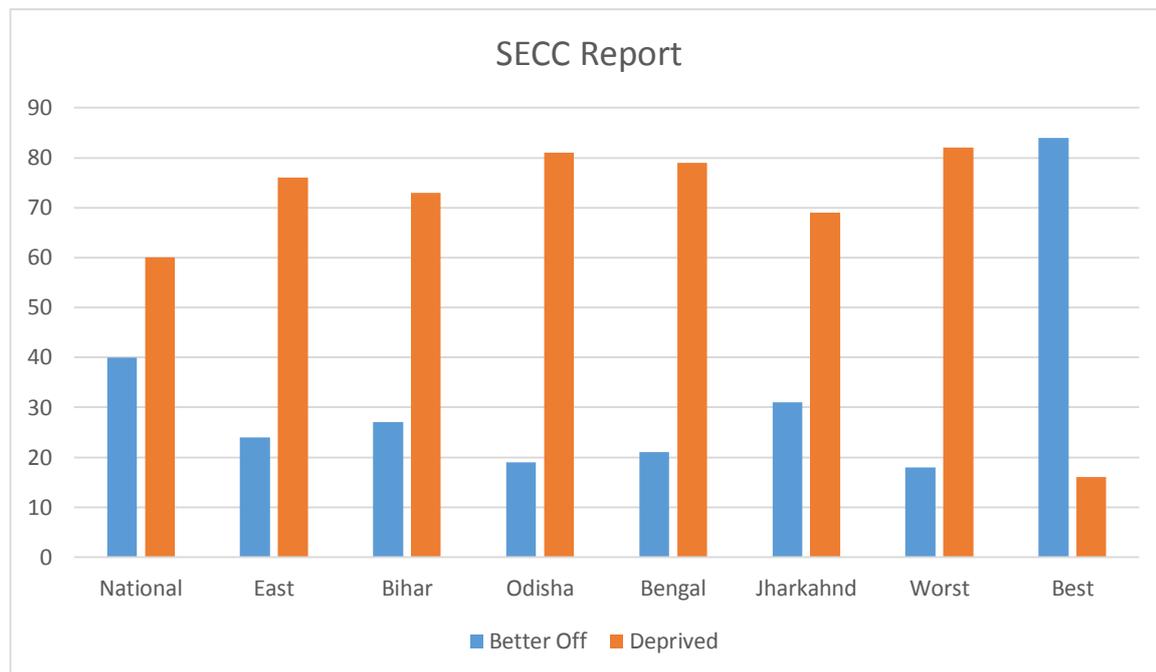
The Standard of living of citizens of a country is an important parameter for determining the state of sustainable development of the country. Economic disparity has been a major concern to Indian Economy for decades. A study published by the World Health Organization in 2000 (for India) concluded that it is the wealthier citizens who benefit most from public healthcare because facilities are generally better in rich areas.



(<http://southasia.oneworld.net>)

Figure: Status of Economic Disparity in India

Figure: SECC report showing Economic Disparity



The relationships established, alarms for a situation of sustenance in all critical aspects. What shall we do? Where shall we direct our growth? It becomes obvious to lead a smart move towards sustainable development. Therefore, in this paper an attempt has been made to define Smartness which for a developing nation like India should be sustainability in terms of Economics, Environment, Technology and Society & Culture. The sustainable city of tomorrow is the new smartness which cities of today need to inherent. Smartness in the realm of this paper will be sustainability not ICT. This is the indigenous way to lead while responding the unique growth of a developing nation and it states.

Parameters of Sustainable Approach

For sustainable development of regions, many parameters such as employment and economy, ecology and environment, community and culture, technology and innovation need to be amalgamated together in a balanced smart way to create a product what we can term as smart regions and there units. Here forth we do not just refer to cities but to all kinds of settlements found in a country which includes metropolitans, cities, semi-urban areas, towns and villages. Provision of infrastructure and its up-gradation along with a response to economics, is being emphasized here. Infrastructural development which is discussed in the realm of this paper is physical infrastructure which includes road ways, water supply, electricity distribution, communication and technology with special focus on intra and inter connectivity of settlements (under the layer of economics).

Since the inception of history, trade has encouraged movement which further exposed into different scales of settlement. And today, economic activities sprouts, flourishes and grow where connectivity is. Connectivity acts as catalyst for economic development. The up-coming dedicated freight corridors or industrial corridors are a paradigm of this concept. For example value of regional output would increase by 163% in the year 2040 without DMIC but with DMIC industrial output is expected to triple in 9 years whereas regional employment and exports would double in 7 years.

Table: Future population and projections scenarios with and without DMIC

Year	Population		Employment	
	Business-As-Usual (Millions)	Business Induced (Millions)	Business-As-Usual (Millions)	Business Induced (Millions)
2009	231	231	91	91
2039	425	518	191	233

Source: Scott Wilson (2009)

Thus it can be deduced that connectivity encourages economic development. In which case roads and railway connectivity are of major importance for the movement of goods and services. An analysis shows that 61 % of the freight movement in India in 2007-08 took place through roads only and there has been a constant in the freight movement through roads since independence.

Figure: Comparison of Freight traffic movement by mode (2007-08)

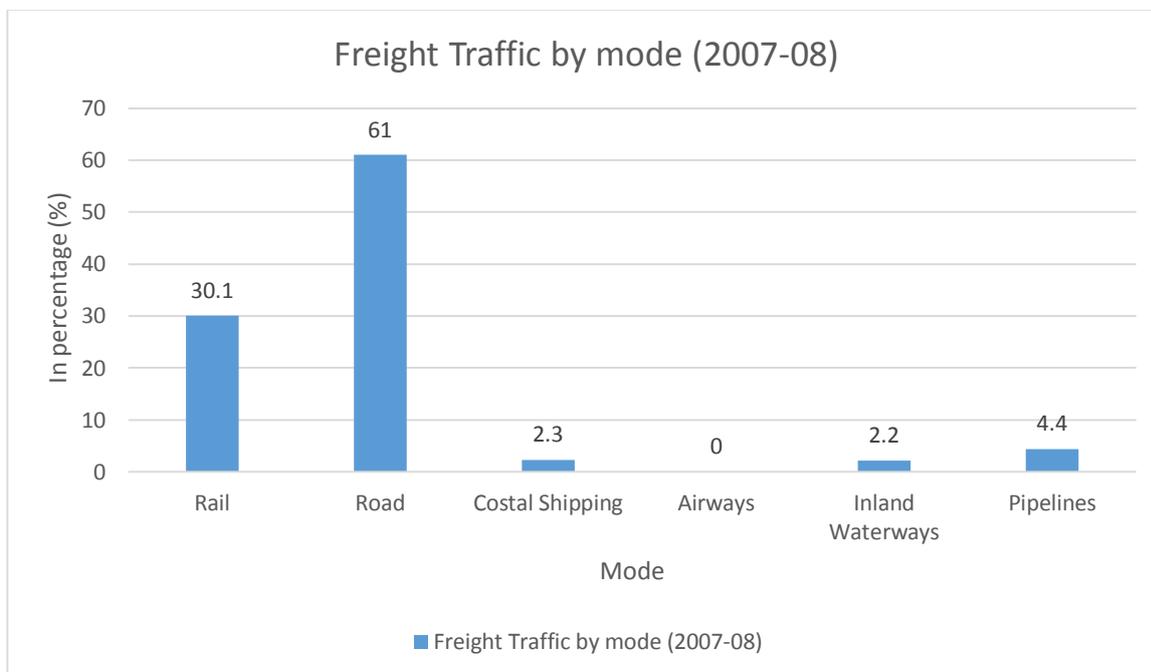
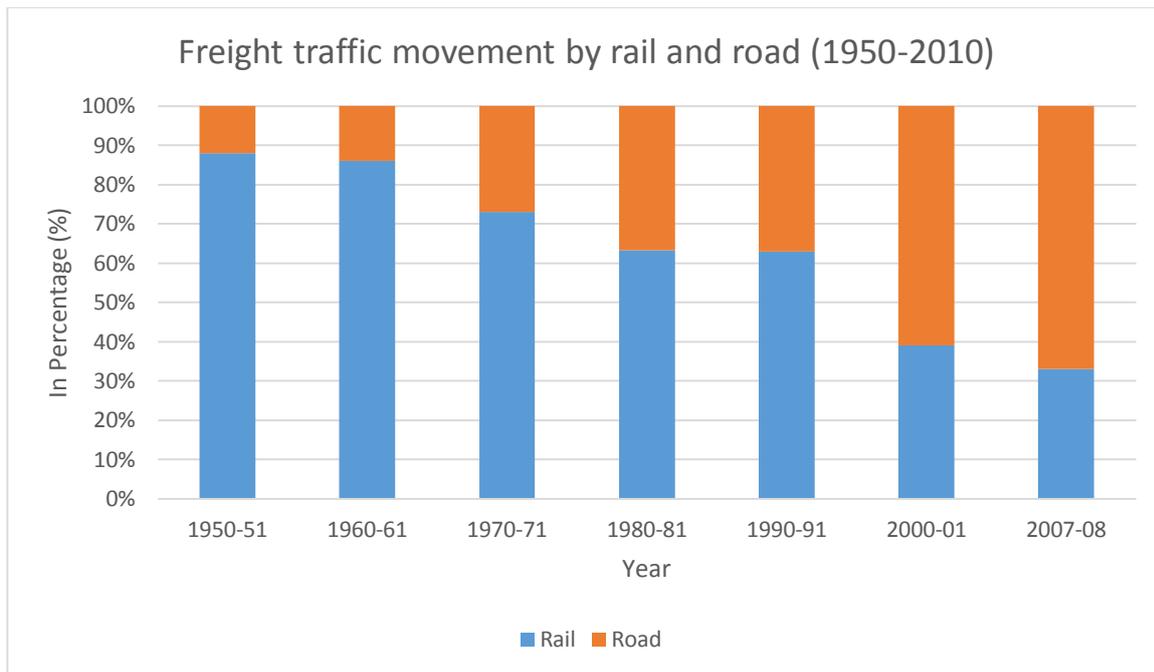


Figure: Comparison of Freight movement by Rail & Road in Million Tons (1950-2010)

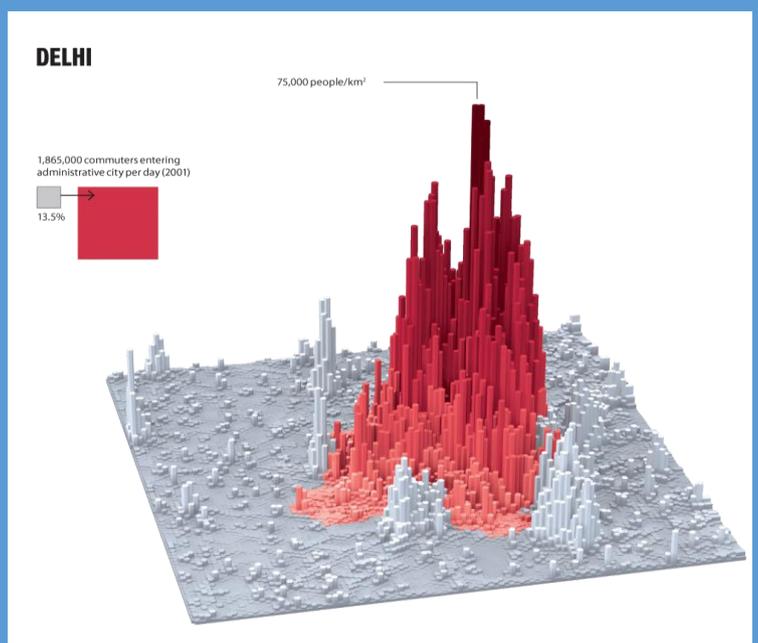


Source: RITES 2009

Being an economic center, cities and urban lands encourages work opportunities, financial gains and life style it its citizens because of this migration takes place. According to an analysis given by IHS based on census of India (2011), it was found that 24% of the urban growth in the last decade was constituted to rural migration only. Indian Cities, which were rarely planned for such situations, demonstrates unsustainable growth patterns. For example In East Delhi the annual influx of migrants is continuously depleting city’s resources. A study revealed that more than half of Delhi’s population lives in urban slums with inadequate provision of basic services. Delhi gets into a crisis mode for

Destination of Density

East Delhi (Trans Yamuna) is an administrative district of the National Capital Territory of Delhi in India. East Delhi had a population of 1,448,770 (2001 census) and an area of 64 km², with a surging population density of 22,638 persons per km². This density figure may look sustainable as large no. of people utilizes lesser piece of land, but the quality of life (both social and physical) lead by its inhabitants is not “sustainable”. also, phenomena’s like urban heat island effect and high levels of pollutions are the byproducts. Being well connected with roads and bridges, metro and rail, the land offers a fertile land for people of agglomerate and serves the economic hub of Delhi.



something as basic as drinking water. Ever-increasing population is to be blamed for the surging demand and dwindling supply of drinking water. Even today, the city faces a daily deficit of around 1000 million litres of water (www.mapsofindia.com)

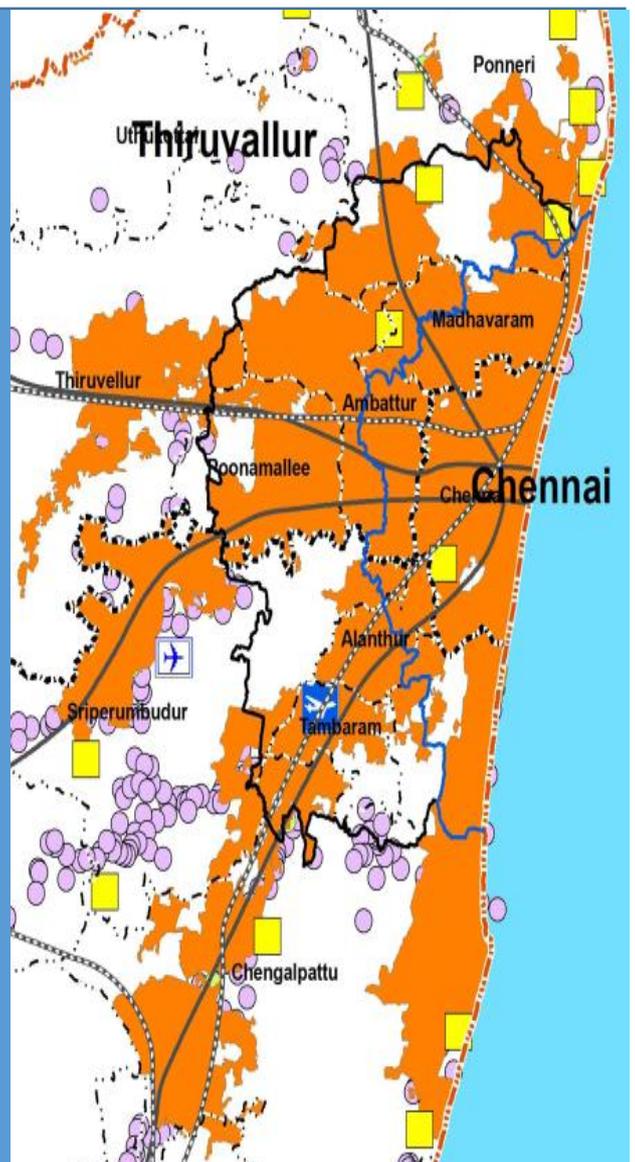
A huge amount of population gets attracted to well-connected city centers as can be seen in the case of Delhi or any other metropolitans, the effect of which can be seen in development of Peri-urban area, urbanizing rurals and slums within the cities, which are unsustainable form of development but contrarily, well connected most of the times. In fact it is the connectivity which leads to the development of such settlements.

Peri-urban areas lie at the interface between urban-rural, and are often places in crises. Typically they are governed by rural authorities who lack both the capacity and resources to manage such unplanned developments. Thus the net settlement is a web like star shaped agglomeration of people in and around the roads & highways. Now we can conclude the Peri-urban areas are unsustainable growth as a result of economic pull offered by the city and distributed or aligned along the connecting corridors such as highways.

Peri-Urban and Chennai: Connectivity & Economics

The metropolitan city of Chennai is good enough for us to understand the forces of economics and how movement corridor acts as a urban growth escalator. The patched area showing the half star shape (for most of the non-coastal cities and town, it's a full star shape following the natural features) of the city because of aligned highways connecting to other economic centers with this mega center of economics.

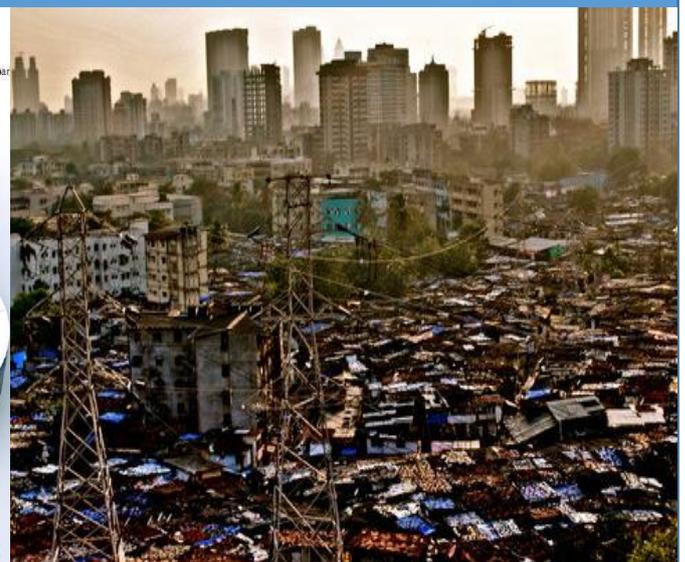
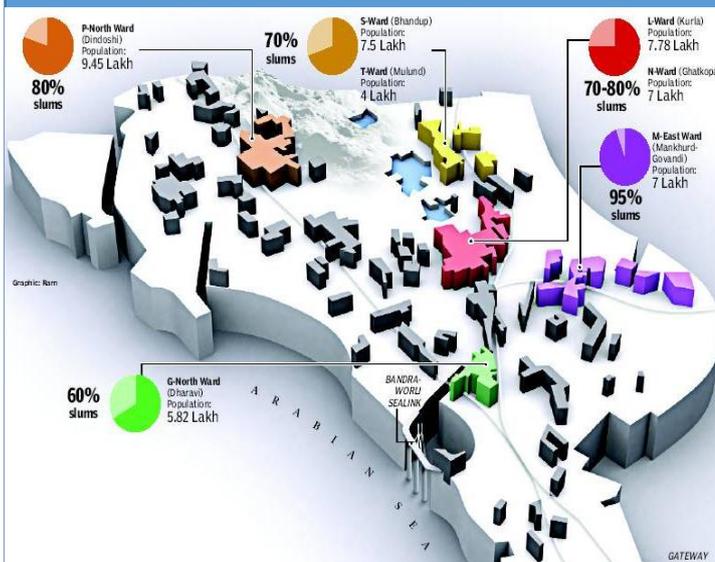
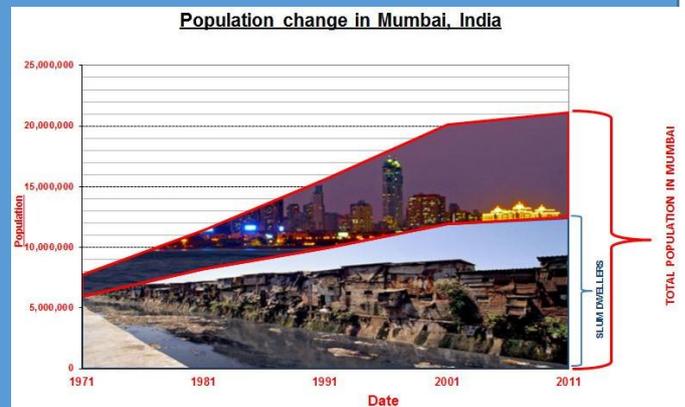
Much of Chennai's recent urban expansion has been southwards. It is bound on the East by the Bay of Bengal, and Northwards, it touches the boundary of Andhra Pradesh. Thus, it is predominantly the South that provides space for the city to grow. In this context, the Old Mahabalipuram Road (OMR) has been the seat of urban expansion, expanding the frontiers of the city towards the World Heritage site and tourist attraction of Mahabalipuram. Parallel to this is the East-Coast road, that has also witnessed some development over recent years. South Chennai has since been growing as an IT corridor; in this process of expansion, the city has engulfed several fishing and agricultural villages and hamlets – of which Chennai has traditionally been an agglomeration - creating several ecological and environmental challenges that the current governance and administrative machinery is unable to cope with. Many of these problems have resulted from the growth of the city beyond its carrying capacity and the disconnect between urban and environmental planning.



Another form of unsustainability caused by these two forces of economics and connectivity is slums. This is the result of close proximity to work (as low income people cannot afford high traveling cost, also unavailability of direct connectivity) within the city and concentrated economic activities in the city. These slums are unsustainable form of settlements as they lack in proper basic amenities like sanitation, water supply, power which generate unhygienic and poor living conditions etc. This proves as a serious issue not only because they are unsustainable within themselves but also, sprouts where a patch of land is free, most of the times, areas left vacant in cities for ecological, conservational or expansion purposes which creates another problem of illegal settlements.

Mumbai- The Economic Capital or Slum Capital ???

Mumbai has urbanized over the past century and urbanized rapidly from its origins as a fishing village. The population graph clearly indicates that majority of population in a developed metropolitan like Mumbai still resides in slums. Mumbai booming economic capital of India means that migrants come for economic opportunities in the expanding industries, services sector, businesses, administration etc. Low income population tend to live in slums as they provide cheap residential locations very close to the work place irrespective of the condition of living and availability of basic infrastructure. Thus the **live-work** or travel distance between work place and residence and **unaffordable housing** along with lack of administrative measures are few major causes for slums in the metropolitans.



As discussed above, the changing working patterns, relation between economics and resulted unsustainable planning drives to unsustainable development. Scattered and spontaneous economic planning leads to migration and hence leads to unsustainable ways of living lead by migrants. The way out could be hidden in the provision of well distributed employment, which will lead to lesser migration from rural to urban and within the city and hence may lead to a sustainable development.

Analysing smartness in Indigenous way

India had a set of Smart cities 3000 years ago, they had running water, attached bathrooms, covered drains, clean & well maintained streets, public places, well ordered public planning, garbage renewal. They also had some low cost housing on outskirts, public places and protection from outsiders. Smartness would mean differently for different people. India does have a few elements of sustainability inherited, our villages of past lived as sustainable units for centuries, they used to cultivate the amount of product which was sufficient for there consumption. Most of the basic services were produced locally. Surplus was sold at village level markets or haats along with barter things which an individual is not capable of producing.

Under the economic forces, villages act as feeders for cities in terms of man power, raw materials and food. The size of a village was defined (for many villages, even today) by the population which can be sustained within an area one can walk to access goods essential for living and his work i.e. majorly agriculture. Once the area attains a sustainable population density (and subsequently, cultivable area of farms around the village also fills up) it's the time to seek for a next cultivable area of land to develop and grow as a new village. Only the occasional trips are made to larger settlement (such as higher education, specialty health

Connected Scales of Settlement : The Story of Punjab (Give some picture)

On an overlook, the state of Punjab demonstrates a bench mark of state/regional level planning with decentralized settlement hierarchy which is almost evenly distributed and well-connected by movement corridors. The State's urban population is distributed over 217 towns or urban agglomerations. Also, the urban population in Punjab has witnessed 25.9 per cent increase over the past decade with the State's population increasing from 2.45 crore in 2001 to 2.77 crore in 2011 comprising 37.5 per cent in urban areas. Punjab is experiencing rapid urbanization, and the increase in urban population at 25.9 per cent is more than thrice the increase of rural population by 7.8 per cent. Where the urban population in India is 31.2 per cent, and 68.8 per cent of the population is rural, Punjab has 37.5 per cent population in urban, and 62.5 per cent rural.

The above data reviles that decentralized settlements and connectivity will not help in reducing migration until distribution of economic activates takes place at regional level i.e. enhancing local economics. Upgradation of existing villages and provision of better opportunities will lead to the lesser migration. Also, not only connectivity, but better quality of connectivity will act as a catalyst for economic activities.

services). This type of growth is indeed a form of sustainable development, though, up to an extent sounds theoretical today. The idea is not to discourage largely grown settlements (both in size and population) but the attitude of forgetting sustainability (in all respects) by these cities. It is clear that urban & rural are interdependent, but the issue of migration and the pace of consumption of raw materials, unsustainable and unhygienic condition of living, environmental impact and local becoming global while losing its cultural uniqueness and traditions, is under the critical condition to look after smartly. Thus we suggest a process of development here termed as indigenous smartness, where the roots are remembered to define the new trajectories of sustainable development.

Village approach and Scale of development:

As elaborated above, the unsustainable condition is governed by the economic planning, (inter and intra settlements of all scale both in size and population) connectivity and distances between live-and-work. The optimization of above parameters will direct us towards the smart sustainability which we envisage to achieve. The development of smaller unit, which is here grounded in the learnings from village, connects to each other to form a holistic singular identity called smart city. The decreased live work relationship (reduced distance and better connectivity) will enhance the efficiency, which is another form of sustainability while meeting the economic aspirations of city as an entity.

Enhancement of public and mass transport will not only be economical and sustainable but shall also be made easy to access and readily available (while the economic activities are evenly distributed across the city and not concentrated, like the farms of village are spread all across). It is not like we are immersed in unsustainability, for eg. For sustainable living and holistic development many models like local area planning, public meetings and public hearing, are not new to us as panchayats are not typical to villages. Another eg. Could be the decentralized planning of cities, both economical and infrastructural which are further well connected with LRTs and MRTs. Like our villages sometimes evolve as a reaction to movement corridors, TOD (transit oriented developments) are now been planned as an integral part of sustainable cities. This clearly indicates that we are moving towards sustainability, but unconsciously. The approach described in this paper, could lead us ahead into the world of indigenous smart cities of India.

Conclusion

Hypertrophied cities of today has shown a constant growth through unsustainable means. Not only figures from different sources, but also the physical condition of Indian cities, which urbanites can feel, highlights the need to become sustainable which is referred as smartness. Economics and connectivity being the vital thrust of sustenance, Scattered and spontaneous economics leads to migration and hence, leads to unsustainable ways of living lead by the migrants and other city dwellers. The spontaneity in the existence of village showcases

sustainability in terms of population density, local economics, public participation, and quality of life. Understanding of self-sustenance as a unit, from our villages, show us an approach which can be implemented for *polynucleotide city*. The *urban grouping* of such sustainable units with walkability (easy availability of social and physical infrastructure), stronger live-work relationship, public participation, decentralised economic activities, transit oriented development etc., with city level infrastructure, will result in a strong base for sustainable future. Also, to mitigate the causes of migration and hence growth of slums and peri-urban areas, our villages shall be re-strengthened with connectivity and planned economic distribution. This highlights the importance of quality rural connectivity. The approach described in this paper, will lead us ahead into the world of indigenously smart cities of India and India will become a benchmark for its own smartness.

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