Socio-Environmental Perspectives of Urban Development: The Case of Hyderabad, India.

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Abstract:

Concentration of urban populations in Metropolitan cities in developing countries like India, due mainly to the pull factors including impetus on production activities in the post liberalization period, is contributing to high growth but it is also showing up negative impacts on society, environment and health. This review paper addresses to the socio-environmental issues in terms of land, water, air, sanitation and hygiene taking place Hyderabad urban agglomeration as a case study based on secondary data sources such as public documents, study reports, published articles and media coverages and search engines like google scholar. The results show high pressure of population and concentration of industries on limited resources of land, water and air as reflected in unplanned growth, high density of population, growth of slums, density of built-area. It further shows how the degraded environment is leading to higher levels of soil, water and air pollution beyond tolerable limits and poor level of living of slum dwellers who constitute about one-fourth of city population and limited prospects for long-term production. Increased urbanisation is tending to cause socio- economic inequity and irreversible damage to the natural environment keeping the sustainability at stake, that needs proper planning and priority.

Index Words: Determinants, inequity, irreversible damage, pollution, slums, sustainable development, urban environment.

1.1 Introduction. Demographically, India, like many other developing countries, is moving from rural base to urban base to keep itself in tune with mainstream economic development pattern. In the process of globalizing their economies, state governments have been focusing on the already developed cities for increased economic and commercial activities, considering them as growth engines in the post -liberalisation period. With the result, urbanization picked up momentum. The decadal growth of urban population being 17.7 per cent during 2001-11, the process of urbanization is characterized by varying proportion of urban population across different states [1]. The states like Maharashtra, West Bengal show high concentration. Though the tendency of concentration of large-sized cities commenced since 1951, the liberalization process hastened the concentration in metropolitan cities. First ten metropolitan cities share more than 50 per cent of total urban population in the country and currently contribute 62 per cent of the country's GDP. The fallout of such high urbanization in cities is the inability of municipal administration to cope with growing basic demands of civic amenities such as safe drinking water, sanitation, waste management and prevention of pollution of all vital resources- air, water and soil, all reflecting in distressing picture of local environment that is emerging as a deterrent for further growth besides resulting in rural -urban, rich and poor divide in the share of gains and multiple other hazards.

1.2 India has signed many international conventions on equity, environment and urbanization and the responsibility lies with the nation to adhere to the principles laid down there and translate them in to action. In this connection, Declaration of the UN Conference on the Human Environment -1972, under clause 14 mentions 'Rational planning constituted an essential tool for reconciling any conflict between the development needs and the needs to protect and improve the environment'. Further, clause 15 states 'Planning was to be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all. Indian constitution lays for obligation for protecting the environment in its Directive Principles of State Policy (48)[2]. In the constitutional division of powers, urban administration was a state subject and with 74th amendment, the powers are rested with Local Governments, but, the states have not transferred the full powers to the local bodies. Neither the state governments nor the Central Government framed any Urban Development policy as yet taking cognizance of the environmental aspects. There is a persisting feeling that compared to the grimness of environmental damage, the response of governmental agencies is far from adequate (B[3]. In the absence of this, there is a haphazard growth of cities, particularly in the recent decades. Studies report woeful situation born out of lack of acknowledgement of the failure of the present development mode, overlook of the socio-economic roots of environmental degradation and wide spectrum of social conflicts. However, due to historical and other factors, the dimensions of the city problems might vary, and therefore, there is a need to study them separately to understand the dynamics of any city's development and their impact on its people and environment.

1.3 For example, Telangana state, that occupies 2.89 per cent share in population, shares 3.6 per cent in urban population in the country with 38.8 per cent of urban population in the state in 2011. Moreover, Hyderabad city alone accounts for more than 54 per cent of total urban population in the state. Further, it is important to note that the city alone contributes more than 54 per cent to the State Gross Domestic Product in the state and is one of the fastest growing states in India to boost economic activities [3]. Experience shows that the

same cities, with increased population, are exerting pressure on scarce resources that is leading to shortages in infrastructure, essential civic services and environmental degradation [2].

1.4 If one has to accept the framework of sustainable development that is normative, the ecological perspectives, inter and intra generational equity comes to the fore. Realizing the importance of environmental sustainability, the State of Telangana has incorporated environmental goals in its development agenda [4]. Even the new schemes launched in 2015 by the Central Government like Smart Cities Mission and AMRUT etc., stress the people- centric urban development. How far the state is moving in the direction of preserving the environment in the city becomes a matter of research interest. This paper addresses the social and environmental issues of urban development taking Hyderabad city as a case study.

2.0 Objective and Methodology:

2.1 The main objective of this paper is to analyze the socio-environmental issues confronting in Hyderabad city in the process of its development. The specific objectives include:

1. To portray the inventory of environmental resources at the command of the city;
2. To examine the present status of these environmental resources;
3. To analyze the factors that determine environment in the city;
4. To assess the impact of the built- environment on sustainability.

An attempt is made in this paper to understand the status of city environment by integrating the available secondary data, Government/ Other Reports and various studies conducted in Hyderabad and data generated on various aspects of city development. It is more of a review paper as it depends on the literature and secondary data as available with public and private sources- academic contributions, media publications etc. Impact of urbanization on environment is analyzed in five- part structure: 1) Environmental resource inventory 2) Public health activities 3) Environmental status 4) Impact of environmental pollution on socio-economic aspects and 5) Sustainable development perspectives.

3.1 Hyderabad City Profile:

Locating in Deccan Plateau, Hyderabad has a tropical wet and dry climate bordering on a hot semi-Arid climate with 854.6 mm of annual rainfall, seismically in a safe zone and with long historical background, it used to present reasonably a good place to live. It is endowed with rich natural resource base- the land, the water, the air, the temperature, humidity etc. Coupled to this, the human resources available from time to time offer high potential growth. The Musi river flowing through the city, having about 900 small and big lakes and built tanks, besides being a source of drinking and irrigation needs, and together with green fields, it used to provide a balancing ecosystem. Hyderabad lakes and the sloping terrain of its low -lying hills and wide -open places used to provide habitat for an assortment of flora and fauna. With plenty of Green fields and nice parks developed to be called as "Garden City", it used to present pleasant environmental conditions in the city. Being a capital city located at the centre of the State, besides being an administrative unit, it had traditional business foundations in diamonds which was also called as 'City of Diamonds'.

3.2 Hyderabad City and Urban Growth in Telangana:

During 2001-11, the annual growth of urban population in the state being 2.13 per cent, Hyderabad urban agglomeration consisting of Hyderabad and Ranga Reddy districts noticed 2.97 per cent and 91.47 per cent growth respectively. Hyderabad district having reached almost saturation stage with no scope for further growth. The growth of Ranga Reddy has been witnessing fast growth and still offers scope for further growth. The adjoining districts of Medak, Nalgonda and Mahbubnagar noticed fairly higher urban growth under city influence. While few districts like Adilabad and Khammam noticed lower urban growth, many districts noticed high urban growth (Table 1) more than the State average.

(Table 1 here)

3.3 Trends in Growing City Population

Population in urban areas has been witnessing significant increase in recent years resulting in Telangana becoming one of the fastest urbanizing states in the country. With an urban population of 136.09 lakh, Telangana shares 3.61 per cent in the total urban population (of 3771.06 lakh) in the country in 2011. It occupies 6th position in urban agglomeration in the country. Trends show that the share of Hyderabad city (Hyderabad and Ranga Reddy districts together) population has been rising constantly indicating its high growth as compared to other urban centres in the state (Table 2). The decennial growth of urban population of the city in 1980s and 1990s show high growth compared to other decades. But, large- scale additions are still continuing unabated. Given the tempo of industrial and commercial activities, the net addition is likely to be more than 22 lakhs in 2011-2020. Migration flow is from rural parts of Telangana (3/4th) as well

as other parts of the country (1/4th). Most of the rural migration is engaged in the construction works and unskilled industrial workers and other menial jobs in the commercial establishments as unorganized workers. This pressure of population has changed the land-man ratio where the density of population per km² in the city has gone up to 18 430. Absence of employment opportunity in rural areas being acted as push factor, the pull factors played significant role in the inflow of migration in to the city. The immediate effect will be on land, water and essential civic amenities like drinking water supply, sewage and solid waste disposal with which the built- environment come in clash with natural environment.

(Table 2 here)

4.0 Environmental Impact:

Hyderabad city environment, primarily, comprises of natural and built environment. The natural environment comprises land, water, soil and air, and therefore, the urbanization is likely to impact these elements. The built environment includes all sorts of buildings covering houses, institutions, offices, industrial establishments and roads, railways track etc. As all human settlements subsist on land and the relationship between land and man will be an organic one and changes in human actions tend to affect not only the land but others too.

4.1 Land Resources and Land Use:

Hyderabad city used to occupy an area of 55 km² in 1869. As with city population growth Greater Hyderabad Municipal Corporation (GHMC), the area of the city expanded to 84 km² in 1921 and to about 200 km² in 2005 and further to 710 km² by 2011, while that of Hyderabad Metropolis Development Authority (HMDA) from 1874 km² to 7252 km² in the recent years. The pressure of urbanization on land can also be understood from the land-man ratio that has been falling. The density of city population being 6363 per km² in 1869 was increased to 7347 in 2001. However, the density of core city was as high as 20,920 while in the adjoining municipalities it was 4073. The overall density of city population increased further to 18,430 per km² in 2011, indicative of pressure of urbanization on land and more so in core city. The land use pattern has undergone change from green fields, agricultural fields that have been converted to built- area to house the growing population, building roads, locating big and small industries, institutions, offices etc. A recent government survey found 5.53 lakh acres of government land in Ranga Reddy district, and 17500 acres of land (4365 acres of non-agricultural and 13145 acres of agricultural land) worth Rs. 3 lakh crores had been encroached by individuals and institutions. Last two decades witnessed tremendous growth in housing activity prompted by speculative business and soaring prices of lands, denying access to the poor. Lopsided planning given way to excessive concentration in area in which already support a population beyond their carrying capacity. With price escalation of land, agricultural lands have also given place to housing and the city expansion took rapidly in Ranga Reddy district, that has more of rural background. This growing problem necessitated for a plan on bigger area and today, under HUDA, the out growth is to cover an area of 7252 km², and to that extent, the landscape is altering in due course of time. The result is emergence of a built-environment in concrete jungle in place of trees and open places.

Growth of Slums:

Another pressure on land is seen in the ever- growing slums in the city. There are about 1476 identified slums in Hyderabad city and 2/3 of them are locating in the Core city itself. About 1.7 million people constituting 1/4th of city population, lives in slums. This indicates inaccessibility of land to the poor who are mostly from migrant population. Studies have brought out that the pressure is not only on land but also on essential civic services like drinking water supply, sanitation, hygiene, sewage, roads in the slum areas. Yet another feature is that of their location. Slum dwellers are locating on tank -beds, adjoining nallahs, riverbeds, hillocks, and public places in the low- lying areas which are normally prone to floods and inundation due to uncleared storm water and breeding centres of mosquitos. There are 27 high risk flood zones and 116 flood zones identified in the city. The recent floods (2020) badly affected more than 1 million households, mostly the slum dwellers in almost all parts of the city. The socio- economic conditions of the slum dwellers are well documented to be quite poor-with low incomes and poverty, poor housing or houseless, low infrastructure of roads, informal (seventy thousand households in Street vending) and low- income employment, poor drinking water facilities and sanitation (Safe Water Network 2016), exhibit dualism in living and health conditions [5], [6].

One more culprit is road network that has been expanding in length and breadth with increase in transport needs on account of growing urban population and ever- increasing vehicular density (one vehicle per two persons). It has developed a road network of more than 9100 km in the city. In order to ensure transit- oriented development, an Inner Ring Road (IRR), 158 km of Outer Ring Road (ORR) and the connecting roads have been developed. In view of the traffic congestion on important routes and as a facilitative step towards integrated transit and smart city, it developed

Metro lines on PPP mode and strengthened the rail transport with MM trains within the city area. All this required more land that came by acquisition from farmers who used them for agricultural purposes. Periodic government policy to regularize the unauthorized constructions (2016 and 2020) and lakhs of applications received for regularization in the recent years bears the testimony for haphazard and unplanned constructions, mostly occupying government land, open lands, water bodies etc.

4.2 Industrial Concentration:

In Hyderabad city agglomeration, the settlement pattern of industries is a crucial matter. From the beginning, the policy has been to encourage location of factories (major and minor) in and around Hyderabad and was at the neglect of location in other parts of the state. More than 50 per cent factories in the state, are located in and around city and shows high level of concentration of industrial location in the city. While some industries are located in the peripherals like Patancheru (Medak district), Bollaram, Jeedimetla, Balanagar in the North and adjacent areas of Nalgonda district in the South, Uppal, Nacharam on the East and Kattedan in the South - West etc. Big industries such as BHEL, BDL, ECIL etc., are also located in the city since long. In the later part, Software Park in Hi Tech in city, apparel park at Gundla Pochampalli, Export promotion at Pasha Mylaram, Biotechnology park at Turkapally etc., and Automobiles and Components Industry, Pharmaceuticals, horticulture, poultry have been established by acquiring lands from farmers, indicative of conversion of agricultural land to non-agricultural land. The Industrial Policy of Telangana (2015) is not different from the earlier one as it continues to encourage establishment of huge industries and multinational corporations through the policy of Ease of Doing Business (EDB), establishment of the large sized Special Economic Zones (SEZs), industrial hubs, TS i PASS and enrollment of new industries. As many as 11 big industrial areas are planned recently to locate along the Outer Ring Road itself. This is further likely to concentrate industries in and around the city. Today, Hyderabad is already a big international market for IT products, medicines, medical services etc. Hyderabad city's Hi Tech is considered as 'Silicon Valley of India' during 1990's & 2000's. Very recently, Hyderabad Pharma City is proposed at National Investment Manufacturing Zone (NIMZ) with 150 firms at Mucherla Village in Ranga Reddy district on the outskirts of Hyderabad and acquired about 8500 acres of land for it. The expansion of these existing institutions / industrial units is likely to enhance the economic and commercial activity base in the city.

On the other hand, the mechanisms developed for protecting the environment such as Environmental Impact Assessment (EIA) in the post-liberalization period, are being diluted in the recent period by the Government of India, in an overriding concern to attract industries in to the cities [7]. This, in turn, with weak administrative structure to implement the existing regulations, the environmental problems are likely to increase, adding further woes to the people of the city.

The potential pressure can be understood from the extent of houselessness in the city. Though overall houselessness is less in the state (0.15%), yet, nearly 3/4ths of houseless households in the state are in Hyderabad alone (9449 households) in 2011 (Table 3).

Table 3 here)

The adverse effects of all these developments have resulted in declining green fields which used to provide balance in the city environment for long, acting as a source of environmental sink for carbon dioxide and other emissions and as source of oxygen supply. The tree coverage is reduced from 2.7 per cent in 1996 to 1.7 per cent in 2016. Densification of built environment is the prime reason for the loss of green cover in the city.

5.1 Water Resources:

The water resources of Hyderabad consist of mostly Musi river that flows through the city in the South and partly the Nakka vagu that joins Manjira in the North, 943 tanks and ground water. The annual rainfall being 864 mm, river water alone is not sufficient to meet the water needs. In view of serious floods in early 20th century, two big lakes (Osmansagar and Himayatsagar) were built across Musi river in its upper reaches that used to serve the drinking water needs of the city. Chain of tanks were built to irrigate the fields and ground water was to be used for drinking as well as irrigation. Over the years, with increase in population of the city, additional water supply sources were found first in tapping Manjira river water by constructing Singur dam. When that too was found insufficient, big water lifting projects were built to bring water from Krishna River through Nagarjuna sagar through the lift system. Now the plans are afoot to bring water from Godavari river through a long distant lift system (though mostly for irrigation). Despite all these efforts, the water needs could be met only to 50 per cent.

Urban Water bodies face several threats from pollution, encroachment, dumping construction debris, eutrophication, illegal mining activities and cultural misuses. The river side encroachments and constructions narrowed the river passage. Such activities on tanks resulted in severe loss of water area in the city that declined from 118

km² to 110 km² in 1996 [8], [9] due to urban spread. The area under water bodies had decreased by 11.84 km² in the period from 2001 to 2015, especially the area under river/ streams had declined from 16.62 km²in 2001 and further to 15.32 km² in 2015 (EPTRI 2015). While some tanks shrink in their area, many are subjected to extinct. Eighteen water bodies of more than 10 ha. were completely [10] leave aside plenty of small tanks of <10 ha. Coupled to this, large scale extraction of ground water for domestic and industrial purposes, is resulting in loss of ground water potential. Not only the water levels have fallen to steep levels, as per the estimate of World Bank and NITI AYOG, ground water to deplete completely by 2020 in Hyderabad [11]. Consequently, with depleting water resources, Hyderabad city is finding it difficult to meet its growing demand for water – both drinking as well as other purposes. Way back in 1988, National Commission on Urbanisation (NCU), considering the depleting ground water and attempts to bring water from far off places, it suggested for recharge, instead of depending on other sources, that it has a great truth even today.

5.2 Water Pollution:

The more perturbing aspect is water pollution of all the water sources- the rivers, the tanks and the ground water beyond the bathing standards, not to speak of drinking standards. The industrial pollutants, mostly untreated, are discharged in to the water bodies, causing serious levels of pollution of heavy metals and other industrial effluents. The domestic waste which constitutes the bulk is also discharged into nallahs which join tanks and rivers and from there to big rivers. Several studies have estimated the pollution levels and found that the pollutants concentrate more than the stipulated standards making it unfit for consumption. Musi watershed covers more than 80 per cent of the city agglomeration while the rest is covered by the Manjira - Nakkavagu basin. In the Musi watershed, there are 520 water polluting industries and in Nakka vagu basin 245 water polluting industries, operating in the red category, besides engineering, metal, lubricants /rubber etc. Pharmaceutical industries contribute about 90 per cent of total quantity of toxic effluents.

5.3 Musi River Water Pollution:

Musi river that flows from Hyderabad city joins the Krishna river in the South, carries waste water that is highly polluted with highest levels of BOD, COD and hardness in the downstream of Himayat sagar. According to CPCB estimates, Musi is the sixth most polluted river in the country. It estimated BOD to be in the range of 4.0 to 60 mg/l in Musi, 5.0 to 26 mg/l in Manjira and Nakkavagu and included in the priority projects for restoration. Most of the city industrial polluted waters (treated / untreated) join tanks and ultimately join Musi river. Total alkalides are also the highest in Musi. Water pollution in Musi at mg/ l is the highest at 30 mg/l at Nagole in Hyderabad. Polluted waters are carried up to Suryapet project, and from there to Krishna river, where also the pollutants are severely loaded (Table 4).

Geological Society of India (2017) [12] in Nalgonda as reported in The Hindu paper dated 30-11-2017, shows that 'ground water in the Nalgonda district in the East of Hyderabad contains toxics including lead, cadmium, vanadium, and arsenic in concentration that are thousands of times higher than the maximum levels prescribed for drinking water quality by WHO & Bureau of Indian Standards (BIS}. The paper reported that one likely origin of the pollution is 'the release of reactive pollutants in to the atmosphere by industries', listing the pharmaceutical industry of the area's key 'anthropogenic activities'. Pharmaceutical pollution, whether from the excretion of drugs or industrial activity, carries specific dangers for human health and ecosystem ranging from near elimination of entire species. The ill effects are well documented as to the 'feminization of fish' and, 'the spread of antimicrobial resistance (AMR) (CMF 2016) [13]. Crops are raised with polluted water of the Musi river that adversely affects the quality of food grains or other crops, particularly vegetables grown all along the Musi and its twenty- four Katwas (canals) irrigating about 250 tanks in the downstream [14]. The adverse impacts of Industrial pollution are not only seen heavy metal pollution in nallahs, tanks and ground water but also that the Nakkavagu basin has been turned in to a 'biological desert'.

(Table 4 here)

5.4 Pollution of Tanks:

Studies on assessment of lakes' water quality in Hyderabad urban agglomeration reveal high levels of pollution. Govil P K et al. (2012) [15] study of lake sediments revealed high prevalence of heavy metals, that are carried in to the lake from Katedan industrial area through water fed in to the 5 lakes (Table 5). In another study, 23 out of 25 water bodies had been rendered unfit for irrigation and industrial cooling, let alone for drinking and domestic use (CMF 2016)]16]. The study CMF (NORDEA 2016) [16] finds another harmful feature of spread of AMR in 23 of 25 water bodies which had been reduced unfit for irrigation even with seepage of chemicals in to ground water, active pharmaceutical ingredients (APIs), foam and froth in water bodies. The contaminants in the important lake Hussainsagar in the middle of the city has also contain traces of heavy metals

(Table 6). In another study of five lakes in Hyderabad by Centre for Climate Change (2017) [16] observed that most of the water quality parameters like pH, EC, BOD Dissolved Oxygen, COD, TDS, Nitrites, Ammonial nitrogen, phosphates, total solids, total suspended solids, fecal coliform, surfactants and Filamentous Bacteria were found to be higher than the permissible limits.

(Table 5 here) (Table 6 here)

5.5 Ground Water Depletion and Pollution:

Depleting ground water source is posing a still higher threat. In several places, it is overdrawn leading to steep fall in the water table. As per NEERI Report (2019) [17], ground water levels vary significantly across different parts of the city in Musi basin. For example, in 2015, it varied between 2.69 M (Meters) to 35.36 M in 2016, whereas, in the following year, it varied between 1.56 to 47.8 M. In more than 50 per cent of city area, ground water sources are depleted even at great depths. In another 1/4th area, ground water is polluted severely. The problem is much more severe in industrial areas where they depend more on ground water source. There are 226 industries drawing ground water to the tune of 5743 KLD for their use and is on increase in several places, it is overdrawn leading to a fall in the water table steeply. As observed by NITI AYOG (as reported in The Hindu, New Delhi ed.2018), the ground water resource is to exhaust by 2020. As for quality, most of the pollution parameters were found to exceed the drinking water quality standards (IS 10500-2012) in both pre- monsoon and post-monsoon periods. Of the total samples, 69 and 31 in pre and post monsoon were found to be contaminated, (geogenic), by fluoride (concentration more than 1.5 mg/l. Similarly, 77/65 borewells were contaminated (anthropogenic) by nitrate (concentration > 45 mg/l during pre and post monsoon. Similar is the situation of ground water quality in the Nakka Vagu and Manjira basins, where also all the parameters of ground water quality at drinking water exceed permissible limits in 2015, 2016 and 2017. It was observed that all the bore wells and tube wells were contaminated (anthropogenic), which shows the impact of sewage in the ground water resources in Nakkavagu- Manjira basin. Ground water use is extensively done by pharmaceuticals, paints, pulp, plastic, bulk drugs and chemical units. Seventy-one industries locating in Sanga Reddy, Ranga Reddy and Medchal-Malkajigiri districts in Nakka Vadu and Manjira basin draw ground water in the order of 2808 KLD.

Krishna A K. et al (2019) [18] studied ground water quality in 120 samples drawn in the Katedan Industrial Area where about 300 industrial units exist. They are mostly small units that categorize in to edible oil, battery fabricating units, metal plating, metal amalgams, plastic items, synthetic substances. It analysed cations, anions and heavy metals in two seasons- summer and winter. The results of the study are presented in Table 7. Th study concludes that 'Water quality degradation is associated with various natural and anthropogenic sources and unsystematic apportionment. It identified six dominant factors for each during summer and winter that explained 70.43 per cent and 71.06 per cent of variance in the data set. High and significant correlation between cations, anions and metals indicate that contaminants in the study area waters have a similar source which originates from industrial activities. Health risk assessment of chronic daily intake (CDI) and Hazard Quotient (HQ) during both seasons were in the order Ca> Na> HCo2> Cl. Co3> So4> NO3> K> F'.

(Table 7 here)

5.6 Water Quality:

Quality of water in the water bodies is adversely affected by inadequate and improper treatment of waste water output in the drainage. It generates about 1600 MLD daily and only 40 per cent of it is treated in the STPs, while the rest is directly discharged in to water bodies causing pollution. Moreover, the Hyderabad drainage carries combined discharges of industries, hospitals, domestic and therefore, it contains heavy metals as such. They carry great part of solid materials such as plastic that comprises of about 30 per cent, debris 20 -40 per cent. The pipelines laid for certain capacity are being overloaded with increase in the density of residents in a given area. These features of sewage cause choking of drains that cause overflow of waste water on to the roads causing nuisance and health hazard [19]. The surfactants used in the manufacturing of highly demanded new life style products such as soaps, shampoos, detergents, hair dyes, cosmetics and other household cleansers and usage of foam washing of automobiles that use surfactants let in to the sewage system cause foaming in tanks. Filamentous bacteria are largely found in contaminated lakes and thrives during lake eutrophication stage with zero dissolved oxygen levels and high levels of BOD, N, P, C and surfactants. Partially digested hydrocarbons in STP /ETP have the potential to induce Filamentous bacteria [16].

6.1 Air Pollution:

Estimates show high levels of air pollution in the city than the limits and is only second after Delhi. Sarath K G. & Kopakka R V (2014) [20] estimates the modeled concentrations for urban area 105+ or -28.64 ug/m^3 for PM10 and 72.6+or -18.0 ug/m^3 for PM 2.5. On source apportionment in Hyderabad, it listed transportation, industries and dust as critical sources of particulate matter

pollution in the city of Hyderabad (Table 8). Transport sector and industrial emissions and dust are the main contributors to the PM2.5 and PM10, carbon monoxide (CO) and black carbon (BC). Specifically, transport sector contributes to about ¾ th to carbon monoxide (CO) and VOC and 60 per cent to NOX. Dust contributes 68.2 per cent to PM10, 1/4th to PM2.5. Industrial emissions contribute ½ to So2 and 43.5 er cent to BC, 1/4th to OC and 28.7 per cent to PM2.5. Others contribute marginally to various pollutants. (Table 9). It is reported that Black carbon is also spread in to city outgrowth (The Times of India Hyderabad ed. 2018)

(Table 8 here)

6.2 Transport sector: The high contribution of transport sector emissions is due to high density of vehicles in the city. Hyderabad urban agglomeration consisting of two old districts of Hyderabad and Ranga Reddy share 54.7 per cent of all vehicles in the state (Table 9). The density is 1 vehicle for every two persons in the city as against 1 for every five in the state. They share more of Non-transport vehicles (55.8 per cent) than in transport vehicles (46.0 per cent) in the state. Among total vehicles, non-transport vehicles constitute more than 90 per cent showing heavy reliance on private ownership of vehicles. The density of vehicles is relatively more in Hyderabad than Ranga Reddy and the intensity of emissions is also higher in Hyderabad.

(Table 9 here)

6.3 Industrial Emissions:

Debit side of industrialization and hazardous products like polychlorinated biphenils (PCBs), hazardous and toxic waste, is seen to have adverse effect on the urban environment and thereby the health of the people. As mentioned earlier, it contributes heavily to almost all the components of air pollution. Pharmaceutical industry is the main culprit in the sense that they are emitting hazardous chemicals /gases that cause high morbidity in the Manjira-Nakkavagu basin. Most of them - Pharma / Chemicals, R&D, Engineering and Metal, paper, lubricants / rubber etc., are in red category.

6.4 Other Emissions. Dust pollution: Construction activity, demolitions, uncleanliness on the roads contribute to dust and particularly to PM10.

7.0 Sanitation and Hygiene:

7.1 Solid Waste Management:

Hyderabad generates solid waste of 5030 to 6000 MTDs (metric tons per day) of garbage every day, that comes to an average of 599 gm per capita generation which is quite higher than the average norm of 380 gm per capita. One problem that is faced in the management of waste is non-segregation at source. It is estimated that only 8 per cent of waste is segregated at household level. Only 76 per cent of solid waste is scientifically processed that too by composting. Legacy of dump yards in Hyderabad is a major challenge. Garbage treatment sites were few and Jawaharnagar dump yard is one where more than 10 million tons of garbage has been dumped over last 20 years. Pollution is caused due to open and unscientific dumping of solid waste. More importantly, hazardous waste management is posing great threat to local environment. Due to concentration of industries in the city, most of the industrial areas create hazardous waste that contain hazardous materials like lead, mercury, arsenic, copper; It is only 20 per cent of industrial hazardous waste is covered under TSDF facility. Only 48 per cent of hazardous waste is scientifically managed and the main hindrance in Hazardous Waste Management (HWM) is lack of capacity to develop, implement, operate and monitor the factories. Another source of problem is biomedical waste management where only hospitals are covered but clinics and laboratories are not covered and the biomedical waste is mixed with solid waste. With Information Technology Revolution and increased use of electrical and electronic gadgets, e- waste problem has emerged on the scene. Dumping in solid waste, unscientific collection and processing has emerged as an environmental problem.

7.2 Sanitary facilities: Sanitary facilities are fairly improved recently where, as per 2011 data, 98 per cent households have toilets within the house premises of which 82 % are connected with piped sewer. The presence of 11.5 per cent septic toilet, is causing problems in septage disposal that is done in the open fields (Table 10). The city is declared as 'Open Defecation Free' (UDF) in 10-100 rank category under Swachha Bharat Mission (Abhiyan) (SBM).

(Table 10 here)

7.3 Drinking water: As mentioned above, city administration is able to meet 50 per cent of drinking water supply, while the rest is met from market. Though authorities claim 94 per cent quality, field studies reveal low quality even in the piped water supply (Safe Water Network 2016). The transit loss is estimated to be in the range of 20 to 35 per cent. The problem is more intense in slum areas, where they suffer from access to safe drinking water (Safe water Network 2016). The problem is intensified more due to pollution of water bodies as well as depletion of ground water sources in the city. With heavy investments, water is brought to the city from far off places from Krishna river and plan is afoot to bring Godavari river waters to the city

through lift system. Though some measures are initiated in the recent past through enhanced STP (Additional 32 units), rejuvenation of tanks and cleaning of Musi river (Musi River Development Authority), the progress is far from adequacy and the problem continues unabated. Where do we leave the waste water that comes out at 80 per cent of water used, with further increased levels of pollution that already lost the carrying capacity in all the water bodies, emerges as a priority issue to resolve- the preventive way with least cost or curative way with heavy environmental costs which may not be internalized.

8.0 Cross - Sectional Responses:

Despite 74th amendment to transfer of powers from State to local bodies, it is not yet done fully. The Department of Municipal Administration continues to control the affairs. Municipal affairs are now dealt by multiple agencies and lack of coordination is identified as a major problem. The State government, though recognized and included SDG in its policy, the industrial policy of 2015, and the pronouncements/declarations on provision of infrastructure and various concessions have a tendency to further concentrate industrial location in and around the city. There are claims to make the city Global, to attract foreign investments in to the city, amply shows the intentions of the state. The peoples' perceptions of visitors to the city accord low rating (WHO 2020).

The Producers' responsibility in adhering to the rules and regulations is not exhibited. The precautionary measure like Environmental Impact Assessment (EIA), a tool to assess the industrial projects, and to mitigate the damage, and that is supposed to give a place for public scrutiny or public participation, has become mere nominal tool with dilution in the recent past. They are just heard but never listened. The environment regulatory authority in the state (TSPCB) lacks machinery to implement the regulations. Civil society interventions have been there to bring out hazards to the light and raising voice of protests and legal battles from time to time. The civic battles waged against environmental pollution by Citizens Against Pollution at Patancheru industrial corridor way back during 1980s (Ramesh Raju & K. Purushotham Reddy 1989), Nalgonda district peoples' protest against pharmaceutical industry and Musi river pollution are some to make a mention. There are few civil society organisations to create awareness on civic amenities and environmental pollution. NGO like Green peace, CMF, NORDEA, Center for Climate Change, Forum for Better Hyderabad etc., have conducted studies on environmental conditions, slums, and brought out reports to educate the public. Courts have been playing the deserved role in protecting the environment by interpreting the law in the best interests of the public, who are the victims of environmental hazards.

Conclusion:

The study brings out the skewed distribution of urbanization in Telangana, more tending towards Hyderabad city. In an overriding concern for economic development through industries and service sector being concentrated in the city, the environmental aspects are overshadowed. The city presents a grim picture in terms of water pollution, air pollution and serious gaps in the management of civic amenities like safe drinking water, sewage and solid waste disposal. Though some ad hoc measures are introduced, they are quite inadequate to address the loss of carrying capacity. Urbanisation is causing inequity as between city and the rest, and within city dualism as between slum dwellers and the rest. It comes in clash with the present versus future generations. A long-term vision with proper planning and strategy to address eco-centric and people-centric approach alone can mitigate the problem and ensure sustainable development.

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Table 1 Percentage Decadal Growth of Population by Area and Districts 2001-11 (2011 Census)

S. No	Districts	Total	Rural	Urban
1	2	3	4	5
1	Adilabad	10.18	8.37	15.19
2	Nizamabad	8.77	2.19	38.53
3	Karimnagar	8.15	0.43	40.13
4	Medak	13.60	0.82	89.78
5	Hyderabad	2.97	-	2.97
6	Ranga Reddy	48.16	-3.64	91.92
7	Mahbubnagar	15.34	9.63	63.64
8	Nalgonda	7.41	0.39	53.1
9	Warangal	8.21	-3.91	59.23
10	Khammam	8.47	3.55	28.39
	State	13.58	2.13	38.12

Source: Statistical Year Book 2017, Government of Telangana (Table 1-6)

Table 2: Trends in the Growth of Urban Population in Telangana 1951-2011 (population in lakhs)

S. No	Year	Rural Population	Urban Population	Total population	% of Urban Population (Col 4/5)	Hyderabad City Population	Addition during decade	Decennial growth rate %	%of Hyd Population(Col 7/4)
1	2	3	4	5	6	7		4	8
1	1869					3.5			
2	1951					11.31			
3	1861					12.64	1.33	11.75	
4	1971	124.92	33.21	158.18	20.9	18.12	5.48	43.19	54.5
5	1981	154.87	50.99	205.86	24.7	25.92	7.8	43.00	50.8
6	1991	182..15	78.74	260.89	30.1	43.86	17.9	69.20	55.7
7	2001	211.38	96.53	307.87	31.3	58.12	14.2	32.50	60.2
8	2011	213.95	136.09	360.04	37.7	77.51	19.39	33.36	56.9
9	2020*					100.4	22.89	29.50	

Source: Statistical Year Book 2017, Go TS *= projected;

Table 3: Houseless Households in Hyderabad and Ranga Reddy Districts and Telangana (2011)

S. No	Area	House less House holds	Population	Total Households
1	2	3	4	5
1	Hyderabad Dt	4948(37.8)	17903 (37.12)	881512 [10.4]
2	Ranga Reddy Dt	4501(34.4)	17641 (36.57)	1263714 [15.0]
	Sub Total	9449 (72. 2)	35544 (73.69)	1045226 [25.4]
3	State	13061(100)	48226 (1000	8420662 [100]
	% Houseless Households in the state	0.15%		(100)

Source: Government of Telangana, Statistical Year Book 2017; Note: Figures in parenthesis ( ) indicate % to state total; Figures in [ ] indicate the % share of district households in state total households.

Table 4: Pollution Parameters for Musi river at different Stations (Annual average for 2018)

Sampling Station	pH	DOB Mg/l	BOD	Total Coliform	EC	Boron	SAR
	2	3	4	5	6	7	8
Gandipet	7.74	6.3	3.0	233	511	0.1	0.3
Nagole	7.55	1.33	23	920	1358	0.4	2.9
Oratapsagaram	7.27	2.15	16	837	1453	0.2	2.8
Kasaniguda	7.74	4.68	3	408	1666	1.1	4.4
Wadapally	7.95	7.04	3	434	901	0.3	1.9

Source: NEERI-CSR 2019

Table 5. Heavy Metal Pollution in Tank Sediment of Hyderabad (Values in mg/kg)

Tanks	Pre & Post Monsoon	As	Ca	Pb	Ni	Cd	Cr	Cu	Zn
Noor Md	Pre	>-400	8.0	709	79	2	135	137	490
	Post	>-400	14.5	914	234	12	172	447	1336
Chilan	Pre	42	10	96	46	2.0	70	47	244
	Post	12.4	6.25	146	24	1.4	70	50	339
Ura	Pre	34	10	79	32	2.0	62	39	142
	Post	5.6	12.8	64	26	1.3	879	52	77.5
Devullama	Pre	57	25	142	46	0.05	95	36	76
	Post	-	-	-	-	-	-	-	-
Narsabai gunta	Pre	>400	12	422	31	2	75	95	292
	Post	-	-	-	-	-	-	-	-

Source: Adopted from Govil P K et al. (2012)

Table 6 Heavy Metal Pollution in Selected Sites in Hyderabad (2017)

S. No	Heavy Metal	Observed Pollution Levels	
		Hussainsagar lake Pollution levels	Nallah beside Hussainsagar
1	2	3	4
1	Arsenic	o.776ug/l	7.29ug/l
2	Copper	1.74 ug/l	-
3	Zinc	8.52 ug/l	2230 ug/l
4	Cadmium	1.17ug/l	303 ug/l
6	Hexavalent	6.85ug/l	6.85ug/l
7	1,2 Dichloroethane	3.45ug/l	265 ug/l
8	Isopropyl alcohol	3.16ug/l	-

Source: CMF (NORDEA)- (2017)

Table 7: Observed values of cations, anions and heavy metals in ground water in Katedan Industrial Development Area, Hyderabad

S. No	Elements	Summer	Winter	S. No	Elements	Summer	Winter
1	2	3	4	1	2	3	4
1	Cations & anions			Heavy metals			
i)	Ph	7.0	6.9	I	As	18	4
ii)	TDS	1875	1527	Ii	Cd	2	0.4
iii)	EC (Ms /cm)	3	3.3	Iii	Cr	29	5
iv	Ca2+	655	569	Iv	Cu	17	4
V	Ma2+	59	56	V	Ni	25	6
vi	Na+	340	211	Vi	Pb	82	3
vii	K+ (mg/l)	5	4	Vii	Zn (ug/l)	953	989
viii	Co_3^{2-}	148	126				
ix	MCo3	301	228				
X	Cl	289	223				
Xi	F	0.5	0.85				
Xii	SO42-	999	86				
Xiii	No3 (mg/l)	28	23				

Source: Krishna Ak et al (2019)

Table 8: Total Estimated Emissions by Sector for 2018 (units in tons/year)

S. No	Emission Source	PM2.5	PM10	BC	OC	N0X	CO	VOC	So_2
1	2	3	4	5	6	7	8	9	10
1	Transport	7250 (20.8)	7650 (9.1)	2600 (32.1)	2450 (29.3)	36650 (60.2)	334850 (74.3%)	73550 (71.2)	850 (19.5)
2	Residential	1300 (3.7)	1400 (1.6)	200 (2.4)	610 (7.3)	250 (0.4))	20150 (4.8)	2300 (2.2)	250 (5.7)
3	Industrial	10000 (28.7)	10100 (12.1)	3550 (43.8)	1950 (25.4)	8150 (13.4)	15300 (3.4)	1650 (1.5)	2250 (51.7)
4	Dust	9150 (26.3)	56800 (68.2)	-	-	-	-	-	-
5	Open Waste Burning	3350 (9.6)	3550 (4.2)	250 (3.1)	2050 (24.5)	100 (0.16)	16150 (3.5)	3250 (3.1)	100 (2.3)
6	Diesel Generator set	2100 (6.1)	2200 (2.6)	1050 (12.9)	650 (7.8)	14100 (23.2)	45100 (10.0)	20300 (19.7)	300 (6.9)
7	Brick Kiln	1600 (4.6)	1600 (1.9)	450 (5.5)	600 (7.1)	1550 (2.5)	18800 (4.5)	2250 (2.1)	600 (13.8)
	Total	34750 (100)	83300 (100)	8100 (100)	8350 (100)	60800 (100)	450350 (100)	103300 (100)	4350 (100)

Source: Sarath, K. G. et al 2014): Note: Figures in parenthesis indicate percentage to total.

Table 9: Distribution of Transport and Non-Transport Vehicles in Hyderabad & Ranga Reddy Districts & Telangana (2011 Census)

S. No	Area	Non-Transport Vehicles No.&%	Transport Vehicles No./%	Total vehicles No.
1	2	3	4	5
1	Hyderabad	2149114 (30.8)	207692 (23.7)	2356806 (30.0)
2	Ranga Reddy*	1737894 (25.0)	194750 (22.3)	1932644 (24.7)
3	Sub-total (1+2)	3887008 (55.81)	402442 (46.0)	4289450 (54.7)
	Sate Total	6964130 (100)	874(416 100)	7838546 (100)

Source: Census 2011, Note: Figures in parenthesis indicate percentages

Table 10: Status of sanitary facilities in Hyderabad 2011:

Location	Toilet Within premises	Connected to Piped Sewer	Septic Toilet	Other	Night Soil	No latrine	Own Rev Receipts
1	2	3	4	5	6	7	8
GHMC	97.92	82.12	11.52	0.68.	3.6	2.08	80% (2013-14)
Core City	98.4	91.42	4.3	0.56	2.19	1.51	63% (2004-05

Source: Metropolitan World Congress: Cities for All (2014)

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