

URBANIZATION AND PARTICIPATORY GOVERNANCE IN MITIGATING CHALLENGES: A CASE STUDY OF DELHI METROPOLITAN REGION

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ABSTRACT

Megacities like Delhi have expanded in an unprecedented way. This expansion is fraught with a number of challenges which pose questions on the planning and sustainability of urban areas. This paper highlights some of these challenges in case of Delhi Metropolitan region. The paper first provides a historical overview of Delhi planning and discusses some of the administrative social-economic challenges that exist in implementing the planned measures. While these challenges are being dealt, there have been a number of initiatives that have been taken to improve the overall quality of living in the city. The paper provides an overview on few of these initiatives related to public transport, air pollution, urban greenery, energy supply, housing and climate change.

I. INTRODUCTION

Delhi, officially known as the National Capital Territory (NCT) of Delhi, is the largest metropolitan area in the country. It also contains New Delhi, the national capital of India as one of its administrative units. The metropolitan region of NCT is in the north-central part of India and extends to cover parts of the adjoining states of Uttar Pradesh, Haryana and Rajasthan.³ The total span of the National Capital Region is around 1,484sq. Km and is inhabited by nearly 20 million population (Census, 2011). This makes NCT 3rd largest Metropolitan area in the world after Tokyo-Yokohama and Jakarta. Apart from being capital and a political center of the nation, Delhi is also an economic growth driver of the country. Delhi's Gross Domestic Product (GDP) was estimated to be around 110 billion US dollars for 2017-18. This is approximately 11 percent more than the last fiscal year. Also, Delhi's per capita income, of 5,094 US dollars. It is almost three times of the average national income (936 US dollar) and is highest in the country both at the current and constant prices (Financial Express Online, 2018)⁴. This economic growth is however characterized by high inequality and debt. There were nearly 1,297,000 people registered as unemployed in 2016 and the outstanding debt of Delhi government was estimated to be US 1.2 billion dollar for the year 2017-2018 (Press Trust of India, 2018).⁵

Delhi's economy is predominantly service sector. It contributed nearly 82.26 percent in NCTGDP during 2016-17 (Financial Express Online, 2018)⁶. Banking, financial services, insurance, construction and real estate, agricultural processing, information technology and enabled services, logistics are the major sectors of investment and employment in Delhi (IBEF, 2018).⁷

In addition to this, Delhi's location, connectivity and rich cultural history makes it a preferred tourist destination in the country. Locational advantage and presence of Yamuna River makes Delhi's history to be as old as 6th century BC. This was the period of Hindu epic Mahabharata and Delhi was known to be Indraprastha. Since then, Delhi has served as a capital of various kingdoms and empires. As such, the city has witnessed many wars, demolition and rebuilding activities. However, under British Raj, India's capital was shifted to Kolkata but in 1911, it was shifted again to Delhi. Today, Delhi is a Union territory and resembles the administrative structure of that of any other state. It has its own parliament, high court, council of ministers headed by Chief Minister and Lt. Governor.

Delhi's trajectory as a metropolitan area reflects its economic, social and political progress. Old and New Delhi are the examples that have been carved out of this progress in different times. However, this evolution to metropolitan region has also led to serious urban complications. This includes rising problems of: housing, waste disposal, public transport, traffic congestion, pollution, water and electricity supply and increasing rate of crimes. A number of policies, institutions, programmes and schemes have been developed to tackle these issues. However, these problems are still persistent and never ending. The solution therefore requires comprehensive measures that are to be implemented in a collaborative manner involving government, private organizations, NGOs, resident welfare associations and citizens.

II. URBANIZATION HISTORY AND SPATIAL EXPANSION OF DELHI

Urban areas in British rule and post independent India evolved either because of their location advantage as ports (Mumbai,

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³ Delhi's east boundary touches to the state of Uttar Pradesh; from north, west, and south it is bounded by the state of Haryana

⁴ <http://www.financialexpress.com/economy/delhi-economic-survey-2017-18-city-shines-on-gdp-per-capitaincome-fronts-these-concerns-remain/1104640/>

⁵ http://www.business-standard.com/article/pti-stories/delhi-gdp-size-grows-debt-rises-economic-survey118031901255_1.html

⁶ <http://www.financialexpress.com/economy/delhi-economic-survey-2017-18-city-shines-on-gdp-per-capitaincome-fronts-these-concerns-remain/1104640/>

⁷ <https://www.ibef.org/states/delhi.aspx>

Kolkata and Chennai) or as administrative centers (Delhi). All these cities served as an important industrial center and markets attracting traders and laborers to sell their products and labor. Among all these major cities, Delhi has the oldest and most turbulent history. The city had been under continuous invasions from Middle East and Western Asia. This is because Delhi's geographical location is an entry gateway for west to other parts of India. Yet, many regimes including Mughal maintained Delhi as their capital. Defending Delhi and regulating India from it also became a status quo over a period of time. However, in 1772 under British Raj, Indian capital was shifted to Kolkata (the quint, 2017)⁸. The East India Company continued to rule Indian subcontinent from Kolkata for next 129 years. Growing violence, nationalist movement and the execution plan to reunite Bengal, however, led British to again shift capital to Delhi in 1911. This re-shifting was not only political but also led to their shaping of Mughal city in British style. British architects, Edwin Lutyens and Herbert Baker took nearly 20 years to complete New Delhi – a new city area which stood apart with its bureaucratic offices, wide roads and residences. The new administrative centre lied on the southern extremities of Shahajana bad what is today known as Old Delhi—the original Mughal city.

The British decision to move capital to Delhi also led to the population growth of the city from 238,000 in 1911 to 696,000 in 1947 (Dupont, 2000).⁹ Delhi continued to remain the capital of Indian State after independence in 1947, in the backdrop of India-Pakistan partition, the city witnessed massive influx of 900,000 refugees from erstwhile provinces of Punjab and Sindh. There was also an out flow of 320,000 Muslim to Pakistan. As such, 1941-51 was the period of large demographic transition in city's history. Delhi's population during this period grew from 700,000 in 1941 to 1.4 million in 1951. Decadal growth rate of 105 percent during this period is highest ever in city's history. The population implosion in the city continues till today. Census data shows that while India since 1951-2011 had an average population decadal growth rate of 22 percent, Delhi's decadal growth rate has been 45 percent (Statistics Times, 2021)¹⁰. In 2001-2011, Delhi's population decadal growth was recorded to increase by 21 percent the increment is lowest since 1951 but still more than the national average.

Internal migration from other Indian states accounts for a substantial proportion of Delhi's population increment. For example: in 2001-2011, migration accounted for 23 percent for Delhi's total increase in population. Most of the migrants, nearly 42 percent, are from Uttar Pradesh (Government of NCT of Delhi, 2019).¹¹ This number has further increased to 43.1 percent in a recent survey conducted by Institute for Human Development, Delhi in 2013 (The Indian Express, 2015).¹² The other predominant state for migration is Bihar. As per the survey, percent age of Bihari migrants to Delhi also increased from 14 percent in 2001 to 31 percent in 2011. For a long time, it was only men who used to migrate largely to cities leaving their family behind. But now married women are also migrating with their husbands. As such, women now constitute large portion of 45 percent of the total migrant population to Delhi in 2011 (Government of NCT of Delhi, 2019).¹³

Continuous in flow of migrants has changed the socio-economic and cultural profile of the city. Delhi is no more characterized by predominantly Punjabi migrants anymore. It has become a cosmopolitan geography with multi-ethnic and multi-linguistic culture. However, most of the migrants are poor. For example: of the total migrants from Uttar Pradesh and Bihar, nearly 46 percent and 63 percent are poor respectively. In addition to this, there are nearly 50,000 homeless people in Delhi. This figure does not take shanty and slum dwellers into account which is as high as 1.7 million (Mahapatra, 2012).¹⁴ Such large figures point out to the lack of livelihood opportunities in migrant native states. It also points out that migration has also not been very much successful in up lifting their economic status. The outcome of these events is an uneven social geography of city. That is, co-existence of both rich and poor on city landscape.

Population growth and migration has resulted in a high population density of 11,297 297 persons per square kilometer in the city. This is almost thrice the population density of 382 persons per square kilometer at national level. The increasing concentration of people also led to the physical expansion of the city. This expansion has been in all directions as Delhi does not have any substantial physical barrier in its vicinity. The multi-directional urban expansion continues till today and has now extended to include parts of neighboring states of Uttar Pradesh, Haryana and Rajasthan. What is interesting here is to note that the process of sub-urbanization which began somewhere around 1981 (Dupont, 2000)¹⁵ in case of Delhi has now taken the form of regional urbanization. Delhi Metropolitan region can now be viewed to be constituted by many cities such as Noida, Ghaziabad, Faridabad, Dwarka and Saket. All these Cities are physically separated but are functionally connected through commuting and communication infrastructure. This infrastructure largely facilitates the flow of labour, information, goods and services. As such, the physical distance between pre-existing distant towns and rural hinterland has now decreased. While most of these peripheral areas are getting densely populated, central Delhi is getting de-urbanized. That is, it has largely now been an area of education and work during peak hours and have residences either of bureaucrats or that only rich can afford.

This type of spatial expansion is not only physical but also institutional and cultural. There has been decentralized governance framework that is adopted to administer each of these areas. A major challenge that lies ahead is the proper coordination between these institutions and effective implementation to overcome urban problems.

III. URBAN CHALLENGES AND COMPLEXITIES IN ADMINISTRATIVE STRUCTURE OF DELHI

⁸ <https://www.thequint.com/videos/news-videos/delhi-birthday-capital-13-february-1931-british-india-lutyens>

⁹ http://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers14-11/010023836.pdf

¹⁰ <http://statisticstimes.com/population/population-of-delhi.php>

¹¹ http://delhi.gov.in/DoIT/DoIT_Planning/ES2012-13/EN/ES_Chapter%202.pdf

¹² <http://indianexpress.com/article/india/india-others/a-city-with-room-for-migrants-if-not-a-roof-over-theirheads/>

¹³ http://delhi.gov.in/DoIT/DoIT_Planning/ES2012-13/EN/ES_Chapter%202.pdf

¹⁴ <https://timesofindia.indiatimes.com/city/delhi/Half-of-Delhis-population-lives-in-slums/articleshow/16664224.cms>

¹⁵ http://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers14-11/010023836.pdf

Delhi's mega urbanization is posing enormous governance challenges. On one side, this expanding urban area should cater to the basic needs of growing population by providing quality services. On the other side, Delhi has to create a healthy social-economic climate that is capable of ensuring sustainable growth. These are however ideal characteristics that every urban area should fulfill. In reality, no urban area and as such Delhi is problem free. There are problems like, air pollution, traffic congestion, water and waste management which need comprehensive planning to deal with. In addition to these, issues of women safety and spread of endemic diseases like Dengue, Malaria and Chikungunya, need urgent measures. National Crime Records Bureau (NCRB) data 2017 shows that Delhi accounted for 40 percent of total rapes across 19 major cities in India. The city also accounted for majority of murder, kidnapping, abduction, juveniles' in conflict and economic offences. This grim picture of crime raises a serious question mark on Delhi's living environment and governance efficiency.

To deal with problems and ensure better governance, Delhi has gradually developed its institutions and evolved mechanisms within the federal framework. Functioning of these institutions is however not that easy. The major problem arises because of the nature of Delhi as an administrative unit. Delhi is neither a full state nor a full territory. It rather resembles a hybrid of the two. Before 1992, Delhi was a union territory under direct jurisdiction Central government. It was governed largely with the help of bureaucrats. In 1992, Delhi became a State and residents were given the right to choose their state government through democratic elections. This State government is headed by Chief Minister and elected council of ministers. Still, governance in Delhi is complex as it is not fully autonomous compared to other States. Functioning of Delhi is governed by Articles 239AA and 239AB (Sridhar, 2016),¹⁶ introduced by a constitutional amendment in 1991. With these articles, the Central Government can exercise its legislative and executive powers in Delhi which otherwise cannot be done in a full-fledged State Government.

The role of Central Government increases further as it recommends to The President, the appointment of Lieutenant Governor who heads Delhi as an administrator. This is in accordance with the Article 239A (4) which specifies (Srikumar, 2016):¹⁷ "There shall be a Council of Ministers in the Legislative Assembly, with the Chief Minister at the head to aid and advise the Lieutenant Governor in the exercise of his functions in relation to matters with respect to which the Legislative Assembly has power to make laws, except in so far as he is, by or under any law, required to act in his discretion." Chief Minister along with Council of ministers is therefore recommending bodies and executive powers are reserved with Lieutenant Governor which only reports to The President.

Furthermore, the powers over the key subjects of public order, police, land and revenue in case of Delhi are vested with Central Government through constitutional amendments. The Delhi Legislative Assembly cannot exercise any of its executive and judicial powers over these subjects state list as per Article 239AA. In addition to Central and Delhi government, Delhi has five municipal corporations - the North Delhi Municipal Corporation, the South Delhi Municipal Corporation, the East Delhi Municipal Corporation, the New Delhi Municipal Corporation, and the Delhi Cantonment Board. These corporations are formed under 74th Constitutional Amendment Act, 1993 and are run by elected mayor and commissioners. Both Central and State government partly control these corporations. Besides, a small part is autonomous as per the Constitutional Amendment Act.

Delhi's complex governance model creates more political issues particularly in light of opposing political parties at the Central and State levels. This leads to confrontation on issues of fundal location, priority setting, welfare schemes and programmes, bureaucrat appointment and share over revenues. These entire political tussles affect the governance of the NCT, planning and implementation of programmes to tackle urban problems.

IV. URBAN PLANNING IN DELHI

Delhi development authority (DDA) is the statutory body in Delhi conferred to look after land management, housing development, and preparation of city Master Plan. It was established in 1957 with an act of parliament (Delhi Development Authority, 2011)¹⁸. DDA's mandate is to acquire land on large basis and develop it to provide basic amenities and facilities to existing population. In addition to this, DDA makes provisions for future growth and carries out building, engineering and allied activities to ensure city's sustainable development and living (ibid)¹⁹.

With the legal mandate, DDA has prepared three Master Plans since its inception. These include the First Master Plan 1962, Second Master Plan 2001 and Third Master Plan 2021. DDA's planning framework is based on hierarchy of developmental zones. The idea is to address different needs as per the different: concentration of people, neighborhood and community contexts.

The First Master Plan was prepared in consultation with the Ford Foundation and was sanctioned in the year 1962. Delhi was the first city to formulate a Master Plan in India. The plan was prepared to deal with the challenges that emerged in the background of partition, internal political turmoil and give planned directions to the future city expansion. In this backdrop the plan first proposed to restrict the city expansion by proposing a 1.6 kilometer wide green belt around the city (Delhi Development Authority, 1962).²⁰ Also, the surplus population was proposed to be directed to the ring towns. To achieve this, DDA laid the plan for the formation of Delhi Metropolitan Area (DMA), defined as the Union Territory of Delhi. DMA was demarcated with an area of about 800 square miles together with a group of satellite towns. The idea was to curb the population increase in the main city which will help in cutting down government's expenses.

But cutting expenses will not ensure sustainable economy. New industrial and commercial areas were therefore planned to promote growth and generate revenues. What went missing in this plan was the linkage between peripheral urbanization and

¹⁶ <http://www.thehindu.com/todays-paper/tp-opinion/where-the-chief-minister-is-the-rubberstamp/article5555781.ece>

¹⁷ <http://www.thehindu.com/opinion/lead/more-constitutional-than-political/article7236281.ece>

¹⁸ http://dda.org.in/ddanew/about_us.aspx

¹⁹ <http://dda.org.in/ddanew/charter.aspx>

²⁰ http://www.isocarp.net/Data/case_studies/1248.pdf

industrial planning. Necessary steps were not taken to foster the development of rural hinterlands. Rather, the plan focused mainly on amenities and service improvement in Delhi city.

The first Master Plan, 1962 was postulated for next twenty years. As such, next plan was due in 1981-82. But the Asian Games in 1982 set the priority for all the development works in the city and the plan could not be operationalized. Experiences and lessons learnt in Master Plan 1962 led DD A to make some modifications. The modified plan was put into operation in 1990 and was labeled as Master Plan Delhi 2001. The plan focused on to provide better amenities, public infrastructure, housing and economic development through mixed land use while ensuring ecological balance. The ultimate goal of the plan was to construct a fitting image of the city as the National Capital.

As such the plan set a target of 68,770 hectare of land to be developed as an urban area (Delhi Development Authority, 1996)²¹. To facilitate the urban expansion, the plan envisaged to acquire around 20-24,000 hectares of land by 2001 New town ship projects at Rohini, Dwarka and Narela were planned. Total 1,620,000 housing units were also proposed to construct, including 280,000 squatter settlements. All this was intended to accommodate 1.28 million of projected population by 2001. In addition to this, high way development, industrial development, landfill sites, green cover, sports complexes and multi modal transport system were also planned (ibid).

The 2001 Master plan had broad visions but lacked practical strategy to implement within the complex governance model of Delhi. With these complexities, the plan faced many short comings. For example: At first the population projection proved wrong. The projected population as per the plan was 1.28 million which reached 1.37 million by 2001. The plan also could not successfully build other commercial centers as an alternate veto Can naught Place and its extension. Against the set target of 22 such central business districts, only three were built. While no major commercial land were developed, clause of mixed use led to the development of small commercial spaces within residential areas. By 2005, there were nearly 0.5 million shops were developed in Delhi whereas only 0.1 million shops were provided in central business districts. Issues of traffic congestion, air pollution, automobile growth, and rapid rise of in formal economy were also not deal with concrete roadmap.

The short comings in Master Plan 2001 led DD A to revise it. In view of the new developments and challenges, DD A then came up with a new roadmap Master Plan Delhi 2021 for the target Period till 2021.

The new master plan aims to make Delhi a global metropolis and a world class city. A new land use plan Vision 2021 has been prepared to guide new development pattern that will foster sustainable development, public-private and community participation, and there by effectiveness of collective efforts to improve the quality of life in the region. The main highlights of this plan are:

- Necessitate planning and action to meet the challenge of population growth and migration into Delhi.
- Provision of adequate housing, particularly for the weaker sections of the society.
- Addressing the problems of small enterprises, particularly in the unorganized informal sector.
- Dealing with the issue of slums, up gradation of old and dilapidated areas of the city.
- Provision of adequate infrastructure services.
- Conservation of the environment and preservation of Delhi's heritage.

The Third Master Plan like the previous two is ambitious. It is attempting to address the multiple challenges which Delhi is facing now. However, many experts have raised serious reservations regarding its success. The major constraints are:

- Ever increasing urban population of Delhi which is up to 97 percent against the national average of 28 percent.
- 2.4 million New houses will be required in Delhi for a population of 23 million by 2021. However, there is not enough planning that has been done by DDA and no financial plan has been presented yet.
- Land allocation is a major challenge in the city where resources are limited and demand is ever increasing.
- Providing a supply of water, electricity, and sanitation facility is a major challenge, especially when Delhi's water sources like Yamuna, Ganga, and the ground water table is facing deep stress.
- Developing climate resilient city is another obstacle when pollution in the Delhi at the highest level and already declared as one of the most polluted cities in the world.
- City transportation and traffic challenges are huge and initiatives like DMRC and CNG fleets not able to fix the problem.

V. MITIGATING URBAN CHALLENGES IN DELHI

To address the above stated issues, both Central and Delhi government with Municipal Corporations have taken few key initiatives to prepare city against major urban challenges such as traffic congestion, air pollution, energy supply, housing and climate change.

Public transport: Transport policy of Delhi acknowledges the need for traffic decongestion and promotion of extensive mass transport system including metro, commuter rail and buses for future need. Considering this, Delhi Metro with its Phase IV completion has planned to extend its services up to 420 km from 319 km in present (Delhi Metro Rail Corporation Limited, 2022)²². The expansion will increase the number of metro stations from 286 in present And increase the daily commuters to two and half fold which in present are 2.59 million every day. The project expansion is being done with investments from Delhi and Central Government in partnership with Japan International Cooperation Agency (JICA) (Delhi Metro Rail Cooperation Ltd, 2022). It should be noted that Delhi Metro has been credited to be the first ever railway project in the world to claim carbon credits for regenerative braking which reduces carbon emissions by nearly 6.3 lakh tones every year.

In addition to Delhi metro, buses play an important role in public transportation. To improve bus services, Delhi's integrated bus

²¹http://shodhganga.inflibnet.ac.in/bitstream/10603/100706/13/13_chapter%204.pdf

²² http://www.delhimetrorail.com/about_us.aspx#Introduction

service is planning to run 10,000 CNG buses by December 2018 (Zee News, 2017)²³. Presently, Delhi has 3,944 CNG buses running in the Delhi city and 1645 buses under the Delhi Integrated Multi-Modal Transit System in its cluster bus service. This is the largest public transportation CNG fleet in any city across the globe. However, still there is a large gap between demand and supply which the Delhi government is trying to address. To accommodate new bus fleet and ensure connectivity across the city, Delhi Transport Corporation (DTC) has sought 137 acres of land from Delhi Development Authority (The Times of India, 2017)²⁴. Already, 68 acres of land are presently under depot development which also includes two new interstate terminals at Dwarka and Narela. Presently, Delhi has 43 bus depots and three interstate terminals. To smooth and the movement of public buses, Delhi government also experimented with Bus rapid transit system (BRTS) on a 6 kilometer²⁵ stretch in 2008. However, facing a lot of problems in implementation, the BRTS was closed in 2016 (Bhatt, 2017).

Apart from developing physical infrastructure, Delhi government is emphasizing equally on improvement of commuter services. This includes launching help line numbers for buses, taxis, auto rickshaw passengers, online and offline booking, time table services and fare charts, GPS vehicle tracking, more prepaid taxi and auto rickshaw booths, improved bus terminal designs to suit especially a bled persons, senior citizens, patients and pregnant women.

In addition to this, two more issues, managing traffic and promoting electric vehicles are also of high priority. After 2008, Delhi has developed many flyovers and now third ring road is also under construction and is targeted to be completed by 2020 which is now delayed²⁶. Earlier the project was to be completed by DDA but now it has been transferred to National Highway Authority (NHAI). The project is estimated to cost around INR 7,700crore of which DDA will provide funding of INR 3,600crore (The Times of India, 2022). Delhi government is also proving subsidy and insurance to promote electric vehicles (The Times of India, 2016).²⁷ At the end of 2016, more than lakh E-rickshaw are running on Delhi road but still more needs to be done to promote electric vehicles.

Air Pollution: Delhi's deteriorating air quality has been an increasing matter of concern. On October 31, 2017, air quality index in Delhi shoot up to 999 indicating the Hazardous level of pollution level (Press Trust India, 2017).²⁸ In this back drop, 12 point action plan has been prepared by a high level committee headed by the Principal Secretary to the Prime Minister. The action plan also known as the Graded Response Action Plan contains implementable. Strategies on the basis of source of pollution and emphasizes on time bound implementation of these strategies with coordination among different departments.

Some of the issues that plan aims to address include: coordinated action to combat stubble burning, effective pollution monitoring and source attribution, reducing pollution particularly NOx curtailment in all power plants, increase decentralized processing of bio degradable wastes, better management and remediation of sanitary landfills, processing and reusing of construction and demolition waste, better solid waste management and public transportation system.

The plan prioritizes strategies in different domains as short terms that are to be implemented urgently, and also medium to longer terms. The quality of air i.e. moderate to poor, very poor, severe and emergency determines the priority of the strategy that is to be implemented. The salient feature of the plan is involvement of multiple agencies with their specific roles. These include Delhi Pollution Control Committee (DPCC), Transport Department (DTC, DIMT and DMRC), Traffic Police and Delhi Police, Municipal Corporations, Public Works Department (both state and central) and National Highway Authorities of India.

In addition to this, Delhi government has also implemented Odd Even Policy as an urgent measure to tackle the air pollution. Under this scheme, the use of private vehicles is restricted in accordance with their registration plates. Odd numbered registration plates would be allowed to run on odd dates and those with even numbered registration plates will be allowed on the other days. Odd-even scheme was implemented for the first time from January 1-15, 2016. Since then, odd even rule has been applied successfully thrice till 2017.

Urban Greenery: Delhi is one of the greenest cities in India. The city has a green cover of about 23 percent of the total area and spans over 180 sq. km. (Press Trust of India, 2015).²⁹ It is the largest among all other Indian metropolitan cities. The city has nearly 14,500 parks under Delhi Development Authority (DDA) jurisdiction (Press Trust of India, 2020)³⁰. While bigger greens are retained by DDA for up keep and maintenance, it has been observed that the smaller green cover and parks can be maintained in a better way with the active involvement of people and private agencies. Recognizing the merits of public-private partnership, DDA launched adopt a park scheme (The Times of India, 2014)³¹. Under the scheme, DDA provides a financial assistance of Rs 8,000 per acre per month to resident welfare associations and NGOs to employ gardeners and undertake other work (Roy, 2016)³². These funds are provided so that the adopting agency may carry out day to day works like planting, hedge trimming, and spread of

²³ <http://zeenews.india.com/delhi/epca-gives-delhi-dec-2018-deadline-to-augment-bus-fleet-to-10000-2060409.html>

²⁴ <https://timesofindia.indiatimes.com/city/delhi/2000-new-cng-buses-for-cleaner-november2018/articleshow/61695327.cms>

²⁵ <http://www.dimts.in/Dimts-Our-History.aspx>

²⁶ <http://delhi-masterplan.com/third-ring-road-unveiled-to-clear-delhis-monstrous-traffic-jams/>

²⁷ <https://auto.economictimes.indiatimes.com/news/commercial-vehicle/lcv/a-lakh-e-rickshaws-on-delhiroads-just-4-5k-legal/53920759>

²⁸ <http://www.financialexpress.com/india-news/supreme-court-appointed-body-enforce-graded-action-plan-in-delhi-ncr-to-control-air-pollution/898372/>

²⁹ <https://www.ndtv.com/delhi-news/delhi-greenest-among-all-metropolitan-cities-in-the-country-742664>

³⁰ http://zeenews.india.com/news/delhi/mcd-launches-adopt-a-park-scheme_595358.html

³¹ <https://timesofindia.indiatimes.com/city/delhi/Adopt-a-DDA-park-and-splash-your-name-all-over-it/articleshow/45528977.cms>

³² <http://www.thehindu.com/news/cities/Delhi/DDA-modifies-its-%E2%80%98adopt-a-park%E2%80%99-scheme/article14482194.ece>

soil and manure. Regular monitoring visits by third party ensure that the public private partnership is successfully maintaining the area parks. In addition to this, the scheme inculcates a sense of responsibility to the citizens in maintaining green cover and public assets for common good.

Committing to maintain and expand Delhi's green cover, Delhi Development Authority has kept 20 percent of the total urban land reserved for green parks. Forest department of Delhi development authority and Municipal Corporations work together to maintain the city's green coverage.

Energy supply: Delhi's electricity crises are worsening every year. Within the last decade, Delhi's select city demand has raised by an average of 6 percent every year. From 20 billion units in 2002, 27 billion units in 2014, the demand reached over 33 billion units in 2017, which is almost 65 percent growth. To meet the demands, Delhi purchases electricity from more than 17 states. These states themselves face significant power shortages in summer. Also, electricity power bought from other states has to be supplied through grids which have substantial transmission loss and operational, maintenance charges (Greenpeace India, 2013)³³.

To address the crises, Delhi Government in collaboration with Central Government has developed a roadmap with following interventions:

- Delhi Government in July, 2016 expressed an interest to join Central Government's Ujwal DISCOM assurance yojana (UDAY)³⁴. Delhi along with six other Union Territories and 20 States will be joining the scheme. Under UDAY scheme, state governments can take over 75 per cent of the debt at the distribution utilities while the rest is issued as state-government backed bonds by the distribution utilities. The scheme aims: to improve operational efficiencies of discoms, reduce cost of power and interest cost of discoms, and enforce financial discipline on discoms through alignment with state finances³⁵.
- To reduce the dependency on coal based thermal power plants, Delhi Government announced its Solar Policy in 2016 (Government of NCT of Delhi, 2016).³⁶ The policy begins with an outline that Delhi has a solar potential of about 2.5 GW. In this backdrop, government has planned to install 1 GW solar power capacity plants by 2020 and has proposed a target of 2 GW solar capacities in the next five years by 2025. To ensure effective implementation, government has made it mandatory for government and public institutions to install solar panel on their rooftops. Also, solar systems up to 200 KW are exempted from certification by the Electrical inspector.
- Central and Delhi Government are to reduce the energy consumption at the household level distributed more than 60 lakh LED bulbs till March 31, 2016 (Government of NCT of Delhi, 2016)³⁷. Further, under the UJALA scheme, LED bulbs are now being distributed at a subsidized price of Rs.75 to households. The installation of LEDs has also been done to replace conventional street lights. Under Street Light National Program (SLNP) 136,000 conventional street lights have been replaced by energy saving LED lights across the National Capital Region.

Housing for all in Delhi: Housing for all is one of the major challenges for Delhi. Rising real estate prices, limited employment opportunities, low wages and rising inflation have led many people to live in slums. Delhi's slum population is estimated to be around 1.7 million distributed in around 860 slums across the region. With an aim to transform Delhi as world class city, Delhi Development Authority (DDA) has been working on providing affordable houses to all. This will also include redevelopment and rehabilitation of slum areas. To facilitate their development process, DDA has introduced new Land Pooling Policy (2017).³⁸ As per this Land Pooling Policy, an individual or group of individuals pool their land and hand it over to DDA to develop basic amenities like roads, water, sewer, electricity, and so on. The developed area is then handed over to the owner on a condition that the agency can utilize a maximum of 40 percent of land as a resource and minimum 60 percent land has to be used for in-situ development (Delhi Urban Shelter Improvement Board, 2016).³⁹ ⁴⁰ About 22,000 hectare of land is expected to be pooled which will benefit nearly 1.5 million slum residents living in around 44 resettlement colonies. Also, 9.5 million additional houses will be constructed to address the housing demand. The scheme will also lead to the emergence of new sub cities like Dwarka and more planned peripheral development. In addition to this, DDA in its Master Plan 2021 has made Green Code certification mandatory in the construction of new buildings. DDA has also asked the developers to develop earthquake resistant infrastructures Delhi is in Zone IV earthquake region a disaster prone probable high earthquake at any time.

VI. CLIMATE CHANGE ADAPTATION POLICIES

India on June 30th, 2008 released its National Action Plan on Climate Change (NAPCC). The objective was to frame a roadmap to enable the country to adapt to climate change and thereby enhance the country's ecological and developmental sustainability. The plan had 8 core missions to be implemented across the country (Press Information Bureau, 2021)⁴¹: 1) National Solar Mission 2) National Mission for Enhanced Energy Efficiency 3) National Mission on Sustainable Habitat 4) National Water Mission 5)

³³ <http://www.greenpeace.org/india/Global/india/report/2013/Rooftop-Revolution.pdf>

³⁴ <http://www.governancenow.com/news/regular-story/seven-more-states-delhi-join-uday>

³⁵ <https://www.uday.gov.in/about.php>

³⁶ http://ipgcl-ppcl.gov.in/documents/renewable/2016_08_03_6_Delhi_Solar_Policy.pdf

³⁷ http://delhi.gov.in/wps/wcm/connect/doi_eerem/EEREM/Home/Initiatives+Achievements/

³⁸ <http://www.ddalandpoolingprojects.com/blogs/delhis-land-pooling-policy-to-be-approved-on-december-8/>

³⁹ <http://delhishelterboard.in/main/wp-content/uploads/2016/04/Policy-Part-A-amended.pdf>

⁴⁰ http://delhi.gov.in/wps/wcm/connect/doi_publicity/Information+and+Publicity/Press+Release/Chief+Minister/Delhi+Slum+and+JJ+Rehabilitation+and+Relocation+Policy+2015,+16th+December+2015

⁴¹ <http://www.delhi.gov.in/wps/wcm/connect/55e4f2004eff270888aaacb60aeeeb21/Delhi+Climate+Change+A+genda.pdf?MOD=AJPERES&lmod=-1927857611&CACHEID=55e4f2004eff270888aaacb60aeeeb21>

National Mission for Sustaining Himalayan Ecosystem 6) National Mission for Green India. 7) National Mission for Sustainable Agriculture 8) National Mission for Strategic Mission for Climate Change. Under these guidelines, Delhi city has developed its own climate change agenda with eight focus areas: Transportation, Forest, Waste, Water, Building, Lightning, Energy supply and Renewable energy.

Different central and state government departments and autonomous institutes like DMRC are working to get here achieve this goal .However, one critical facts, Delhi has submitted its last action plan in 2009 to combat climate change and it has not been updated even when NGT is reminding same to state government (Kumar, 2012).⁴² A more proactive approach this need of the hour.

A more comprehensive need is also necessitated by the sporadic climate events such as air pollution. On November 7, 2017 Delhi recorded an Air Quality Index (AQI) of 448 on a scale of 500. Such high AQI indicated severe polluted air capable of being hazardous to respiratory and cardiovascular systems. Thick smog was covering the city and a feeling of suffocation was persistent throughout. Delhi Government was evaluating the situation and issued warning to citizens of all age groups. With reports from Central Pollution Control Board and Indian Meteorological Departments, Delhi Government decided to implement Graded Action Plan and a number of measures within its purview. Primary schools were shut for next seven days, construction activities were ordered to halt, odd even policy was implemented, and Delhi Government was negotiating with the farmers of Punjab and Haryana to stop crop straw burning. All these urgent actions regulated the situation for time being. But this entire incident exposed Delhi's governance to counter climate change and make Delhi a clean green city.

VII. CONCLUSIVE REMARKS

Delhi is a mega city and is now used to challenging urban problems, both natural and due to human activities. These in clued pollution, transportation, housing, cold waves in winter season, heat stroke in summer season, air pollution, flooding in monsoon despite of low rainfall, frequent disease out breaks. The major constraint in dealing with these problems is the absence of an effective and clear State Action Plan. Also, for each of the issue there are multiple agencies involved. But there is no inter-departmental coordination and a substantial controlling authority to monitor these measures in coherence. The differential roles of Central and State Governments further increase the complexity. On documents, various policies on traffic, water and waste management, and electricity supply sound optimal but seem to be potentially conflicting when it comes to implementation and synchronization with ground realities. This clearly reflects that policies need to equally social rather than being only technically sound. Implementation of these polices poses further challenge given the fact that population and pollution are both rising at an alarming rate in the city.

The entire case study of Delhi necessitates comprehensive social-technical policies and collaborative governance for effective implementation. A number of observation scan be made in this regard. For example: A number of measures should be taken taking Delhi National Capital Region (NCR) as a whole and also in terms of zones to address the challenges more locally. The Master Plan formulated as guiding documents should be as pragmatic as possible and should be formulated for short period of 5 years rather than for long periods just based on extrapolation. Serious efforts should be made to involve government departments, NGOs', civil societies, welfare associations, corporate, educational, and research institutions, citizens of all age groups for each plan from consultation to implementation. While there have been schemes like adopt a park scheme that have been implemented in this manner but the model can be replicated to other schemes as well. The land use of the city should be based on geographical aspects rather than economic aspects only. This will ensure staineable development in accordance with the available resources.

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