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Green City: A Case-Study of Chennai

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Abstract

The most compelling issue of the 21st century, in light of the climate crisis and the Sustainable Development Goals of 2030 is the challenge of optimal growth in urban areas that strikes a balance between environmental degradation and economic development. Rapid urbanisation calls for engineers, architects and planners to look for sustainable urban living. Chennai, belonging to the state of Tamil Nadu is a city in the south-eastern region of India, which has undergone rapid expansion and economic growth since the economic liberalisation of the 1990s. As a consequence, the city has witnessed the loss of essential green infrastructure leading to loss of biodiversity and ecology. Nevertheless, to address the growing loss of environment in the city, Governments at the Centre, State and local levels resorted to schemes, policies and programmes to restore and preserve the environment. Against this backdrop, this paper seeks to analyse the transition and progression of Chennai to a greener city by looking at sustainable projects adopted by both private and public entities. The paper seeks to throw light on the responsiveness of the city with respect to the initiation and implementation of sustainable programmes. To achieve the objectives of the research, a qualitative study of the green spaces in Chennai was undertaken in the following aspects - Green and Blue oxygen-producing belts, urban forests, green buildings, vertical and roof gardens, street network, public transport and other eco-friendly practices. The paper successfully brings out the various perspectives that make Chennai a 'Green City'.

Keywords*: Eco-friendly, economy, environment, sustainability, urban planning*

1.0 Introduction

With the Sustainable Development Goals of 2030, urban planning through a greener lens has become a matter of vital concern. The act of urbanisation, thus, in the modern world is comprehensive, interfering both with natural and human-made enterprises in order to address environmental concerns such as pollution, rise in sea levels, carbon emissions and climate change. In this backdrop, urban planning has been extended to include not only "elements of spatial arrangement, dynamics, functionality", but also "flows of matter and energy" resulting in the "complex territorial system called the urban environment" (Manea et al., 2014).

The capital city of Tamil Nadu, Chennai, located on the southeastern coast of India, with a population of 11, 235, 018 people (Chennai Population, n.d.), was ranked fourth by Indian Green Buildings Council (IGBC) with 321 registered green projects among the Indian cities in 2016 (DNA Web Team, 2016). Due to well-established industries and multiple factories in and around Chennai along with commercial and residential expansion, it contributes the most towards the economy of Tamil Nadu (Sukumar, 2019). Post the economic liberalisation of the 1990s, the commercial capital of South India underwent rapid urbanisation that negatively impacted the environmental processes including air quality, water quality and climate (Sundaram, 2010).

The environmental performance of a city can be determined primarily by its ability to support human life through the provision of suitable air, water and land quality. Though the city of Chennai has the advantage of being near the coast as compared to cities that are landlocked, due to poor sustainable planning in the early 2000s, the city had failed to maintain proper environmental standards. According to the Centre for Science and Environment, the city represents a different pollution challenge in comparison to other megacities whereby, "its annual average pollution levels -- though lower than other megacities -- still vary between moderate to critical" (Centre for Science and Environment, 2013). Adding to the pollution levels despite the geographical advantage, the city has a green cover of a mere 15 per cent while the national average amounts to 24.56 per cent (Baraasu, 2020).

Chennai has the capacity to become a green city taking into consideration its location, urban development, and natural resources. Brilhante (2018) defines a green city as "a city that promotes energy efficiency and renewable energy in all its activities, extensively promotes green solutions, applies land compactness with mixed land use and social mix practices in its planning systems, and anchors its local development in the principles of green growth and equity." As of the present day, on one hand, the city is confronted with receding green cover while on the other, the city is rapidly recovering the lost greenery by adopting alternative means of expansion. Hence, there is a dire need to understand the green economics and science of the city.

2.0 Scope and Objectives

The paper aims to analyse the transition of Chennai to a green city by looking at sustainable projects and initiatives adopted by the Greater Chennai Corporation, the Government of Tamil Nadu and other private and public entities. The paper seeks to throw light on the responsiveness of the city with respect to the initiation and implementation of sustainable programmes by citing specific landmarks within the city.

3.0 Background and Methodology

In order to achieve the objectives of the research, a qualitative study of the green spaces in Chennai city has been undertaken. Following this, various policies adopted for making Chennai greener have been covered. The fundamentals of this research paper are primarily inspired and developed from "Green Cities - Urban Planning Models for the Future" (Manea et. al., 2014).

Manea et. al. (2014) lays down the essential elements of a green city and the importance of urban planning seasoned with sustainable development. The study deals with green cities and analyses the relationship between green components and urbanisation. It also highlights viable and sustainable alternatives that need to be adopted for a greener future and help in reducing the 'heat-island'. Furthermore, the paper gives an understanding of the Green City Index (GCI) to quantitatively measure the green advantages of a metropolis. The findings of authors on the vital constituents of a green city including, green and blue oxygen-producing areas, urban forests, green buildings, vertical gardens, roof gardening, greenhouses, street network, and eco-friendly walk paths, have been used in this paper, in congruence to the case of the Chennai to understand the various factors that make the city, green.

4.0 Chennai City Through the Green Frame

Overcrowding in the metropolitan cities of India including Chennai has caused a tremendous burden on energy sources, water management, and transport systems. This has significantly impacted the atmosphere, climate, lithosphere, biosphere, hydrosphere, as well as land and water resources (Ramaiah & Avtar, 2019). With growing awareness among the city developers and citizens on the need to embrace sustainability, the city has incorporated several

projects and policies in the path to becoming a green city. As of 2016, Chennai has 321 registered green projects of which 119 are residential, 117 are commercial, and 19 projects are city railway stations operated by the Mass Rapid Transit System (MRTS). The other projects fall under rating systems like factories, landscape and buildings that are already up.

The signs of Chennai heading towards a green city lie in the Tamil Nadu Government's policies of rainwater harvesting, solar power plants for high-rise buildings (DNA Web Team, 2016). In fact, "Chennai has pioneered rain-water harvesting and considerable efforts have been invested in creating bicycle-friendly roads and tree-lined walking precincts. This provides the city with some sort of sustainable blueprint for the future" (Balsavar, 2014). A study conducted by Gandhi et. al. (2015) found out the percentage cover of buildings, parks, trees, temples, tanks, and others, using a remote sensing and Geographic Information System (GIS) approach. The following were the results obtained (table 1):

Table 1: Percentage cover of buildings, parks, trees, temples, tanks in Chennai

Chennai Municipal Corporation		
Name	Area Sq. Km	Percentage of area coverage
Buildings	241.5794	19.23%
Parks	9.2899	0.50%
Tanks	35.7288	0.13%
Temples	0.8449	5.49%
Trees	72.8157	0.06%
Others	104.194	0.04%

Source: (Gandhi et al., 2015)

The percentage of area coverage of trees, parks and tanks which contribute towards a transition of Chennai into a greener city, occupy less than 1 per cent of the total area. It is estimated that within the domestic boundaries of the city, 19 per cent of the buildings have taken up green perspectives. At the national level, green buildings "account for 35 per cent of total energy consumption and this percentage is growing at an annual rate of 8 per cent" (Green Buildings are a Big Hit in India, n.d.). As per reports, 75 per cent of the buildings to be established in India are expected to be constructed based on sustainability standards. For this movement to grow, proactive initiatives have to be pioneered at the city level. Thus, there is a need for more green coverage alongside urban development thereby shaping the way for sustainable urban planning practices. This chapter focuses on the various initiatives that make Chennai a green city.

4.1. Green and Blue Oxygen-producing Belts

The presence of greenery such as shrubs, trees and flowers makes a green city. They have the potential to control pollution levels, prevent soil erosion and mitigate the climate. The greenery also provides cleaner air to breathe and ensures a better quality of public health. The green realms can be divided into public green areas, green areas with limited access and specialised green areas (Manea et al., 2014). In view of the public green areas, Chennai has more than 500 parks that are controlled and maintained by the Greater Chennai Corporation. Under the National Smart City Mission, these parks are expected to undergo renovation (Kumar, 2017). Among the many national parks across the country, the well-known Guindy National Park is situated in Chennai. These green spaces are not only recreational spots for people, but also are home to a variety of ecosystems (Roof and Floor, 2017). More parks that have added beauty and green to the city include People's Park, Huddleston Park, May Day Park, etc.

In addition, the main roads and platforms are dotted with low water-consuming and maintenance-free plants. Educational institutions, namely, the Indian Institute of Technology, Madras (IIT, Madras), College of Engineering, Guindy and Madras Christian College, although not pure public green areas, are considered as one of the finest repositories of greenery in Chennai (Venkatraman, 2017). These fall into the category of green areas with limited success. Some parks, including Semmozhi Poonga which falls into the category of specialized green areas, have been instituted for specific purposes.

Built-in 2010, it is the first botanical park of Chennai, implying the progress towards more greenery. Another green stretch of horticulture park is the Madhavaram Botanical Gardens spread over 8 hectares. The efforts taken by the Greater Chennai Corporation to preserve and maintain these parks and greenery have been highly credited, and other Indian cities must learn and adopt these strategies for a sustainable future.

In support of these green spaces, there is the prevalence of blue belts (regions with water bodies or wetlands such as lakes and ponds) and a combination of green-blue belts in the city. As mentioned earlier, the IIT Madras campus can be categorized also as a green-blue belt region owing to the lake within the premises. Purely blue-belt areas include the Adyar river and the Chetpet lake which contribute to the estuarine ecosystem of the city.

4.2. Urban Forests

Urban forests are planned connections of green spaces on which a community relies. They can range from parks to trees in the streets to boulevards to lakes and rivers (Forest Service, U.S. Department of Agriculture, n.d.). In Chennai, there are close to 120 forest patches ranging from 40 to 300 hectares in three districts around the city. However, the interaction between humans, flora and fauna has been deteriorating, resulting in the need for restoring the connection (Times News Network, 2020).

In the light of urban forests, Chennai has adopted the idea of Miyawaki forests to increase the green cover of 17 per cent to 25 per cent in the city. Miyawaki is a restoration method of degraded land instituted by the Japanese. In this method, to regenerate the layers of original forest cover in the area, trees are planted tightly close to each other in order to make the native species compete with one another for sunlight and nutrition resulting in the rapid growth of the trees in a matter of 4 to 10 years, as against 20 years (The Times of India, 2021). Under this initiative, the rate of growth of the plantations is 10 times faster and the yield is 30 times denser than usual. In addition, after a duration of 3 years, the region becomes maintenance-free (How to make a mini forest with Miyawaki method, 2019). With the advantages posed by the Japanese method of urban forests, the Greater Chennai Corporation has initiated a project to develop 1000 Miyawaki forests across the city, out of which 15 have been completed as of December 2020 (Bhalla, 2020). As of 2017, the Miyawaki project covers 15 regions, one in each zone in the city.

The green cover in each of these zones is given in table 2.

Table 2: The percentage of green cover and square kilometres of vegetation across the zones of the city

Zone	Green Cover (percentage)	Vegetation (Sq. km.)
Thiruvottiyur	9.90	2.47
Manali	10.73	4.26
Madhavaram	16.21	5.42
Tondiarpet	8.57	1.82
Royapuram	13.09	2.79
Thiru Vi Ka Nagar	18.14	3.30
Ambattur	12.61	4.82
Anna Nagar	20.85	5.28
Teynampet	22.78	5.53
Kodambakkam	17.20	3.87
Valasaravakkam	12.78	2.60
Alandur	13.36	2.69
Adyar	30.10	12.06
Perungudi	5.31	1.90
Sholinganallur	12.17	5.13
Total	15.00	64.06

Source: DT Next (Baraasu, 2020)

4.3. Green Buildings

When the construction of buildings takes into account an environmental perspective it is called a green building. Manea et. al.(2014) has defined it as, "those edifices built and used in a more responsible manner with regard to the environment during all their life cycle: design, construction, use, maintenance, rehabilitation and demolition". Location of the construction site is considered the most important in addition to water and energy-efficient methods adopted in the building premises.

In 2001, it was mandated by the then Chief Minister of Tamil Nadu that every house in the state should support Rainwater Harvesting Systems in Chennai as per the amendment, "made to section 215 (a) of the Tamil Nadu district municipalities Act, 1920 and building rules 1973" wherein "all new buildings should be provided with a Rainwater Harvesting System (RWH System)" (Tamil Nadu's step towards making Rain Water Harvesting Systems Mandatory, 2019).

Table 3: Buildings with RWH Systems in Chennai (2020)

Type of Buildings	Number of Buildings	Number of Buildings providing RWH structures so far	Balance
Government	24116	23190	926
Residential	2208377	2114294	94083
Commercial	148170	145064	3106
Industrial	11794	17794	0
Total	2392457	2294342	98115

Source: Directorate of Town Panchayats (Rainwater Harvesting, 2020)

Furthermore, 'Viswa Shyamlam' in Madipakkam, Chennai is the first platinum-rated green home in the city. Regional school cum residence, Ramakrishna Mission Students Home in Mylapore is recognised as the fourth school in the country to hold the platinum rating.

Chennai also houses the first Reserve Bank of India project in the nation that is associated with green ratings and one of the hostels has secured a platinum rating from the Indian Green Building Council (IGBC), among other buildings namely ITC group hotel, Leela group hotel, TCS Techno Park, Mahindra Technical Academy, L&T Ship Building Ltd, Shell Business Service Centre and Turbo Energy Limited (DNA Web Team, 2016).

Based on a study by The Energy and Resources Institute (TERI) in 2016, the Tamil Nadu Government works towards designing policies to favour the construction of green buildings in the city (Press Trust of India, 2016).

4.4. Vertical and Roof Gardens

In extension to green buildings, the municipal authorities have carried out vertical gardening in buildings and bridges. Vertical gardening is a gardening technique using hydroponics on vertical surfaces, which can be attached or unattached to the surface. Vertical gardens or green walls can be set up both within and outside doors. According to studies, green walls have the potential to reduce the temperature by blocking 30 per cent of the sun's rays (Omjasvin, 2020).

The city of Chennai, at a cost of Rs 8.14 crore has initiated vertical gardening from the Capital Grant Fund of the State government. Across the landscape of the city 108 piers in 14 bridges - "Mint, Tondiarpet, Purasaiwalkam, Pantheon Road, Peters Road, Radhakrishnan Road, CP Ramaswamy Road Junction, Royapettah High Road, G K Moopanar Bridge, South Usman Road, Sardar Patel Road, Gandhi Mandapam Junction, Perambur Murasoli Maran Flyover" (Omjasvin, 2020) - have been identified for vertical gardening. The first vertical garden was laid out in G.N. Chetty Road in T.Nagar.

Alongside vertical gardens, urban horticulture in terms of terrace or roof gardening is considered a primary tool to effectively reduce nature-based risks worldwide. The conceptualization of roof gardens came into force with the Urban Horticulture Initiative (UHI), which works in association with technical professionals from the Greater Chennai Corporation, Tamil Nadu Department of Horticulture and Plantation Crops, Centre for Urbanisation, Building & Environment (CUBE), Tamil Nadu Corporation for Development of Women and the Tamil Nadu Skills Development Corporation (Ramanathan, 2020).

Proposed for a duration of 10 years, the project targets to reduce the susceptibility of 2.5 million people due to climate change in terms of food. Across 281 government schools, the project has been planned and rooftop gardening has been suggested so as to use the produce from the garden for the midday meal schemes in the school campus. By 2030, the project aims to envelop six lakh households for rooftop gardening.

Lastly, the Tidel Park at Pattabiram is expected to incorporate the idea of 'hanging garden' or vertical gardens in the 21- storey building in order to instil the idea of green building features in urban modern-day constructions.

4.5. Street Network and Public Transports

With rapid urbanisation across India, cities including Chennai face challenges with respect to inadequacy in public transport infrastructure. Chennai busses carry 30 per cent more passengers every day than the international average. As a result, more affluent individuals resort to private modes of transport. With more private vehicles i.e. cars, air quality can drop significantly leading to severe pollution in the city. In response to these unsustainable practices, in 2010, 15 key urban departments came together to form a central decision-making body, the Chennai Unified Metropolitan Transport Authority (CUMTA) to help in developing and promoting sustainable and integrated transport systems. The primary objective was to focus on cycling, walking, and usage of bus transport in a city with individuals dependent on cars (Carr, 2014). To supplement the above objective, as part of the National Smart Cities Mission, Chennai inaugurated e-bikes in the year 2019. As per the reports, e-bikes (smart bikes) amounted to 370 (Natarajan, 2019). In 2021, the Government flagged off 1000 more cycles for the public in 100 docking stations (Express News Service, 2021). Chennai also has a well established and functioning railway network, air and water transport, which has caused a reduction of the burden on the road transport system and has caused a decline in both air and noise pollution. In fact, the Tamil Nadu Pollution Control Board (TNPCB) was also set up to check the air quality in important cities like Chennai. Furthermore, to make transportation more environmentally friendly, the State Government had roped in Transport for London (TfL) to provide quick solutions and efficient means for increasing mobility without compromising on the environment (Sekar, 2019).

In November 2020, the Tamil Nadu Government rolled out a policy declaring that all battery-operated vehicles would be exempted from the tax levied under the Motor Vehicles Act, 2019 (Balachander, 2020). This is a stepping-stone to ramp up the demand for e-vehicles and reduce the dependency on diesel and petroleum transport systems. The municipality has also invested in Light-Emitting Diode (LED) lights for the street lamps as part of both the Smart City Mission and sustainable development (Simhan, 2013).

4.6. Other Eco-friendly Practices

In 2019, the Government of Tamil Nadu brought into force a ban on single-use and non-biodegradable plastic bags, thereby urging and recommending individuals to resort to eco-friendly alternatives to plastics. The production of plastics has declined, but the figures for consumption haven't changed drastically. Despite such an initiative by the government, plastics have still found their way into Chennai city. In response to this, in late 2019, it was announced that any violation of this ban, would be heavily fined. This penalty was believed to prevent the illegal usage of plastics by individuals.

With respect to Municipal Solid Waste treatment, Chennai does not have efficient disposal and treatment processes. However, sanitary workers collect and segregate recyclable wastes at the household level. Currently, since October 2020, a new and more decentralised method of waste collection and disposal has been introduced in Chennai. This was launched in association with a Spanish company, Urbaser Sumeet, which has signed an eight-year contract to help manage solid waste in Chennai (Express News Service, 2020). Besides solid waste management, TNPCB has also installed seven authorised e-waste collection centres in Chennai (Kumar et al., 2017).

5.0 Conclusion

These initiatives by the city corporation, government and people is a path that works towards a greener Chennai. The rate at which the city has unveiled the aspect of a ‘Green City’ shows the city’s responsive attitude towards a sustainable country. The paper has provided strategies for other Indian cities, primarily metropolitan cities, to draw inspiration from Chennai and adopt feasible measures to tackle the growing environmental concerns amidst urbanisation.

Chennai, as a municipality in its phase of embracing sustainability in association with the Smart City Mission and the SDG 2030, has the potential to stand as an example to other cities across the globe to become greener for the future.

Despite these initiatives and programmes, Chennai still fails to be a green city. In reality, these programmes have implementational challenges that hinder the process of advancement of the city. The schemes also possess their own share of demerits as against the normal processes embedded in nature. For instance, the Miyawaki method, according to environmentalists, are not substitutes for natural forest implying that these trees would not bring rainfall to the region. Similarly, though a single-use plastic ban has been enforced by the government, there is a surge in plastic pollution in the city, which has further been aggravated by the pandemic. On the same lines, the case of electric cars and the benefits accrued to them through policy measures are in place, there is no infrastructure in the city to support the transition from diesel and petroleum vehicles to battery-operated cars. Secondly, there is also no proper system set-up in order to address the waste disposal problem from batteries along with other e-waste.

Hence, this paper gives room for more studies to understand the administrative aspects of the schemes and suggest effective measures to be adopted by the government from other green cities across the world. In extension, further research can be extended to understanding the role of private enterprises in addressing the restoration of green infrastructure in the city.

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