DEVELOPMENT STRATEGY FOR SMART CITY - A case of Chennai City

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Abstract - *The term and the concept of "Smart City" are to be promoted as an effective assessment and instrumental tool to drive the economic growth and to improve the quality of life of the citizen. This present study paper aims to formulate the indicators and parameters executed in world cities and also to categorize to build a new understanding on the development of smart city application, strategy formulated, solution and funding provisions of cities nominated and need in Chennai city.*

***Key Words*: Smart City, Strategy, Policy, Area Based De- velopment, Pan City Development, Chennai Smart City.**

1. INTRODUCTION

Population tends to increase and grow in large scale years by years as a result more citizens will move to cities which in turn needs to fulfil the infrastructure facilities become hard and hard. As India's urban population meets the 31% of the total population, which as a turn contributes over 60% of India's gross domestic product (GDP). As per the census re- port 2011 it is projected that urban India will contribute nearly 75% of the national GDP by 2030. It is estimated, that the Indian cities could reach 843 million numbers of people by 2050.

There starts a need and direction of platform change in the management of complexity, income stability, improvising the efficiency and to enhance the quality of life which is termed as smart city. To understand this concept it is most im- portant at the first to analyse why cities are considered key elements for the future. Cities are engines of growth for the economy of every nation.

1.1 Smart City Definition

First, there is no universally accepted definition of a smart city. It means different things to different people.
S - SOLUTION TO M - MANAGE THE
A - APPLICATION OF R - RESOURCE
T - TECHNOLOGY FOR CITY.

This is the terminology which was understood by the author. A range of conceptual variants is often by replacing "smart" with alternative adjectives, for example, "intelligent" or "digi- tal".
According to the Smart Cities Council, a smart city is one that uses Information and Communications Technology (ICT) to enhance live ability, workability and sustainability. The definition also varies person by person as shown in the Table-1.

Table -1: Definition of Smart City by various Authors

Sl. No.	Definition	Author	Year
1	A city that monitors and integrates conditions of all its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities and monitor security aspects while maximizing services to its citizens.	Hall	2000
2	A city well performing in a forward looking way in economy, people, governance, mobility, envi- ronment and living built on the smart combination of endowments and activities of self-decisive, independent and aware citizens. Smart city generally refers to the search and identification of in- telligent solutions which allow modern cities to enhance the quality of the services provided to citizens	Giffinger et al.	2007
3	A city connecting the physical infrastructure, the IT infrastructure, the social infrastructure and the business infrastructure to leverage the collective intelligence of the city	Harrison et al.	2010
4	A smart city is based on intelligent exchanges of information that flow between its many different subsystems. This flow of information is analysed and translated into citizen and commercial ser- vices. The city will act on this information flow to make its wider ecosystem more resource effi-	Gartner	2011

	cient and sustainable. The information exchange is based on a smart governance operating frame-work designed to make cities sustainable		
5	The label "smart city" is a fuzzy concept and is used in ways that are not always consistent. There is neither a single template of framing a smart city, nor a one-size-fits-all definition of it	O'Grady and O'Hare	2012
6	A smart city is understood as a certain intellectual ability that addresses several innovative socio-technical and socio-economic aspects of growth. These aspects lead to smart city conceptions as "green" referring to urban infrastructure for environment protection and reduction of CO2 emis-sion, "interconnected" related to revolution of broadband economy, "intelligent" declaring the ca-pacity to produce added value information from the processing of city's real-time data from sen-sors and activators, whereas the terms "innovating", "knowledge" cities interchangeably refer to the city's ability to raise innovation based on knowledgeable and creative human capital	Zygiaris	2013
7	Smart Cities initiatives try to improve urban performance by using data, information and IT to pro-vide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration among different economic actors, and to encourage innovative business models in both the private and public sectors	Marsal-Llacuna et al	2014

Source : various authors articles

1.2 Concept of Smart City

The conceptualization of Smart city is that it

(i) Varies from city to city and country to country
(ii) Depending on the level of development
(iii) Willingness to change and reform
(iv) Resources and aspirations of the city residents.

1.3 Objective and Focus of Smart City

In the approach of the smart city mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart Solutions'.
The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a light house to other aspiring cities.

1.4 Components of Smart City

The six components with different aspects of urban life have been derived by Lombardi et al. 2012 as shown in the Table -2.

Table -2: Smart City Components

Sl. No	Components of smart city	Related aspects of urban life
1	Smart economy	Industry
2	Smart people	Eeducation
3	Smart governance	e-democracy
4	Smart mobility	Logistics & infrastructures
5	Smart environment	Efficiency & sustainability
6	Smart living	Security & quality

2. LITERATURE REVIEW

2.1 Case Studies of Smart City

The study of different case studies of smart cities from other parts of the world with similar or unique features and differ- ent approaches lead to explore the extensive use of various process and methods used in creating a smart city with a good result.
This also le
d to study on the capitalisation for different methods adopted and time frame for various smart city pro- posals.
These case studies help in developing the ideas which are smart solutions and scalable and to make corrections wher- ever errors and mistakes occurred in the previous proposals.

2.2 Barcelona, Spain - World's Smartest City

The Spanish city of Barcelona has been ranked the world's smartest city, beating off competitors, New York, London and Singapore, with Rio de Janeiro missing out on a top five position.

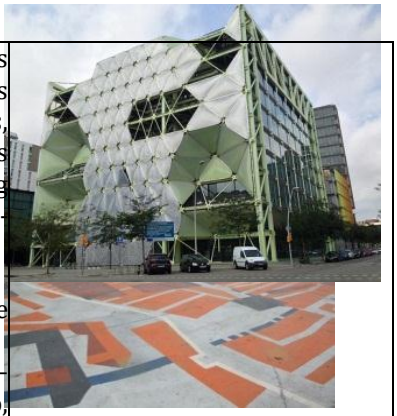
Fig -1: Night Image showing World's Smartest City – BARCELANO

Barcelona is not a perfect city. But with an overall aging population and an economic recession, local government has found ways to create jobs and improve the quality of daily life for its residents and visitors. The various indicators and features are detailed out in the Table -3

TABLE -3: Indicators of Barcelano World's Smartest City

Sl. No.	Indicators	Features	Image representation
1	**Stellar bus transit system**	orthogonal bus network (horizontal, vertical and diagonal lines) reducing emissions with hybrid buses smart bus shelters using solar panels, touchscreen and USB ports	
2	**Bicycle sharing system**	6,000 bicycles circulating Bicing is a sustainable and economical form of transport, designed for citizens to travel short distances without consuming any energy. Bicing card get annual fee	
3	**Smart parking spaces**	Using light and metal detectors, street sensors help motorists find parking, but they also provide data about parking patterns, helping officials improve management of urban mobility.	

4	**Pneumatic waste management system.**	Compact drop-off containers have a subterranean vacuum network through the pipes, sucking up trash below the ground. This automated waste collection system decreases noise pollution made by trash trucks and keeps the public space and stench clear. Through radio frequency and WiFi, the sensor gives data to a central system, detecting the trash level. Sanitation workers can then plan the optimal route and times to collect it	
5	**Installation of smart lighting**	Efficient lighting using LED technology is being installed in Barcelona to reduce cost and pollution it activates when detecting motion, but also gathers environmental information, humidity, temperature, pollution, and noise.	
6	**Use of renewable and more effective energy systems**	taken advantage of the ample solar energy. the first city to require to use solar water heaters in 2006. Solar Thermal Ordinance also regulated all new large buildings such as hotels, hospitals, gyms, or swimming pools to produce their own domestic hot water, lowering emissions.(2000) The heating uses steam from the incineration of urban waste and the cooling uses seawater for refrigerating, producing less fossil energy consumption and carbon emissions. Districlima plant uses local Mediterranean seawater to cool buildings.As one of the largest photovoltaic installations in Europe, this solar panel produces 550,000 Kw/h a year, which can generate power to over 160,000 households.	
7	**The Mobile World Capital**	Many candidates attend the conference and exhibition facilities, tourism and transportation infrastructure, and its commitment to extending the reach of mobility locally and nationally.72,000 people attended the Mobile World Congress	
8	**urban mobility through apps**	**TMB Virtual -** Point your smartphone's camera in any direction, and "bus stop signs, lines and the distance to them in metres will appear on the screen, superimposed on real-world images Trànsit - helps you find the best route Tricentenari - Point your camera at any of the numbered places, and information of Barcelona in 1714 appears	
9	**Participatory citizens and transparent government**	IDBCN - This app enables citizens to digitally identify themselves remotely. They can get a Barcelona residence certificate, check their register details, or even locate their towed vehicle. Open Data BCN - This is public information that is available for everybody to reuse it however they like. Citizens, businesses, and other institutions can use the info such as election results, population, public facilities, or economy to generate new services instead of starting from scratch	

10	**Barcelona's Innovation District**	22@ is a regeneration project: the use of refurbished buildings in a neglected part, a former industrial hub. Municipal leaders are engaging the private sector — companies, universities, research, and communities work in close proximity in clusters in these buildings to accelerate the pace of knowledge sharing and quicken innovation. They're also creating subsidized housing and green spaces. Barcelona Urban Lab, a public space where companies can pilot test their products that will improve city living, such as the parking and rubbish bin sensors mentioned above. 22@ is proven to be successful because of its sustainability — the five clusters are all united by green infrastructure. Also, from 2000 to 2007, 1,000 new companies and 31,000 new employees were working, an impressive amount of growth in a short period of time. Now, other international cities like Rio de Janeiro, Cape Town, and Boston have followed Barcelona's lead.	

3. DEVELOPMENT STRATEGY OF SMART CITY

The strategic components of Area based development in the smart cities mission are: City Improvement (Retrofitting), City Renewal (Redevelopment), City Extension (Greenfield development), Pan-city Initiative in which smart solutions are applied covering larger parts of the city. The Area based development is the key element of the Smart City Proposal are framed in the Table -4 as below.

Table -4: Strategic Components

	AREA BASED DEVELOPMENT			INITIATIVE
DESCRIPTION	**RETROFITTING**	**REDEVELOPMENT**	**GREENFIELD DEVELOPMENT**	**PANCITY DEVELOPMENT**
Planning Aspects	Existing built up area	Existing built up and new layout	Vacant land	Existing city
Planning Benefits	To create a more efficient and liveable of existing area	To enhance infrastructure using mixed land use and increased density	Smart solution Using innovative planning Plan financing Plan implementation tools	Use of technology Information and data to make infrastructure and services better
Development	Existing Area more than 500 Acres	Area more than 50 Acres	Vacant area more than 250 Acres	Smart solution application
Identification	By the city in consultation with citizens	By the Urban Local Bodies in consultation with citizens	Limits of Urban Local Bodies Limits of Urban Development Authority	By the Urban Local Bodies
Time frame	Shorter span	Long span	Long span	
Features depend on	Existing infrastructure services to become smart	Mixed land use Higher FSI High ground coverage	Land pooling Land reconstitution	Intelligent traffic management Waste water recycling Smart metering
Benefit	Replicate in another part of the city	Infrastructure enhancement	Affordable housing for the poor	Reduce commute time

EXAMPLES		▯ SaifeeBurhani Upliftment Project in Mumbai ▯ East Kidwai Nagar in New Delhi	GIFT city in Gujarat	

Source : Smart City Mission and Guidelines

To develop the entire urban system, it is represented by the four pillars of comprehensive development as given in Table -5.

Table -5: Four Pillars of Smart City

INSTITUTIONAL INFRASTRUCTURE 1. Good governance. 2. City development plans based on ICT and spatial mapping. 3. Safety and security. 4. Public participation.	**SOCIAL INFRASTRUCTURE** 1. Smart and quality education. 2. Smart and quality healthcare 3. Entertainment and sports facilities. 4. Convention centres and auditoriums. **5.** Botanical garden.
PHYSICAL INFRASTRUCTURE 1. 24x7 smart utility services(water, power,etc.,) 2. Smart urban mobility 3. Smart but affordable housing 4. Zero emission sanitation services. 5. Integrated ICT infrastructure.	**ECONOMIC INFRASTRUCTURE** 1. Industrial parks and export processing zones. 2. IT/BT parks. 3. Trade, services, financial and tourism centres. 4. Skill development centres. **5.** Logistics hubs.

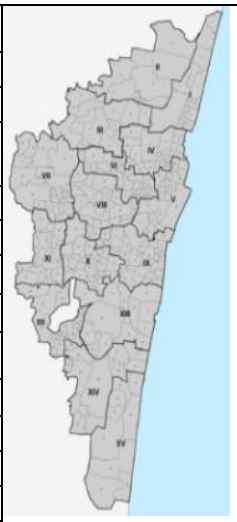
Source : Smart City Mission Guidelines

4. STUDY AREA – CHENNAI

Chennai is the state capital of Tamil Nadu, India's Metropolitan area is fourth largest city, by economy and population. The city directed as a business hub of the state and has a diverse array of economic sectors and is known for its automobile industry historically and rich IT sector.
The location of Chennai with the state and the Table-6 clearly states the Chennai profile status in detail.

Table -6: Profile of Chennai District

CHENNAI PROFILE	
DESCRIPTION	STATISTICS
Area	175 Sq.km
City	**Metropolitan city**
District	**Chennai**
State	**Tamilnadu**
Country	**India**
Population	**8,653,521 (**RANK 1 – HIGHEST POPULATION IN STATE)
Population Density	26553 (per- son per sq.km)
Literacy Rate	**90.2% (**2nd highest in the state
	1000 males for 989 fe- males
Zones	**15 Zones ,200 Wards**
Households	**1.6 Million**
slums	**1240**



Source : Census of India, 2011.

4.1 Chennai's Eminent Features

In recent years, Chennai has emerged as an electron- ic manufacturing hub in South Asia, Chennai is known as the Detroit of Asia.

a) The city accounts for 60 per cent of India's automotive exports, which leads it to be called as 'The Detroit of Asia'.

b) Chennai has been tagged as the Banking Capital of India, for its vibrant banking culture and trading. Chennai leads in the health care sector and is considered the Health Capital of India.

c) Chennai has been recognized as the first city in India to adopt and in the implementation Non-Motorized Transport (NMT) policy as a result of promotion of pedestrianisation. Chennai corporation has been awarded with the prestigious international ***SUSTAINIA AWARD***.

d) Chennai won the ***GLOBAL WATER LEADERS AWARD - 2015*** for fast tracking its innovative resilience plan in solution for the fulfillment of the water scarcity as per Census 2011.

e) Chennai is ranked as a number one districts in Tamil Na- du for 1) Concrete housing roofs about 77%. 2) Houses with bath & drainage facilities of 97%.

f) Chennai with its strong presence in planned environment has scored the number one position as ***"MOST LIVEABLE CITY"*** in India as per Institute for Competitiveness, 2012.

g) India today ranked Chennai as the ***"Best City"*** for two consecutive years (2014 & 2015) in its Best Cities Survey for its excellence and betterment in parameters like expenditure on education, crime rates, economic growth and investment generation.

4.2 Chennai City – A Smart City

Chennai is one of the city has been selected in the list of 100 smart cities and also in the FIRST LIST out of 20 cities under Urban Development Ministry Smart City Mission.

The Corporation of Chennai has selected three cities – T.Nagar, Sholinganallur and Mylapore to develop as a smart city under Urban Development Ministry 'Smart City Mission' which was launched by Indian Prime Minister Narendra Modi on 21 June 2015.

Chennai Corporation selected three Cities to develop as a Smart City as they classified into three different hubs, Such as

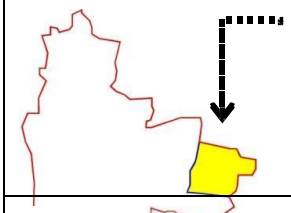
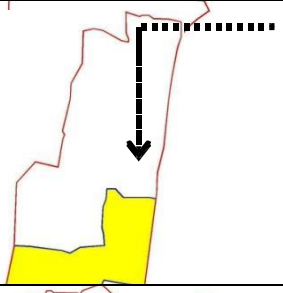
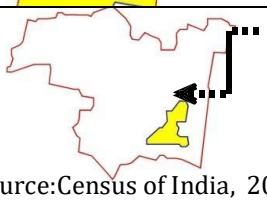
- T Nagar - Commercial hub.
- Mylapore - Cultural hub.
- Sholinganallur - IT hub.

The detail study of the three places nominated to promote as a smart city is given in the Table X

4.4 Chennai City – Identified Features

The Smart City Mission Proposal in Chennai is mainly de- pends on the Area Based Development(ABD) and the special features which are going to take place at the foremost are listed by the ABD – Strategy by the Smart City Mission Guide- lines are given in the Table -8 and Table- 9.

Table -7: Smart City Identified Hub Profile

Map	Place	Area Ex- tent	Rank (vot- ing)
	T.NAGAR – Commercial Hub of the State. X – Kodambak- kam Zone	6.95 sq.km (171 7 Acres)	63%
	Sholinganallur – Information Technology Hub XV – Sholin- ganallur Zone	15.35 sq. km	21%
	Mylapore – Cultural Hub IX – Teynampet Zone		21%

Source:Census of India, 2011. www.chennaicorporation.gov.in (compiled by author)

Table -8: Area Based Development - Chennai

COMPONENTS	PARAMETERS
Open spaces management	Interconnected Open Spaces Smart Open Space manage- ment Rejuvenation of parks and pub- lic spaces Public park over Nallah Plazas Integrating and Re-organizing spaces
Flood Man- agement	Hydrological information sys- tem Flood warning and monitoring system

Table -9: Pan City Proposals – Chennai

PAN CITY PROPOSALS FOR CHENNAI
Smart parking system
NMT infrastructure
LED street lighting
Grievance redresses through web, app and phone
Hydraullic information system/ flood monitoring
Cycle sharing
Parking management (pricing)
Online system of water connections
Water level sensors

Source : Smart City Mission Guidelines

4.5 Area Based Development – T.Nagar

The proposal with the area based development, T.Nagar is shortlisted based on the voting by online/offline, the preferences are from the citizen engagement, stakeholder con- sultation, elected representative discussion. It has a diverse mix of residential, commercial, retail, educational and enter- tainment developments, thereby setting a global example for a balanced and self-sustained mixed use modern city with the model of other smart cities where infrastructure is be- coming more and more connected, intelligent and automat- ed.

The Figure-2 and -3 is the artistic impression an idea of providing smart traffic system and walkway along the park, cycling into the community by introducing non motor transport system after the implementation of the Smart City Proposal in T.Nagar, Chennai city.

Fig -2: Identified parks – ABD – T.Nagar

Fig -3: Artistic Impression Of T.Nagar

4.6 Fund Allocation – T.Nagar

The Chennai Smart City Limited (CSCL) of the Greater Chennai Corporation drives this mega Smart City Proposal in Chennai by the special purpose vehicle tasked with the project's implementation. This project implemented Rs. 518 crore to water management and information technology and Rs. 848 crore worth retrofitting solutions for T.Nagar.

4.7 Findings

The Smart City Mission Proposal by the Government plays a major vital role in developing the infrastructure, application of Smart solutions and achieving the development in broad scale could be one of the biggest initiative project not only in Chennai all over India which will produce an assured concrete benefits to the life of citizens. Chennai shows a keen interest to prove to be a more Resilient city by exchanging the innovative resilience strategy among other 99 cities.

Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive Cities. Undergoing after a long study of the Smart city mission Proposal for Chennai, it is very clear that Chennai shall be privileged to be a universal cultural hub for safe and sustainable living with enhanced mobility, smart urban infrastructure and become more resilient to the physical, social, and economic challenges.

The features of the smart city proposal could bring the best result such as

i) Create a natural environment as the future strategic component.
ii) Inclusion of urban residents
iii) Innovative Planning action in urban development.
iv) Smart Infrastructure Technology.

5. CONCLUSION

The concept of smart city clearly defines it is a different things to different cities. Area based development plays a vital role in the term of smart city project which enhances the quality of life and the environment a better living. Pan city development focus on the advanced technology and being a research model for future projects to be implemented. This study paper clearly defines the various methods, components, strategies and applications adopted for a smart city. Many of the assessment metrics, elements and tools which focus on smart city has been emerged from the analysis of the existing literature. A smart city achievement and assessment should be accounted by which cities have different vision and priorities to reach their objectives, but sure that there should be a promotion for integrated framework strategy development of different aspects.

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