

# HOW TO MAKE A CITY SMART?

## THE INDIAN CONTEXT

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## Index

<b>Sr. No.</b>	<b>Chapter</b>	<b>Page No.</b>
1.	<b>What are the problems facing our cities and urban areas today?</b>	4
2.	<b>What is a Smart City</b>	5
2.1	The Anatomy of a City	5
2.2	The Smart City Paradigm	7
3.	<b>Smart Cities – The Indian Government’s Perspective</b>	10
4.	<b>Nashik Government Perspective</b>	13
5.	<b>The Creation of Smart Citizens</b>	16
5.1	What is a Smart Citizen?	16
5.2	Smart Cities and Smart Citizens	16
6.	<b>The Kumbhathon Experience</b>	18
6.1	What is a Kumbhathon	18
6.2	My experiences at the Nashik Kumbhathon	19
6.2.1	Crowdstearing	20

<b>6.2.2</b>	<b>Meditracker</b>	<b>21</b>
<b>6.2.3</b>	<b>All Shops Online</b>	<b>22</b>
<b>7.</b>	<b>Learnings and An Approach to Developing a Smart City</b>	<b>23</b>
<b>8.</b>	<b>Recommendations for the Genesis of Smart Cities:</b>	<b>25</b>

## 1. What are the problems facing our cities and urban areas today?

Cities are the powerhouses of economic growth, with 80% of global GDP being produced within them on just 2% of the earth's land surface. Urban areas currently account for 60-80% of global energy consumption, 75% of carbon emissions, and more than 75% of the world's natural resource consumption. This trend towards urbanization is resulting in an increased pressure on the environment with an 70-80 per cent of the global population expected to reside in urban areas by 2050. Some 60 per cent of the built environment required to meet the needs of the world's urban population by 2050 still needs to be constructed. In order to tackle environmental issues, cities must be seen as the building blocks of sustainable development.<sup>1</sup>

Another issue is the quality of life that cities can provide with increasing population. A lot of the growth of cities is estimated to be driven by cities in rural areas. People in underdeveloped countries crowd urban centers because of the lack of infrastructure in rural areas. The cities of the developing world are not yet healthy, in part because their governments have been unable to provide the basic infrastructure that cities need. This problem results primarily from nonexistent or poor planning and a lack of good governance. Cities need to focus on sustainability and quality of life. The Smart City paradigm is a way to improve these characteristics.

1. "Gigalopolises: Urban Land Area May Triple by 2030." *Scientific American*. Scientific American, n.d. Web. <<http://www.scientificamerican.com/article/cities-may-triple-in-size-by-2030/>>.

## 2. What Is A Smart City?

### 2.1 The Anatomy of a City

Cities have been centers of civilization for millennia. Cities evolved around convenience. Civilized life is believed to have first emerged in the basin of the Euphrates and Tigris rivers. The river valleys of southern Mesopotamia attracted migrations of neighboring peoples and made possible, for the first time in history, the growing of surplus food. As surplus production increased urbanization evolved and civilization took root.

The complex production processes that take place in cities require division of labour. All members of society must provide different skills for cities to function. Today's major cities are manufacturing and services hubs. Feeding the vast systems in these cities requires an efficient supply of food, electricity and copious natural resources. As a result cities have a vast impact on their surrounding environment. For instance, Sydney gets its electricity from coal fired plants 200 kilometers away from the city.

Cities are designed around the idea of providing resources to people so that they can work more efficiently and live more convenient lives. Cities however face a grave challenge today. More than half of the world's 9 billion people are expected to live in urban expanses by 2030. Cities and their hinterland will occupy an additional 1.2 million square kilometers, thereby tripling in size. That's an additional 1.35 billion people living in cities, suggesting that urban areas that currently occupy roughly 3 percent of the

planet's surface will continue to expand. This will place a great deal of stress on the environment. The need for smart methods to minimize human impact on the environment has never been greater.

## 2.2 The Smart City Paradigm:

The advent of modern technology has now enabled us to address the challenges of population growth and environmental impact due to cities as well as provide services and conveniences to city dwellers more efficiently such that cities themselves are more efficient. This efficiency translates into more effective usage of water, use of renewable energy as opposed to conventional sources of energy and recycling of waste.

The smart city paradigm is an umbrella term for technologies that that can be used to modernise cities. It is an urban environment that is highly advanced in terms of infrastructure and communications. It is a city where information technology is the interface through which services and resources are provided to people and businesses. This ultimately serves to improve the quality of life of people.

There are many things that go into the development of a city. Modern cities are based on urban planning methods in contrast to cities in earlier times that arose organically. Urban planning concerns use of land and the design of the urban environment, including water, transportation, communications, and distribution networks. Today one of the most important challenges that urban planners face is how to integrate the 800-900 million people who live in sprawling slums. Makoko, a community of squatters in Nigeria is a classic example of

how conventional methods of urban development have not provided for slum dwellers like those in Makoko. The people of Makoko live in houses on stilts in the Lagos Lagoon. Communities like Makoko exist in many underdeveloped countries. Conventional urban development methods have not provided for these communities. About half of the citizens of Mumbai are believed to be squatters who live without proper houses. Governments tend to turn a blind eye to these communities further exacerbating the problem of underdevelopment. Governments should utilize creative solutions to try and improve living conditions in slums. Smart Cities also consist of smarter infrastructure. The technologies used to make electric grids have been the same for the past 70 years. Grids today have a large wastage of energy. The next generation of grids needs to be more efficient to ensure that they can transfer energy more efficiently. Potential solutions could mean a wide array of new two-way sensors throughout all parts of the grid, detecting voltage, current, power, temperature, pressure, wind, sunlight, anomalies, stress, failures, hacking and more. This data could be used to optimize electricity in grids. Cities should also focus on improving connectivity for mobile phones. Developing countries have vast populations who use the mobile phone as the primary medium of communication. These devices double up as vehicles to deliver



Information Technology services on. Developing countries need to improve data networks and cell connectivity if they are to utilize the phone as a medium to deliver services on. Cities in developing countries are expected to continue growing at alarmingly fast rates. With the existing infrastructure unable to cope with the rise in population, governments have to increasingly rely on smart solutions to help regulate the congested traffic that is found in cities in developing countries. These problems form the different facets of the smart city paradigm, which attempts to make a city more efficient than ever before.

### 3. Smart Cities- Indian Government's Perspective

The vast majority of India's population lives in rural areas. Around 69% of India's population lives outside cities. This is expected to drop to 60% as more Indians move to the cities. In order to cope with the influx of more people into existing cities, comprehensive development of physical, social and economic infrastructure is required. Cities contribute 63% of India's GDP. This percentage is expected to rise to 75% by 2030. This growth will be fuelled by the influx of people into Indian cities. The Smart City initiative aims at attracting people and investment to cities in India thus promoting growth and development.

The core Infrastructure improvements that the Indian Government believes Smart Cities should target are:

1. Adequate water supply,
2. Assured electricity supply,
3. Sanitation, including solid waste management,
4. Efficient urban mobility and public transport,
5. Affordable housing, especially for the poor,
6. Robust IT connectivity and digitalization,
7. Good governance, especially e-Governance and citizen participation,

8. Sustainable environment,
9. Safety and security of citizens, particularly women, children and the elderly
10. Health and education.<sup>2</sup>

The Government of India views the Smart City initiative as a Pan-city initiative in which at least one smart solution is applied citywide. The government plans to develop the core infrastructure step by step using 3 models of area-based development. The first model is retrofitting- the retooling of existing systems to be smart with digital infrastructure interfacing to existing physical systems. The second model is the redevelopment of existing infrastructure. This involves reconstructing cities from the ground up to be smart. The last model is the Greenfield approach. A Greenfield is a project that lacks any constraints imposed by prior work. The government aims to build new cities from the ground up to be smart.

The Smart City initiative is stipulated to cover 100 cities in the next 5 years from 2015- 2020. The 100 Smart Cities will be divided among the different States and Union Territories of India. Each State will have a certain number of potential Smart Cities with at least 1 in each state. The Indian government proposes to give financial support to the tune of Rs. 48,000 crores over the next five years with an average of Rs.

2. "Smart Cities Mission: A Step towards Smart India." *Government of India*. Government of India, n.d. Web. <<http://india.gov.in/spotlight/smart-cities-mission-step-towards-smart-india>>.

100 crore per year. The States will also have to contribute funds for the development of the Smart City initiative.

## 4. Nashik Government Perspective

Nashik is a city three hours away from Mumbai. It is a Tier 2 city and has a population of 300,000 people. Nashik is situated in an ideal position being close to Mumbai as well as the growing metropolis of Pune.



Me interviewing Mr. Sachin Pachorkar, a citizen of Nashik and an active member of the Kumbhathon Movement

Nashik is also the centre of Indian viticulture and has a thriving agro-based industry. Given this geographical and industrial backdrop, Nashik is poised to be one of India's fast growing cities in the future. Its small size today allows smart solutions to gain the critical mass in order to succeed. Nashik can serve as a launchpad for new smart solutions that will scale up as the city grows larger.

The perspective of the government is extremely important in the creation of a Smart City. The power to effect change is vested in the government. Thus it is but natural that they should be key decision makers in the organic process that is the making of a smart city.

In order to get a greater understanding of the goals of the administration I interviewed Mr. Pravin Gedham, the Municipal Commissioner of Nashik and Mr. Eknath Dawale, the Divisional

Commissioner. These conversations, I believe have given me an incisive outlook at the administration's views on the future of Nashik and how the Smart City initiative ties into it. Mr. Pravin Gedham believes that the main challenges Nashik as a city needs to tackle are

1. Water Supply
2. Underground Sewage Pipelines
3. Public Transportation
4. Solid waste management
5. Roads

He says that his administration is preparing a 5 year plan to solve these problems effectively. Mr. Gedham believes that accountability and transparency are key to his vision for Nashik. He wishes to develop the areas mentioned above while at the same time building consensus



Me Interviewing Mr. Gedham, Municipal Commissioner of Nashik

amongst the citizens about what improvements they would like to see in their own city. He says, "While addressing these issues we

are working to make systems transparent, [and] public oriented."

This is where Mr. Gedham believes the Kumbhathon process can help Nashik greatly. He views the Kumbhathon as a medium for liaison between the Administration and the people of Nashik. The Kumbhathon is a platform on which the citizens of Nashik can come together to work on solutions for Nashik as a city.

Mr. Gedham demonstrated to me some solutions to me that illustrated the efforts Nashik was making towards optimising itself. The first was a software on which the citizens of Nashik could upload photos of places where administrative attention was required. This was aimed at strengthening the

communication lines between the government and the people of Nashik. Another software was a 'selfie' based attendance system for municipal contractors which saved the Nashik



Interviewing Sandip Shinde, a Nashik resident on his views on the Kumbhathon, Smart Cities and Nashik

Municipal Corporation Rs. 5-6 crores (~ \$1 million) compared to the earlier biometric system that was used. This solution was aimed at increasing transparency and accountability in the government.

Ultimately, Mr. Gedham believes that greater cooperation between the government and the citizens of Nashik is necessary for

future growth. He says that the lack of information about the citizens' needs is a problem that the Nashik government faces when approving developmental projects. "Policy decisions should be made in an informed and prudent manner. If citizens want area A to be developed more than Area B then its the government's duty to do so." He sees this cooperation as a way to galvanise the administrative service into action. In the long term, it is hoped that this increased interaction will help in the transformation of Nashik into a Smart City.



## 5. The Creation of Smart Citizens

### 5.1 What is a Smart Citizen?

A smart citizen is a citizen who is aware of the problems in his or her immediate locality. Smart Citizens are enterprising and are willing to come up with solutions to the problems in their neighbourhood and city using technology. They actively pitch their solutions to the administration and actively contribute to the well-being of their city.

### 5.2 Smart Cities and Smart Citizens

It is usually the case that cities become smart more slowly than citizens do. People move quickly to adopt technology solutions for communication, work and entertainment. Systems in cities are however far slower in modernising mainly because of the associated costs incurred in implementing smarter systems. The government endeavours to better the quality of life of the citizens of the city. It usually does this by identifying certain areas where improvements are needed and implements these solutions. Smart citizens work to come up with solutions to the problems that they face in their daily lives. The development of a Smart City can be greatly accelerated by the

coordination of the government and Smart Citizens to come up with solutions. The Kumbhathon process takes this hybrid approach.

## 6. The Kumbhathon Experience



### 6.1 What is a Kumbhathon?

There are many approaches to creating a smart city. The first is the 'top-down' approach. In the top-down approach, government officials envision how to make a city smart and work towards implementing this vision. The second is the 'bottom-up' approach. In the bottom-up approach, the citizens are encouraged and empowered to identify the problems in the city and come up with smart approaches to solve them. The third approach is a hybrid between these two approaches. The government officials identify areas of the city that need to be improved and reach out to the citizens to come up with solutions to these problems.

Kumbhathons are innovation sandboxes that serve to empower the citizens to come up with solutions for their problems. Kumbhathons provide a platform for the citizens and the government to meet to solve

problems smartly. Kumbhathons strike a harmonious balance between the top-down and bottom-up approaches. Government officials specify the areas where improvement is needed. The citizens work in the Kumbhathon environment under the guidance of the Kumbhathon team to make smart solutions work in the context of their city. The Kumbhathon model was conceptualised for Nashik and may one day be implemented in other cities as well.

*Nashik Innovation Center aims to foster new ventures by empowering smart citizens for smart cities. The innovation sandbox brings together MIT researchers, corporate partners, government officials and Nashik-based organizations for year-round activities. The innovation center gives innovators, entrepreneurs and organizations an opportunity to learn, develop and test solutions to “pop-up city” problems at scale in Nashik and later, world-wide. Biannual Kumbhathon camps combine identification of challenges, discussions with stakeholders, prototyping and customer analysis for multiple corporate and entrepreneurial ventures.* <sup>1</sup>

## 6.2 My experiences at the Nashik Kumbhathon

Witnessing the Kumbhathon was an unbelievable experience. I believe that



the Kumbhathon effectively fulfils the dual purpose of coming up with

smart solutions for Nashik as well as



fostering an entrepreneurial culture in

Nashik. A striking hallmark of the

Kumbhathon approach is that most of

the solutions employ simple yet

effective methods to solve city-wide problems. I witnessed many

solutions that were digital interfaces to physical systems that targeted

various areas like Health, Transportation, Housing, Water, Food,

Finance, Education, Hospitality, Sanitation, Civic Issues and many more

areas. These are some solutions that I found most interesting.

### 6.2.1 Crowdsteering

The Kumbha Mela is a festival that dilates the arteries of Nashik to their

maximum. Nashik is a small city. Its infrastructure is not designed to

cope with the 30 million people expected during the Kumbha Mela.

Roads in the city of Nashik often have single lanes. The city is subjected

to high traffic on ordinary days. This problem will surely be exacerbated

by the large number of people visiting Nashik during the Kumbha Mela.

The optimum way to solve this problem while relying on existing

infrastructure would be for authorities to deploy crowd management

personnel to areas with the highest population density. Thus, there arises a need for effective realtime crowd tracking techniques which could be used by Nashik authorities to track areas where population management personnel should be deployed. The prevalent method of tracking population is to use the Global Positioning System to produce heat maps of population density. This method would not be suitable for use during the Kumbha Mela because the vast majority of rural visitors would not have phones capable of connecting to the Global Positioning System. Thus a population estimate made using the Global Positioning System would probably be inaccurate. A solution I saw during the Kumbhathon was Crowd Steering. Crowd Steering uses the number of phones connected to a cell phone tower as a measure of population. By identifying all the cell phones connected to a tower in a region, Crowd Steering can generate a heat map of the population in an area. Crowd Steering is designed to process data from the towers at half hour intervals. This solution is effective and innovative. Crowd Steering, however faces many challenges at this point. A major challenge, as communicated to me by the team, is the reluctance of telecom service companies to provide cell tower data to the Crowd Steering team. Another challenge is the lack of tower-by-tower data. Towers in a certain area are grouped together into clusters and most telecom

service providers only have data about the number of users connected to a cluster and not to a tower. This results in significantly less accurate estimate of the population. If Crowd Steering manages to overcome these technical problems, it could prove to be a very innovative way to track population densities.

### **6.2.2 Meditracker**

Emergency services in India today are not as automated as they should be. India does not possess a single helpline for all emergency services even today. Private hospitals and Public hospitals have their own numbers for ambulances. The problem with this decentralised approach is that when people are greatly injured, they have trouble contacting the emergency services. Meditracker aims to change this by automating the process of contacting medical services. The application has a single button which when pressed conveys the injured person's coordinates to the nearest hospital and calls an ambulance.

### **6.2.3 All Shops Online**

The vast majority of Indians shop at their local stores to buy household supplies, electronics and other goods. Consumers lack sufficient data about which shops stock the goods they would like to buy and instead rely on past experience to decide where to shop. Consumers have no

access to information about prices of goods. All Shops Online aims to give all the shops in the city of Nashik an online presence so that consumers can have access to data about which shops supply goods at the cheapest price and are closest to them. This data will help empower the consumers. All Shops Online will be extremely useful to people who are new to the city of Nashik. Providing a better experience to people who visit Nashik will help Nashik increase the number of people visiting for business as well as tourism.

I saw many more solutions that dealt with Health, Citizen empowerment and the Environment.



## 7. Learnings and An Approach to Developing a Smart City:

A Smart City ultimately works to use resources effectively and at the same time provide a high quality of life to its citizens. Technology provides a path through which cities can achieve a high level of efficiency in providing services to citizens

sustainably. However the implementation of the Smart City model which emphasizes on technology

as well as active citizen involvement.



Talking to Mr. Gedham about how a greater synergy can be achieved between citizens and the government

The 2 paradigms that can be used are the top down and bottom up approaches- the top down being government driven and the bottom up being a citizen initiative. The Kumbhathon process uses a hybrid of these 2 approaches which improves cooperation between the administration and citizens with the broader goal of making the city smart.

Solutions however must be customized for different cities and are not universal. Solutions that are effective in Nashik may not be effective in other



The Kumbhathon encourages Bottom-up and Top-down Innovation and their synergy

cities. Cities have different strengths and the implementation of the Smart City paradigm should take these strengths into account.

Sachin Pachorkar, a resident of

Nashik says, "Nashik is very close to the city of Mumbai as well as the city of Pune. It has robust agricultural produce and has the potential for agro-industrial growth. Nashik also has popular attractions like the Sula Vineyards. Nashik should play to these strengths when implementing the Smart City paradigm." Similarly, other cities should base their model of a Smart City on the strengths of their city.

## 8. Recommendations for the Genesis of Smart Cities:

The City at the most basic level exists to provide services to the people who live within its construct. Today, smart technology allows governments to be leaner, more efficient and more responsive to the needs of citizens and provide better services faster. Based on my observations, I believe that a set of key areas must be improved for cities to achieve the unprecedented levels of efficiency and convenience that we are aiming for.

1. The ten areas listed above have been identified as focal points of the Indian agenda for Smart Cities. In order to sustainably improve these areas, innovation sandboxes that focus on these areas should be set up in Nashik and elsewhere where new solutions can be tested and be implemented in a relatively small scale to test their efficiency.
2. Metrics should be designed to measure the different areas where improvements are needed. These metrics should be used to analyze progress in the different areas where improvement is required.
3. Information could be made available about these metrics to the citizens through the Internet using intuitive websites and software. This will help increase transparency and accountability.
4. Governments have a reputation among citizens of being slow and bureaucratic. As a result, citizens often show a lack of inclination to work with governments. Governments can automate services using the

Cloud and provide better and more prompt services to citizens. This will help them shed the image of being slow and ineffective. Thus governments and citizens can eventually evolve a better synergy.

5. The Internet can be used as a medium to provide services like education at a low cost. Countries like India have an education problem because of their sheer size. Educated citizens are necessary for smart cities. The educated citizen is integral to the smart city. Educated citizens understand how to use technology to make their lives more convenient and are more open to Smart Cities. Massive Open Online Courses could be used to try and improve the literacy of Citizens.
6. A Commission could be set up to identify cities where solutions should be systematically rolled out. Since every city is different, solutions should be customized from city to city. The Smart City Commission could liaise with the Municipal Governments to localize solutions while keeping the whole nation in mind.
7. To accelerate creation of smart cities, top down Smart City initiatives should work synergistically with bottom-up, citizen led initiatives.