

Smart Cities in India: Practices, Policies, Current Status and Gaps

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Abstract. The concept of smart cities is growing across various countries of the world as the population continues to grow. As a developing country, India has also taken up the initiative to develop and promote the smart city culture in the country. The smart city mission developed by the government and promoted was the first step towards this initiative. The mission promised to create and develop smart cities in the country that would make stand among the countries that are a part of this program. This research tracks the smart city mission that was launched by the Indian government along with the plans and policies put forth by the authorities. The issues that hinder the growth of the mission have been discussed. The various gaps that existed and slowed down the growth of this mission have also been identified.

Keywords: Smart city, India, Smart, Mission, Sustainable, Cleaner production.

1 Introduction

Population growth and the essence of comfortable living have resulted in a tremendous growth in urban areas leading to urbanization. In the current context, urban areas refer to cities and towns that are diverse in all aspects of life compared to rural areas. Such urban areas consist usually of complex sub-systems depending on one another and vice versa. In the West, the focus of smart city initiatives has always been on improving efficiency, sustainability and security. On the other hand, the adoption of smart city initiatives by developing countries focuses more on driving modernization and development of infrastructure. Modern cities in the 21st century are identified as complex ecosystems that tackle a number of social, economic and environmental issues that place demands on key health, energy, education, media and other services sectors. Given that modern cities face challenges in continuously maintaining and upgrading public utilities to meet the demands of citizens, smart city initiatives are needed to provide effective solutions to the current urban problems and improve the quality of life parameters. The need to introduce cleaner production initiatives to

encourage the creation of smart cities, especially in developing countries such as India, should not be ignored. There is no particular definition for smart city as it varies from country to country, from person to person and many other factors. The smart city concept in India would be totally different than any other country in the world because of geographical location, availability of resources etc. In the mind of any resident of India, a smart city sight comprises of a wish list of facilities and services that represents its idealistic level. In order to satisfy citizens ' desires and expectations, city leaders ideally strive to build the entire environmental friendly-system, defined by the four foundations of integrated structural, physical, political and economic growth infrastructure. In the sustainable development Mission plan, the goal is to encourage cities that can provide network infrastructure and give their people a decent standard of living, a safe and sustainable climate, and the implementation of ' Smart ' Systems. The emphasis is on productive and equitable growth and the concept is to look at condensed areas, build a repeatable prototype that will seem to other developing cities like a prototype [1].

The key elements of services in a smart town would include-

1. Electricity
2. Sanitation
3. Water
4. Public Transport
5. Housing
6. IT connectivity
7. Governance
8. Clean Environment
9. Security
10. Health
11. Education

The aim of the Smart Cities Mission is the growth of the economy and improvement in quality of life by allowing district advancement and innovation. A reduced development will reshape old areas, including ghettos, into healthier planned areas, thus improving the life of the entire city. Smart Solutions application would allow cities to make use of infrastructure, technology, and evidence to enhance public services. Since 70 per cent of India's jobs are found in cities, about two-thirds of India's growth comes from cities[1]. Recent statistics show increased migration rates from rural to urban areas to take advantage of the jobs and other opportunities offered by the cities. A majority of India's population lives in rural areas, with less than 30 per cent living in urban area . Indian cities today suffer from congestion and ineffectual resource management [1]. In the past, new urban concepts were proposed that attempted to overcome population segregation in towns by developing new planned settlements away from established cities. Since the government has not been actively involved in planning new cities, private developers have played an active role in creating small and scattered townships and private towns. Some years ago, the Indian Prime Minister, Mr. Narendra

Modi, introduced the idea of smart cities to tackle urbanization problems. The goal of the development is to incorporate technological advances within urban planning agencies and cleaner production initiatives in order to offer innovative, effective solutions to existing problems and thus improve the quality of life in cities[1].

The paper gives a brief review of various research papers put forth by other researchers followed by practices and initiatives put forth by the government of India. The next section focuses on the government policies and the issues that come in the way of smart city development. The current status of the smart city project in India, the Prime minister's various missions and their implementation is being discussed. Lastly, various gaps like social, economic gaps etc. are being discussed followed by conclusion.

2 Literature review

A Smart city is defined as a city having its own intelligence also known as Urban Intelligence. The framework of the smart cities has been highlighted using the 3-C concept which includes competence, convenience and cleverness. A brief light has also been thrown on the concept of smart cities in India which defines the eligibility and selection criteria which is a prerequisite for availing the benefits of this plan. Some schemes and policies like Atal Mission for Rejuvenation and Urban Transformation (AMRUT) have also been mentioned. The Govt. is offering financial aid and investments in the smart city projects but if it exceeds a certain amount then funds have to be raised by the state government. Also, not all existing cities fall under the eligibility criteria of smart city project which is developed by the government and it deprives many cities of this technological advancement. The challenges concerning smart cities have also been discussed [2].

The census report of India from 2001 to 2011 shows that rapid urbanization is taking place which would continue to increase thereby leading to over urbanization and increase in the socio-economic issues in the country. The metropolitan cities are already facing issues like population growth, shortage of resources like gas and electricity, sanitation and hygiene etc. These problems have increased due to the migration of rural population to cities. This has led to the issue of creating new cities and developing the existing ones to boost the smart city development in India. The six dimensions of Smart cities are smart economy, smart mobility, smart environment, smart people, smart living and smart governance. The Indian government has launched a scheme to develop 100 smart cities in the country[2]. For this a tie up has been made with multi-national companies under the Public Private People Partnership also known as PPPP. This could be done in two ways either by uplifting the existing cities with technology like transportation, healthcare, housing etc. like it has already been done in Bengaluru by deploying IP cameras for security of the residents or come up with new Smart cities. Japan has provided financial aid to India to push up the smart city mission.

There are many challenges involved in developing smart cities or even upgrading the existing ones which ranges from financing to technical concerns. India needs to push planned urbanization instead of just urbanization which would add to quality of the life of people living in urban areas. Urbanization should be carried out in a planned manner by keeping a check of the number of migrations from rural to urban areas. This will reduce concerns like electricity and water shortage which is being faced today. Social inequality that is psychological issue also needs to be taken care of while developing smart cities. The blame has been put on state and municipal corporations and the political bodies involved in this project. Their lack of responsibility and corruption has had an effect on this mission. To enter into the competition of the 100 smart cities project, a big check list of prerequisites has to adhered to without which a city would not be eligible for availing the benefits. This demotivated the applicant cities keeping many out of the competition. To keep a check on the urban crises in India, planned urbanization is the only way to solve this problem. The administration, the public and civic bodies need to work together to carry out the smart city project[3].The major challenge that causes a concern with the development of smart cities is security and privacy. The existing strategies of protection cannot be applied to the ever developing smart cities because of their complexity and heterogeneity. The smart systems be it smart homes or governance are vulnerable to security and privacy attacks like denial of service (Dos), Sybil etc. Various methods like encryption, biometrics etc. exist to prevent these attacks but they still don't make the systems secure. The reason is that the devices which are used in smart systems are functionally weak so only simple encryption techniques can be used on them. Moreover, the new technologies like machine learning, artificial intelligence have allowed the hackers to outsmart the existing security algorithms. The characteristics of a smart city like user involvement, mobility etc. should be kept in mind before coming up with any security solution or even upgrading the existing one. The Botnets are posing a great threat to the IoT based systems and can even bring the system to halt. Privacy and security are also a great concern in smart healthcare and virtual reality systems. The requirements related to securing smart cities have also been mentioned by the authors. The current security and privacy technologies like cryptography, blockchain etc. have also been discussed along with the challenges and future scope of these security mechanisms[4].

3 Methodology

3.1 Document Analysis. Document analysis is a method of qualitative research in which the researcher interprets the documents to give credence and sense around an interpretation of a subject. It uncovers social beliefs which can later be used in well defined ways. It gives a better insight to the researcher and offers great help. Review of publicly available documentation is commonly used as a qualitative research tool, since the material included provides the background and the study formulated. It also offers significant visibility into the knowledge base of a particular problem. In addition, record analysis lets the investigator track major changes, besides dealing with things where there is scant information on a particular problem. Analysis of documents was initially selected to discover smart city concept in India since the information available at the moment is quite less. The documents, journal articles etc. The articles found were derived from prominent repositories such

as Google Scholar, IEEE Access and Elsevier Scopus. The terms that were searched were, 'smart city', 'smart cities in India', 'concept of smart city'. The results were carefully analysed by taking a closer look at the article's title, interpreting the abstract and keywords. The search resulted in around 500 papers out of which the papers which best defined smart cities in the Indian context were selected. Some online reports and data from various newspapers was also analyzed that tracked the development of the smart city mission in India. The government created website on smart city mission also helped in discovering new facts about the program. The analysis of all the data collected helped in understanding the smart city and the contribution and development of India in this project.

3.2 Qualitative Content Analysis. The smart city mission is quite new in India even after the creation of a program made by the Indian government in which 100 cities were selected for this mission but only 20 of them were found to be eligible. The Government's envisaged smart city policies received mixed response from various decision makers. After reviewing the documents in the initial stage. In addition to research papers, the author gathered many official, non-governmental and industry studies for analysis to identify the forces and obstacles of smart city growth in India. Evaluation of original content enables the personal interpretation of document data by means of data removal. Analyzing quality content also makes it easier to identify trends of cognitive objectivity and common context

4 Present status

The introduction of the Smart city project in India got both remarks and criticism ever since it was launched in the year 2014. It highlighted that the cities in India should not be a reflection of poverty and misery rather efficiency and development. The government also launched a project of 100 smart cities that would be well equipped with latest technology and innovation as well as infrastructure. By the year 2015, this program had transformed into believable and pragmatic one even though it was not still clear to a majority of the population. The Smart city termed out to be the one which had essential framework and would provide a good quality of life to its inhabitants keeping in mind the sustainability of the environment. This mission offered a financial assistance of ₹48,000 crores for a period of five years which averaged to ₹500 crores for each city [5]. The Urban local body would provide a similar figure for the financial aid. Around ₹42,028 crores would be contributed by other missions, ₹41,022 crores from PPP, ₹9,843 crores from loan money, ₹2,644 crore from other resources [5]. Two strategies were put forth in the project one was Area based development and the other a technology based solution. The former would reconstruct and restore the existing cities which includes the slums into a livable area and improve the overall quality of life. The latter would enable cities to improve the framework and services by incorporating technology and data solutions. These strategies would improve the quality of life, reduce the unemployment rate and boost the socio-economic growth of the country. See **Table 4.1**.

The SCM or the smart city mission implementation has remained doubtful and fragmented and even varied and mixed. Initially, it excited and created an impression in the mind of people that turned too good to be true. It was separated from the reality and needs of the people and lacked planning and execution. In the Indian context, the smart city concept turns out to be unclear and indeterminate because of complexity and variability of the cities. Since no definite meaning of the smart city exists, implementing schemes and plans for the same turned out to be an unsmarted move. No public participation exists nor is the scheme people centric or even IT solution centric. Even though the Twitter and Facebook data was considered, it did not cover the major group of the people who would directly or indirectly be affected by the scheme. The Area based projects comprise of only 5-10% of the city area but 80% of the investment has been allocated to it which adds to inequality and inconsistency [5].

The SCM mission has faced hard challenges because of the presence of barricades in the implementation of the scheme. As of July 2019, 17114 Cr has been given by the Central government out of 48,000 Cr that had been promised before out of which only 6160 Cr has been actually put into use by the cities [5]. The funds have also not been utilized properly because a study reveals that 26 states have utilized 20% of the funds out of the 35 states in total and 33% projects in present date are either being developed or have been completed [5]. Even though the mission has been incorporated in all the 100 cities but the planning, pace and scale that was promised 5 years back as still not been achieved [5].

The framework of the smart city looks good on papers but in a competitive and time-bound system, most guidelines appear vague and often ignored in the name of the greater good, causing aberrations to the Smart City concept itself. Given that the Smart City Mission is a futuristic initiative, its dedication to increasingly concrete issues such as climate change and deterioration of the environment is limited. The vocabulary and tradition of making fair and right-based urban planning and design decisions has also been lost over time, and the future of the ' citizens ' in the smart cities looks bleak if it persists on the existing tracks. Through retrospect, the SCM is more of an opportunity that has been missed through developing and fostering local forms of urbanization for villages and towns that were outside the scope of mainstream, urban planning and development, and that could have explored decentralized, egalitarian, inclusive and functional urbanization for people across classes and social groups.

4.1 The Selected Cities under the Smart City Mission

	Rounds	No. Of Cities	Cities

1.	Round 1	20	Bhubaneshwar, Pune, Jaipur, Surat, Kochi, Ahmedabad, Jabalpur, Vishakapatnam, Solapur, Davangere, Indore, New Delhi, Coimbatore, Kakinanda, Belagaavi, Udaipur, Guwahati, Chennai, Ludhiana, Bhopal.
2.	Round 2	13	Lucknow, Bhagalpur, Faridabad, Chandigarh, Raipur, Ranchi, Dharamshala, Warangal, Panaji, Agartala, Imphal, Port Blair, New Town Kolkata.
3.	Round 3	27	Amritsar, Kalyan, Ujjain, Tirupati, Nagpur, Mangalore, Vellore, Thane, Gwalior, Agra, Nashik, Rourkela, Kanpur, Madhurai, Tumakuru, Kota, Thanjavur, Namchi, Jalandar, Shimoga, Salem, Ajmer, Varanasi, Kohima, Hubli-Dharwad, Aurangabad, Vadodra.
4.	Round 4	30	Thiruvananthapuram, Naya Raipur, Rajkot, Amravati, Patna, Karimnagar, Muzaffarpur, Puducherry, Gandhinagar, Srinagar, Sagar, Karnal, Satna, Bengaluru, Shimla, Dehradun, Jhansi, Pimpri Chinchwad, Bilaspur, Pasighat, Jammu, Dahod, Thoothukudi, Tiruchirapalli, Tirunelveli, Tirrupur, Aizawal, Prayagraj, Aligarh, Gangtok
5.	Round 5	9	Erode, Saharanpur, Moradabad, Bareilly, Itanagar, Silvassa, Diu, Kavaratti, Bihar Sharif

5 Findings and Results

The results have been broken down into various sections like Practices of cleaner production, cleaner production policies, smart city growth issues and gaps in the smart city mission. The results include

the practices that are being adopted to boost the mission along with the policies made by the government. The issues which form a hurdle in the development of smart city are also discussed. The gaps which exist in the system have also been identified and elaborated.

5.1 Practices of cleaner production. A number of initiatives have been proposed by the Modi government to allow clean manufacturing methods in India. The following efforts introduced by the Indian government over the last few years summarize the objectives of cleaner, manufacturing endeavours in India:

Make in India Program- The campaign which focuses on manufacturing sector was launched in the year 2015. The campaign launched the Zero Effect, Zero Defect (ZED) Commitment Policy. The ZED design assesses the quality standards of medium and small-sized companies and reduces their impact on air pollution, water contamination and sewage generation. The Government of India has established a strategy to fully cover one million SMEs and to foster overseas investment and business awareness. Likewise, the Make in India campaign funds local and global corporations across 25 segments defined by the government as performing technologies within India[6].

Smart cities- The project aims to refurbish existing areas and develop new smart cities with sustainable construction practices to reduce carbon emissions, reduce soil, groundwater and noise pollution, improve water efficiency and quality, reduce solid waste, improve transport mechanisms and increase energy efficiency in a resourceful manner.

Model Villages- Model villages use clean and green practices to embrace sustainability initiatives and are identified as hubs for the development of nearby villages. Support for the construction of prototype households will come from the Centrally Funded Schemes which will include regional and civilian government officials. The goal of the prototype villages is to help remote areas, encourage best sustainable practices, apply smart technology and empower rural populations.

Skilled India- This mission focused on developing the skills in the Indian youth. The Skilled India program is controlled through the Ministry of Skill Development and Innovation. The system provides working population of India with suitable skills and training development, and prepares them for meaningful long-term occupations[6].

Clean India- This mission was designed to endorse sanitation in India. The aspirations of the Clean India policy is built from Mahatma Gandhi's doctrines. The priority is on maintaining good hygiene services in rural, urban, and regional areas as well as facilitating urban and mid-sized sanitation. The Clean India campaign has gained immense media attention and greater acceptance among residents about adopting cleaner interventions. Three states in India, including Sikkim, Himachal Pradesh and Kerala, have been declared 'open defecation free' [6].

Solar Power- The main crux is on renewable energy generation and the United States has entered into an agreement with the Indian Renewable Energy Development Agency (IREDA) to provide fair loans on solar-based projects. The program also focuses on increasing job opportunities and reducing emissions.

Digital India- It is an effort aimed at improving the online facilities and also ensuring that government services reach all people through the online platform. The overall objective is therefore to increase Internet connectivity in India and to promote citizen digital empowerment. The Digital India initiative is coordinated in collaboration with various state departments and central ministries by the Department of Electronics and Information Technology (Deity). The Digital India initiative promotes the management of knowledge and participatory governance. As a result, the Internet of Things Center of Excellence (IoT) was developed to provide, among others, smart solutions for transportation, waste management and parking[7].

5.2 Smart city growth issues

Public Services- The project was initially designed for 100 cities but during the first round only 20 cities were chosen, and they were criticized for lack of depth of amenities. The biggest worries relate to the chosen cities ' current progress, economic growth and new infrastructure. The 20 identified cities had better public transport than that of the remainder due to their proximity to big cities[6]. In addition, given the presence of docks and naval assets most of the chosen areas have a booming aggregate demand, generating more opportunities for cultural and intellectual assets and increasing national and international economic growth. See **Table 5.1**.

Resource Management-Freeing up and earmarking funds for smart city and growth measures is another major concern. The available published information suggests that people's interests are linked to the risk management and distribution of monetary and un-financial resources. Good resource management also has to do with administrative bureaucracy and pervasive corruption when enforcing cleaner manufacturing policies and building renewable energy projects in India.

Governance of participation -Leadership in some of the cities listed under the Sustainable development. Research program has been poor due to the absence of funding and adequate training to embrace advances in technology. Integrating ICTs to develop innovative solutions to existing issues and enhancing the collaborative leadership approach by including different participants is vital for the development of smart cities and the adoption of healthier development policies in India.

Attainment of funds- Statistical analysis identified funding from domestic and foreign sources as a significant barrier to the development of safer manufacturing strategies in smart cities. To build smart grids, it is important to implement technical solutions to set up solar parks, to improve efficiency initiatives, comprehensive funding and continuity of funding. The Indian government has been active in securing global support to enforce the planned measures, but unpredicted postponements in the implementation of the planned ventures are evident due to a lack of funds[8].

Awareness of people- Nevertheless, there is a need to take utmost care in recognizing the inequalities in educational and income levels that affect citizen opinions on these measures. Through the process of decentralization, the Government of India empowers departments of government and local governments to raise awareness and educate people of the country on numerous sustainable development projects that could contribute to the development of green infrastructure. Exhaustive

advertising of these ventures on specific social media sites fosters public involvement. Likewise, by using different data collection tools, the Government of India must take into account the opinions and views of citizens' groups that are excluded from using social media sites.

Technical expertise- The idea of smart cities in this country is newish and the introduction of sustainable development strategies for harnessing renewable resources, reducing carbon emissions, reducing traffic, simplifying transport and controlling organic waste through integrating smart strategies in the Indian sense is also innovative and creative. The presence of sufficient engineering skills to deliver the expected results is unclear; nevertheless, innovation in extensive training through initiatives on Skilled India and Digital India helping to address the technical barriers is dubious[9].

5.1 Growth Issues Existing Gaps

1.	Public Services	Political gaps
2.	Resource Managemet	Financial disparities
3.	Governance of Participation	Individual gaps
4.	Attainment of funds	Social gaps
5.	Awareness of People	Service gaps
6.	Technical Expertise	Ethical gaps

5.3 Gaps affecting India's smart city mission

Political gaps- Even though the smart city mission has initiated cleaner production practice in India but its long term sustainability raises questions. The documentation for smart cities does not give any clear definition regarding corruption. The current model focuses on collaborative decision-making processes and includes multiple stakeholders in the process of fostering cooperation in smart city growth and sustainable industrial practices implementation. The decentralized decision-making system is definitely a step ahead of the previous centralized top down initiatives. Indian citizens need to choose leaders with clear vision, direction, and forward-looking orientation. **See Table 5.1.**

Financial disparities-The much-needed discussion of effective management of funds and efficient disbursement of funds and the key players responsible for these activities is not evident and clear in the information available. While India is booming, posting the world's highest 9 percent economic growth, the poverty rate figures seem troubling. For example, the statistics available suggest poverty rates in rural areas of 25% and urban areas of 15% despite the country's reported economic growth [10]. Likewise, those in the poverty-stricken Indian population have limited access to basic sanitation, electricity and water facilities, which underlines the persistence of this systemic issue. In view of the country's rising poverty rates, many have criticized the initiative of the Government of India on smart city growth. However, due to the benefits associated with improving living standards and quality of life in India, the initiation and implementation of cleaner production practices has received a lot of approval. An ongoing problem is finding reliable sources of funding to promote smart city growth and those promoting sustainable production initiatives. There is a great need for attention to detail and consideration to secure sustainable long-term support from reputable public private partnerships, and consistent processes are required to share the same with the wider public [11].

Individual gaps-The credentials, training and expertise required or anticipated by individuals belonging to Special Purpose Vehicles (SPVs) are not outlined in the current literature or in publicly available government reports. Even, in government reports, the creation of contingency plans to handle unforeseen project delays and other systemic issues related to lack of funding, availability of resources and international cooperation did not receive much attention. The successful formulation of policies relating to sustainable manufacturing practices and smart cities needs to be taken very carefully. Building greater awareness among people of initiatives, for example, is a crucial step forward. Then the emphasis must be on identifying potential human capital through the evaluation of skills. The criteria and specifications for implementing cleaner manufacturing initiatives can vary based on the proposed smart city's geographical location. For the long-term sustainability and performance of smart cities and sustainable construction practices, tailored training programs for the holistic development of human resources are therefore mandatory.

Social gaps- Although these development programs have facilitated constructive dialog between people, there appears to be less room for sufficient inclusion of voices of citizens. Quality online discussion forums involving different stakeholders and face-to-face focus group discussions

involving central government officials, state governments, companies, and citizen action groups would be useful in promoting collective creativity in the public sector. Frequent interaction with various actors by government officials and the proposed SPVs would encourage smart governance and networked governance activities. Actually, the emphasis was on validating the responses of people through social media discussions. Nevertheless, care must be taken in creating sustainable manufacturing practices and smart cities to include the marginalized voices of people from low socioeconomic backgrounds and lower educational levels. The incorporation of these social programs points to the government's strong dedication to fostering corporate citizenship.

Service gaps-The physical differences found in the Indian context relate to poor infrastructure and technical incoherence. The statistics available show that the rate of internet penetration in India is 34.6% Although the rate of internet penetration is currently much higher than the levels of previous years, it is lower than that of other Asian countries[12]. The Digital India initiative of the Government of India focuses primarily on increasing the country's digital supremacy to facilitate optic fiber networks, sensor systems, urban planning, and developments in modern technology. The government's planned policies in the country also put greater emphasis on designing smart solutions to address the issues associated with supporting sustainable growth initiatives effectively. The government's plan for smart city growth is to upgrade infrastructure and attract foreign investment.

Ethical gaps- There is no question that the growth of smart cities and the introduction of sustainable manufacturing practices and policies neglect voicing concerns related to identifying key ethical gaps. Poverty, for example, has been a serious concern in India since independence, yet for many years it has been totally mismanaged. Likewise, it is often ignored certain issues related to the caste system, equity, diversity and inclusion. There is no access to basic facilities and services for the country's poor population, which poses serious ethical questions. However, the cost effectiveness or the exact costs associated with both the growth of smart cities and the introduction of sustainable manufacturing practices are not effectively communicated with stakeholder groups, which poses another serious ethical issue about transparency. Therefore, it is possible to address at least part of the problem by concentrating on creating ethical guidelines and encouraging preventive ethics alongside code of conduct and code of ethics to close the defined gap[13].

6 Conclusion

This paper provides an overview of India's smart city strategy along with the new smart economic development plan and the Government's cleaner production initiatives. The study demonstrates significant effects from an Indian standpoint for a fundamental perception of the smart city framework and for identifying the role of collective creativity in promoting smart city progress and healthier development activities. The implications relate to enhancing involvement of citizens at all

stages of smart city expansion and safer production initiatives to further enhance collaborative governance as a method of effectively resolving the defined problems. Dynamic consultation with interested parties and optimization of government-private alliances will naturally mitigate the challenges involved with adopting cleaner procurement practices and promote the phase of smart city growth.

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