

**Major Research Report**  
**on**  
**Analysis of Challenges and Issues faced in Indian**  
**Smart Cities**

*Submitted By*

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*Under the Guidance of*

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## **CERTIFICATE**

This is to certify that Mayank Singh (2K22/DMBA/73) has submitted the report titled “**Analysis of Challenges and Issues faced in Indian Smart Cities**” in partial fulfillment of the requirements for the award of the degree of Master of Business Administration (MBA) from Delhi School of Management, Delhi Technological University, Delhi during the academic year 2023-24.

**Prof. P.K. Suri**

**Professor**

## **DECLARATION**

I, Mayank Singh, hereby declare that the presented report titled “**Analysis of Challenges and Issues faced in Indian Smart Cities**” is uniquely prepared by me as a part of Master of Business Administration (MBA) curriculum of Delhi School of Management, Delhi Technological University, New Delhi. This is an original piece of work and has not been submitted elsewhere.

I also confirm that the report is only prepared for my academic requirement, not for any other purpose. It might not be used with the interest of the opposite party of the corporation.

.....  
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## **Acknowledgement**

I, Mayank Singh would like to convey my gratitude to the Head of Department (HOD) **Dr. Saurabh Agarwal and Prof. P.K. Suri** for their invaluable support throughout my MBA major research project.

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Finally, I would like to thank my family and friends for their unwavering support and encouragement throughout this journey. Their love and encouragement have been a constant source of motivation and inspiration, and I am grateful for their presence in my life. Once again, I express my heartfelt gratitude to Dr. Saurabh Agarwal and Prof. P. K. Suri for their invaluable support and guidance in this project, and for their commitment to fostering the academic and personal growth of their students.

## **Executive Summary**

The current research presents issues and challenges to Smart City projects in India that focus on the development of various factors hampering effective execution of smart city projects in India, for instance, availability of funds, skilled labor, and political stability. It also encompasses ways that various smart city initiatives affected the environment, public safety, crime rates, and energy consumption. Now smart cities have definitely become an aspirational solution for better quality of life for urban citizens in India, but imminently face manifold challenges and problems in their implementation and management. This research project tries to identify and provide an insight into different problems and challenges that smart cities in India may face. The research considered a survey approach to garner the views of residents in India about smart cities. The different statistical techniques applied during the analyses of collected data include descriptive statistics, t-test, test of chi-square, and regression analysis of data. Results showed that the parameters shaping up around population density, availability of skilled labour, digital literacy, funds available, and citizen participation were critical factors in the determination of the success of initiatives under the smart city projects in India. This study would be helpful for the policymakers, city planners, and other stakeholders in implementing and monitoring smart city projects in India. Despite the bright concept of a smart city regarding a range of benefits, working and implementation of smart cities in India has been a lot of struggle and challenges. These include, amongst others, insufficient funds, lack of skilled human resources, political instability, and change resistance. Of course, the smartness of a city is greatly dependent on the uptake and engagement of the citizens; hence, its perception and attitude toward smart city initiatives are also in focus. This project, therefore, sets out by presenting some research about smart cities and the challenges and issues experienced in developing them in India. In this research study, data collection would be done through a questionnaire-based survey among the residents of selected smart cities in India. The data would be analyzed through descriptive statistics, chi-square test, t-test, and regression analysis. This study gives additional proof regarding the problems and issues impacting smart cities in India and will possibly expose available solutions.

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# CHAPTER 1

## 1.1 Introduction

Smart cities have become a popular topic in recent years, attracting significant attention. India as the country rapidly urbanizes. A smart city is a city that utilizes advanced technology and using data analytics to improve its operations and services, elevate the quality of life for its inhabitants, and ensure sustainable development. Obstacles and issues to implement and operationalize smart cities entail ways to achieve the full benefit potential. Notable among these are lack of funds, skilled human resources, political instability, and resistance to change. Success in smart cities depends on the acceptance and participation of citizens, hence their perceptions and attitudes towards smart city initiatives are also crucial.

The present study is based on the challenges and issues being faced by smart cities in India. In this regard, through a questionnaire survey, issues are to be explored with residents of some of the selected smart cities all over India. The data will be analyzed quantitatively by using descriptive data analysis methods, numerical information, chi-square tests, t-tests, and regression analysis. The results of this work will be very useful in understanding the kind of smart city challenges and problems that are happening in India. Such solutions can be very helpful for addressing these identified challenges and issues.

## 1.2 Background

India is urbanizing very rapidly over the past few decades; presently, about 34% of the population lives in cities. It has posed a whole lot of problems and challenges in infrastructure, transportation, housing, and sustainability, among others. Taken as a response to these, in 2015 the Indian government started the Smart Cities Mission focused on creating 100 smart cities throughout the nation. By 2030, an urban population of 600 million will be located in India, now one of the fastest-growing economies in the world. The fast rate at which cities are growing has caused huge problems related to infrastructure, traffic jams, air quality, and availability of necessary services like water and sanitation. A solution lies within the scope of smart cities: they utilize the latest technological innovation together with data analysis techniques to bring about improved uses of resources and services, changing for the better the quality of life for residents and sustainable growth.

The Smart Cities Mission is a comprehensive program targeted at making Indian cities more sustainable and liveable urban centres, ensuring that their residents enjoy a good quality of life. It would do so by bringing in citizen participation, smart solutions, and an integrated approach in its planning as a principle by harnessing technology and innovation against the mega-challenges of urbanization that confront Indian cities today. The Smart Cities Mission by the Government of India was established in 2015 with an aim to develop 100 smart cities across the country. Smart Cities Mission mandates every city to come up with a Smart City Proposal, or a road map on how to make a city smart under this mission. Solutions core infrastructure setup include elements of water supply, open spaces, sanitation, solid waste management, efficient urban mobility, affordable housing, IT interface, and digitization. So far, the Smart Cities Mission has witnessed private sector investment at unprecedented levels, with firms like Cisco, IBM, and Siemens having made partnerships with Indian cities to design and implement smart solutions. The mission has also attracted the eyes of international bodies and the government, in which countries like the United States of America, Japan, and Germany come in through technical and financial support.

As of 2021, over one hundred cities have been selected under the Smart Cities Mission. Approximately INR2lakhcrore (\$26.8 billion) project proposals were at various planning and

implementation stages as part of those cities. Although the mission has encountered a few challenges like sluggish project implementation and lack of citizens' involvement, there is tremendous potential for Indian cities to metamorphose into more sustainable, resilient and liveable urban centers. The mission has identified a set of important infrastructure elements critical to the development of smart cities including; adequate water supply, assured electricity supply, sanitation and solid waste management, efficient urban mobility and public transport, affordable housing (with a particular emphasis on AMRUT cities), robust IT connectivity and digitalisation. Some of the smart cities in India have initiated projects on these aspects to enhance and innovate further. "For instance, Surat in Gujarat has implemented a smart water management system using sensors and real-time tracking to minimize water leakage and ensure efficient distribution. The city has also developed a mobile app that allows residents to keep track of their water use and pay their bills using the web. Similarly, Odisha's Bhubaneswar city has implemented a smart traffic control system for monitoring real-time data to maintain the movement of vehicles and prevent traffic congestion. The system is complete with a mobile application that offers citizens up-to-the-minute updates on traffic conditions and recommends different routes.

A smart waste management system has been implemented by Indore, in Madhya Pradesh, for efficient solid waste management that uses GPS enabled trucks and sensors to track garbage collection and disposal. It also includes a mobile app where citizens can report any issues regarding the house refuse. Another illustration is Pune city in Maharashtra which has put in place a smart parking system that uses sensors for monitoring parking spaces and gives real-time information on available parking spots to the public. The system additionally provides an avenue whereby citizens can book parking spaces ahead of time using their mobile phones and pay through the same application. Moreover, many Indian smart cities are engaged in projects aimed at creating sustainable and ecological urban infrastructure, promoting public transport and active mobility, as well as improving citizen engagement and participation in urban planning process.

Finally, Smart Cities Mission has provided a road map for Indian cities to modernize and develop further leveraging technology and innovation. This mission's programmes are indicative of what Surat, Bhubaneswar, Indore, Pune and other examples have done under this programme thereby showing how it can be utilized to turn all India cities into sustainable resilient liveable urban centers where people would want to live today or tomorrow too!

## **1.2 PROBLEM STATEMENT**

Many advantages can arise from smart cities in theory; however, the reality of establishing and operating them has challenges. These challenges include underfunding, lack of manpower skills, political instability and resistance to change. Furthermore, the citizens' perception and attitude towards their participation as well as acceptance plays a crucial role for smart city to be successful.

## **1.3 OBJECTIVE OF THE STUDY**

The objective of the research project is to study the challenges and issues faced by smart cities in India. The specific objectives are as follows:

- To assess the availability and quality of public transportation, high-speed internet, and affordable housing in selected smart cities in India.
- To determine the level of digital literacy among residents of selected smart cities in India.
- To analyse the perceptions and attitudes of citizens towards smart city initiatives in selected smart cities in India.
- To identify the challenges and issues faced by smart cities in India, including funding, human resources, political stability, and resistance to change.
- To suggest potential solutions to the challenges and issues faced by smart cities in India

## **1.4 SCOPE OF THE STUDY**

This research will concentrate on various smart cities in India with no generalization of results to other Indian towns or areas. Consequently, this study is going to depend on self-reported data since it will involve the use of questionnaires administered to residents of such smart cities in India. Moreover, it does not cover all aspects of challenges and issues faced by smart cities in India but only focuses on selected variables identified through questionnaire.

## CHAPTER 2

### LITERATURE REVIEW

Smart cities are an innovative way of managing urban growth and development. Smart cities are designed in a way that they employ digital technologies that enable data-driven decision making for creating sustainable liveable urban spaces. With its huge population that is growing rapidly, India is one of the fastest emerging economies globally besides having very many low-income people. No one can say that smart cities aren't an innovative way of managing contemporary urban growth. The Indian government has initiated the Smart Cities Mission to convert 100 cities into smart cities. Nonetheless, the success of this mission depends on several factors. This literature review will discuss challenges and management practices of smart cities in India using various data analysis techniques.

#### • High Population Density

India's massive population is burgeoning and is soon expected to become the most heavily populated country, with about 1.7 billion by the year 2050. This rapid growth is putting immense pressure on cities, causing them to congest and sprawl. The high rate of population density in cities will contribute to resource inadequacy, including water, food, housing, or sanitation facilities. Therefore availability of affordable housing remains one of the very good sensitive issues challenged while managing the smart cities of India. The use of descriptive statistics entails analyzing the population density in Indian cities through measures like mean, median, mode, and others in various cities; for instance, the study of population density. This will help us maybe identify cities that are more dense and hence require the smart city initiatives. We can further test the relationship of population density to the existence of affordable housing by applying a chi-square test. Below is more information on the degree to which population density affects affordable housing:

#### • Availability and Quality of Public Transportation

The availability and quality of public transportation should be a critical factor for any smart city, not only to help reduce traffic congestion but also to help reduce air pollution. But in India, this aspect has not been realized. Most people still use private-owned vehicles, which lead to traffic congestion and therefore an increased rate of emission of greenhouse gases. To make Indian cities smarter, the availability and quality of public transportation would have to improve. Using descriptive statistics, we will analyze how well public transport is available in cities and how satisfactory the quality really is. For instance, we can make a lot of decisions within this number: the number of buses, trains, and different means of transportation in various cities; mean, median, and mode. Also, the test is performed, and the correlation that exists between the availability of public transportation and air pollution is observed. This helps one establish exactly how much the availability of public transport influences the degree of air pollution.

#### • Digital Literacy Level

Digital literacy level is the ability of a person to use digital technologies for his benefit effectively. It determines the critical success factor of smart cities—most of the smart city initiatives are going to use digital technologies. However, most of them are in usage. Only a few people in India access the kind of high-speed internet services that are powered with needed digital skills. This renders improvement in digital literacy to be the pivotal challenge in

the management of a smart city in India. Descriptive statistics techniques such as calculating the mean, median, and mode of the percentage of the population with access to high-speed internet and digital skills can be useful in finding out the level of digital literacy in different cities. This will also enable the execution of a t-test to determine whether or not the difference in digital literacy levels is significant across different age groups or reflects the magnitude of the effect elicited by age on this outcome.

- **Availability and quality of high-speed internet**

Internet high speed is among the most important features of smart cities because it supports the deployment and operation of digital technologies and data-driven decision-making. However, it reflects that either the availability or the quality of high-speed internet is not so good. High-speed Internet is an important part of the solution since it helps to ensure that many data sets move within a very short time. High-speed Internet is required since over half the population of India majorly uses low-speed internet, therefore making data transfer and processing slow. Consequently, improvement in the availability and quality of high-speed internet is one of the key challenges put forth into the management of smart cities in India. Descriptive statistics are going to be helpful in making an assessment at an instance, regarding the availability and quality of high-speed internet across different cities. In this regard, it will be essential to compute for the mean, median, and mode of internet speed across various cities. Similarly, a correlation test can be conducted for the above finding on the availability of high-speed internet and interests in participating in smart cities, which will help this research find out to what degree changes in availability of high-speed internet manifest changes in interest levels of citizens for smart city initiatives.

- **Availability of funds for smart city initiatives**

It is impossible to realize a smart city without investing huge sums of money in infrastructural and technological development. But for India, these smart city initiatives do not have excessive funds. Thus, it includes the key role of private investments and alternative sources of funding for smart cities in India. The availability of these funds in different cities can be measured by using descriptive statistics. We could also treat the amount of funds allocated for smart city projects in each city—such as the mean, median, and mode. Similarly, we will do a t-test on the difference in the average amount of funds allocated for smart city projects between cities having high and low GDP. This will help identify the effect on the availability of funds for the smart city initiative because of GDP.

- **Skilled availability**

Smart city initiatives require the availability of skilled resources at the time of implementation and maintenance. However, their availability in India is not very ripe. Therefore, development of skills within the workforce and being able to attract skilled workers becomes important in managing smart cities in India. Descriptive statistics can be used to analyze the availability of skilled labor within different cities. For instance, one would be in a position to access the average, median, and mode of percentages of the population that has the required capabilities for smart city initiatives across various cities. We would be in a position to test if the likelihood of getting such labor was independent of the eagerness of those cities to participate in the smart city initiative by using chi-square. This will enable us to appreciate to what extent availability of skillful workers sways interests in smart city initiatives.

- **Level of interest in smart city initiatives**

The level of interest depicted by the stakeholders determines the success or failure of the smart city initiatives, i.e., the participation of the initiatives by the people and other stakeholders. Therefore, the quantified interest levels in participating for any given smart city initiative are considered invaluable in the management domain concerning smart cities in India. The level of participation or interest to participate in initiatives taken under these smart cities could be determined through descriptive statistics across different cities. For instance, the mean, mode, and median of percentages interested in participating from different cities can be taken. We will also do a correlation test to find the association between the interest level in participating in smart city initiatives and the level of political stability; this helps draw an inference informed by the extent to which the level of political stability is causing differences in the level of interest in smart city initiatives.

- **Political Stability**

Political stability is essential to the success of smart city initiatives. It provides the necessary framework for implementing and maintaining smart city projects. However, in India, political instability is a significant challenge in managing smart cities. Using descriptive statistics, we can analyze the level of political stability in different cities. For example, we can calculate the mean, median, and mode of the number of political parties in power in different cities. We can also use a t-test to examine the difference in political stability between cities with high and low levels of economic development. This can help us understand the extent to which economic development affects political stability.

- **Environmental Sustainability**

Smart cities must be sustainable to reduce their environmental impact. Therefore, incorporating environmental sustainability in smart city initiatives is crucial to managing smart cities in India. Using descriptive statistics, we can analyze the level of environmental sustainability in different cities. For example, we can calculate the mean, median, and mode of the level of air pollution in different cities. We can also use a correlation test to examine the relationship between the level of environmental sustainability and the level of interest in participating in smart city initiatives.

- **Availability of Affordable Housing**

The availability of affordable housing is another important factor that affects the success of smart city initiatives. A study by Tiwari et al. (2021) highlights that the lack of affordable housing is a major challenge in the development of smart cities in India. The researchers suggest that the government should take measures to ensure the availability of affordable housing for all citizens, especially for low-income groups. Additionally, the study highlights the need for innovative financing models to fund the development of affordable housing in smart cities.

- **Crime Rate and Public Safety**

Crime rate and public safety are also critical factors that affect the success of smart city initiatives. A study by Karimi et al. (2021) found that smart city initiatives can help reduce crime and improve public safety by using advanced technologies such as 9 CCTV cameras, real-time crime mapping, and predictive policing. The researchers suggest that the government should focus on implementing smart city projects that address the issue of crime and public safety.

- **Energy Consumption and Efficiency**

Energy consumption and efficiency are important factors that need to be considered while implementing smart city initiatives. A study by Azad and Raza (2019) highlights that smart city initiatives can contribute to energy efficiency by promoting the use of renewable energy, implementing energy-efficient building designs, and using smart grids. The researchers suggest that the government should focus on promoting energy efficient technologies and practices in smart city projects to ensure energy efficiency.

- **Waste Management**

Waste management is another critical factor that needs to be considered while implementing smart city initiatives. A study by Garg et al. (2019) highlights that smart city initiatives can contribute to effective waste management by promoting waste segregation, implementing waste-to-energy technologies, and using advanced waste management systems

## CHAPTER 3

### RESEARCH METHODOLOGY

The study employs a mixed-method research approach, using both quantitative and qualitative methods to gather and analyze data. The research design is exploratory, as the study seeks to explore the challenges and issues faced by smart cities in India. The study population consists of residents of smart cities in India, who are knowledgeable about the smart city initiatives in their respective cities.

#### **Data Collection:**

The data for this study is collected through a survey questionnaire. The survey questionnaire is designed based on the research objectives and the variables identified from the literature review. The questionnaire is distributed online through social media platforms and email to a sample of residents of smart cities in India. The sample size is determined using the convenient sampling method. The data collected from the survey questionnaire is analyzed using SPSS. The data is collected using a predetermined set of open-ended questions and are recorded and transcribed for analysis. The qualitative data is analyzed using thematic analysis.

#### **Data Analysis:**

The data gathered from the survey questionnaire is analyzed through the use of SPSS software. Descriptive statistics are employed for examining both the demographic traits of the participants and the variables under study. Statistical methods like t-tests and chi-square tests are employed to analyze hypotheses and explore connections among variables. Thematic analysis is used to analyze the qualitative data gathered from the interviews. The recorded information is categorized and organized into themes and sub-themes. The topics and subtopics are reviewed and understood to derive conclusions and insights from the information.

#### **Findings:**

The findings of this study will contribute to a better understanding of the challenges and issues faced by smart cities in India and provide insights into how to overcome these challenges and ensure the successful implementation of smart city initiatives.

For example, we could assume that the following variables may be highly correlated with each other:

- Population density and availability of affordable housing
- Availability and quality of public transportation and digital literacy level
- Availability of funds for smart city initiatives and political stability
- Availability of skilled labour and level of interest in participating in smart city initiatives
- Energy consumption and efficiency and environmental sustainability

However, these are just assumptions, and the actual correlations between variables can only be determined through data analysis. Therefore, it is important to conduct statistical analysis to identify the actual relationships between variables and determine which variables are highly correlated with each other.



The study will help in identifying the gaps in the management and implementation of smart city initiatives and provide recommendations to improve the same. The results of this study will be useful for policymakers, urban planners, and project managers involved in the development and implementation of smart city initiatives in India.

## **CHAPTER 4**

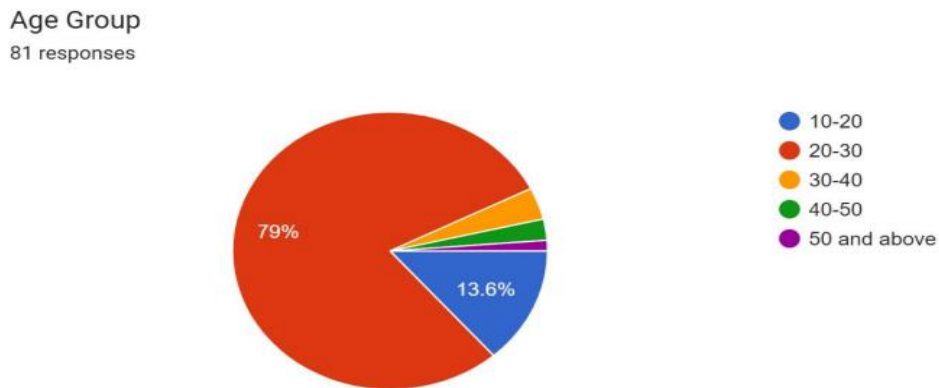
### **Data Analysis**

The Questionnaire for survey was created by taking the below variables into consideration and 81 responses were collected from people living in different smart cities altogether for data analysis on the topic of "Analysis of Challenges and Issues faced in Indian Smart Cities", These variable as been taken after carefully examining the present available data on smart cities. The variable taken into consideration are:

1. Population Density
2. Availability and Quality of Public Transportation
3. Digital Literacy Level
4. Availability and Quality of high-speed Internet
5. Availability of funds for smart city initiatives
6. Availability of Skilled Labour
7. Level of interest in participating in smart city initiatives
8. Political Stability
9. Environmental Sustainability
10. Availability of Affordable Housing
11. Crime Rate and Public Safety
12. Energy Consumption and Efficiency
13. Waste Management
14. Water Supply and Sanitation
15. Air Quality

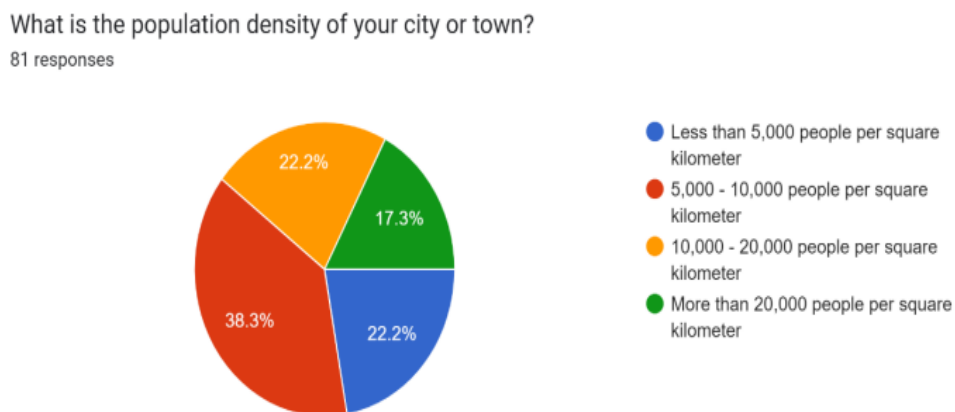
## 4.1 Descriptive Analysis (Initial Data Insights derived from Collected Survey Data)

**A)** The majority of people who participated in the survey are of 20-30 years of age followed by age group of 10-20 and then 30-40.



**Fig. 1** Age Group of Survey Participants

**B)** The max. no. of survey participants lives a population density of 5000-10000 people per square km.



**Fig. 2** Population Density of City/Town

C) Most of the survey participants graded the availability of public transport in their cities as “Average” followed by “Good”.

How would you rate the availability and quality of public transportation in your city or town?

81 responses

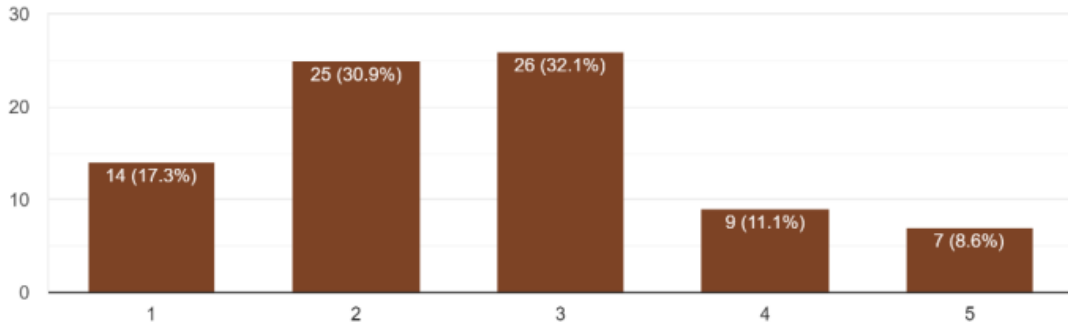


Fig. 3 Availability and Quality of Public Transportation in City/Town

Here, 1-Excellent, 2-Good, 3-Average, 4-Poor, 5-Very Poor

D) According to the survey participants the digital literacy in most of the people’s town/city is 50%-75% and then decreases to 25%-50%

What is the percentage of the population in your city or town that is digitally literate?

81 responses

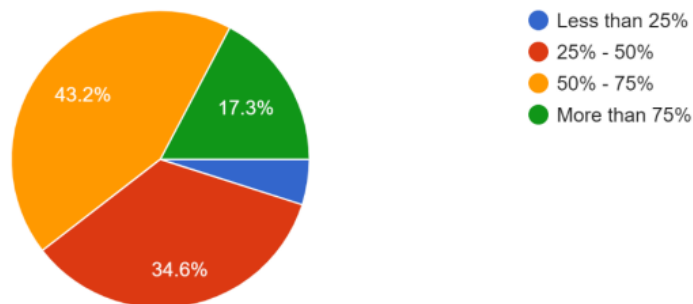


Fig. 4 Percentage of the population in City/Town that is digitally literate

**E)** Most of the people graded the availability of quality of High-Speed Internet in their city as “Good” followed by “Average” and then “Excellent”.

How would you rate the availability and quality of high-speed internet in your city or town?

81 responses

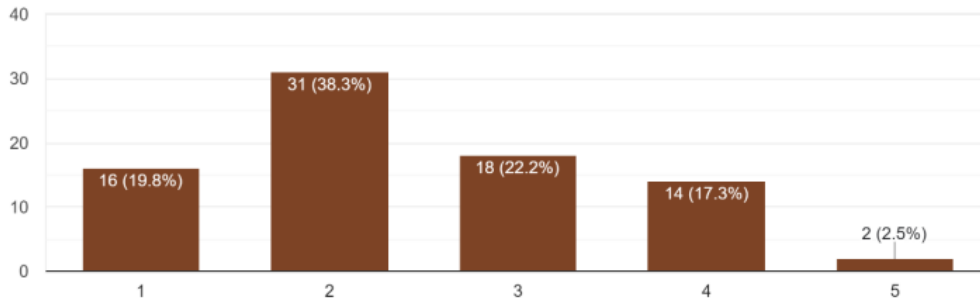


Fig. 5 Availability and Quality of High-Speed Internet in City/Town.

Here, 1-Excellent, 2-Good, 3-Average, 4-Poor, 5-Very Poor

**F)** Most of the people perceive that the availability of funds for smart city initiative is “Adequate” followed by “Insufficient”.

How do you perceive the availability of funds for smart city initiatives in your city or town?

81 responses

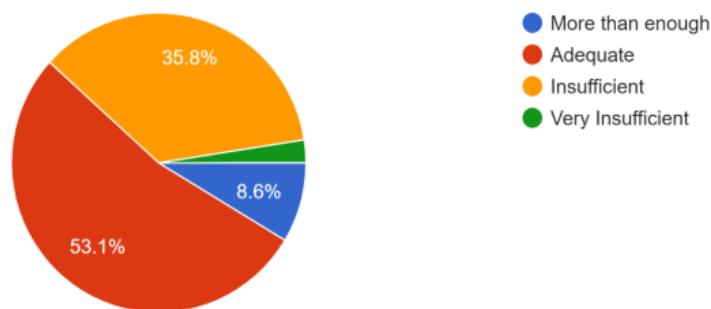


Fig. 6 Availability of Funds for Smart City Initiatives in City/Town.

**G)** “Adequate” level of availability is reported in participants smart cities followed by “Insufficient”, whereas people also thought the availability to be “Abundant”

How would you rate the availability of skilled labor in your city or town?  
81 responses

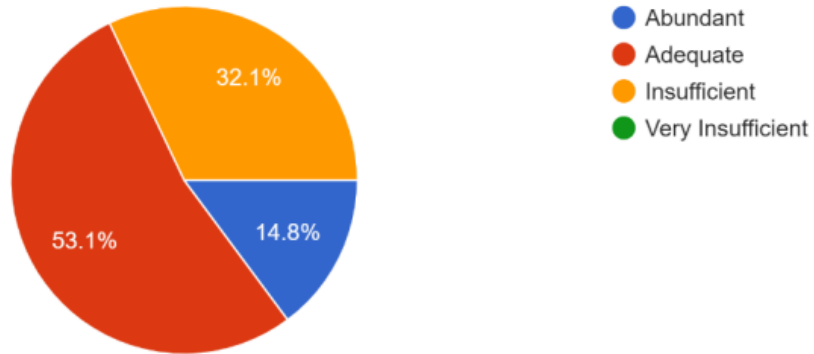


Fig.7 Availability of Skilled Labour in City/Town

**H)** Most admitted that they were “Interested” followed by “Neutral” interest.

What is the level of interest among citizens in your city or town in participating in smart city initiatives?  
81 responses

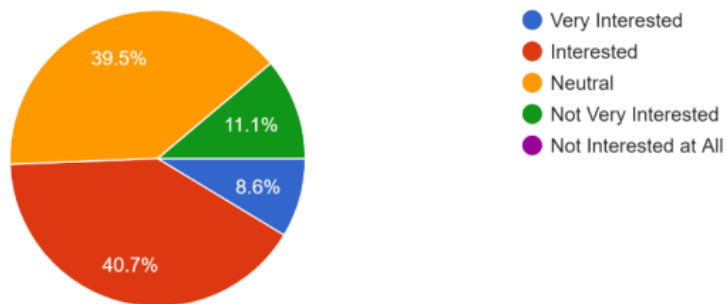


Fig. 8 Level of Interest among Citizens in your City/Town in participating in Smart City Initiatives.

I) Most of the participants reported the political stability in their region to be majorly “Stable” followed by “Moderately Stable” and then “Very Stable”.

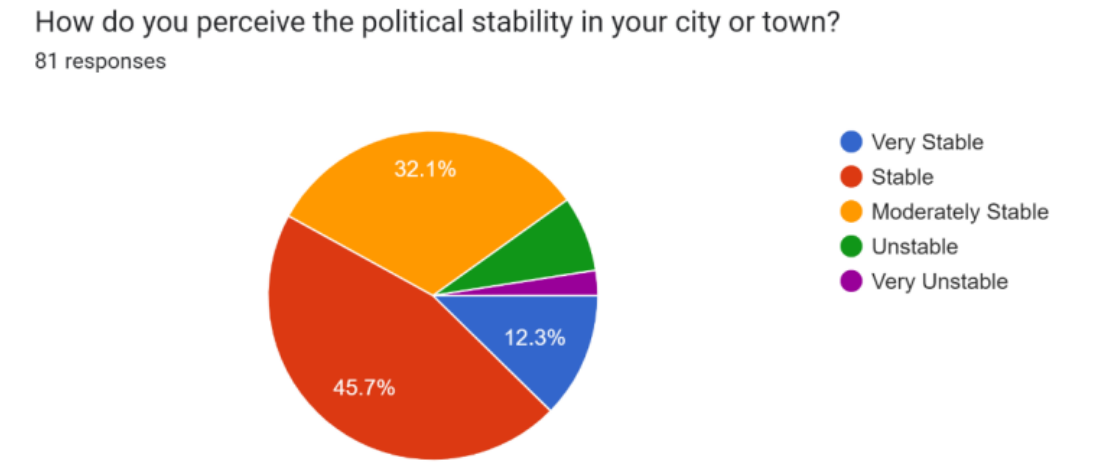


Fig. 9 Political Stability in your City/Town

J) Mostly reported the level of environmental sustainability to be “Average” followed by “Good” and then “Poor”.

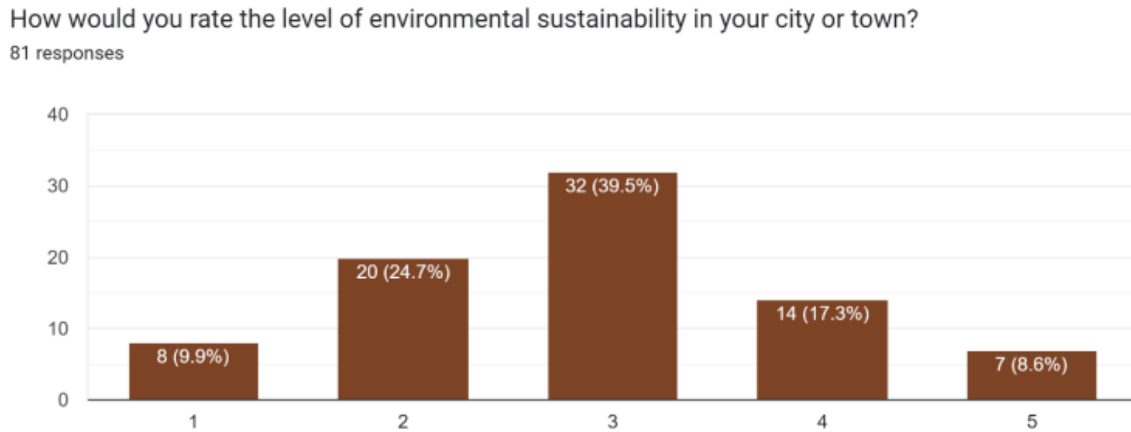


Fig.10 Level of Environmental Sustainability in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4- Poor, 5- Very Poor

**K)** As per survey participants, People majorly reported availability of housing in their region to be “Average”

How would you rate the availability of affordable housing in your city or town?

81 responses

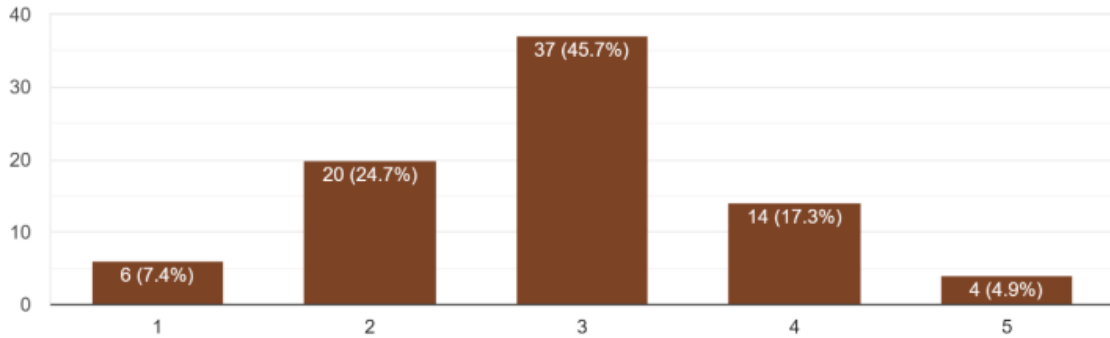


Fig. 11 Availability of affordable housing in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4- Poor, 5- Very Poor

**L)** Majority of people reported the crime and public safety rate to be “Average” and then “Good”.

How would you rate the crime rate and public safety in your city or town?

81 responses

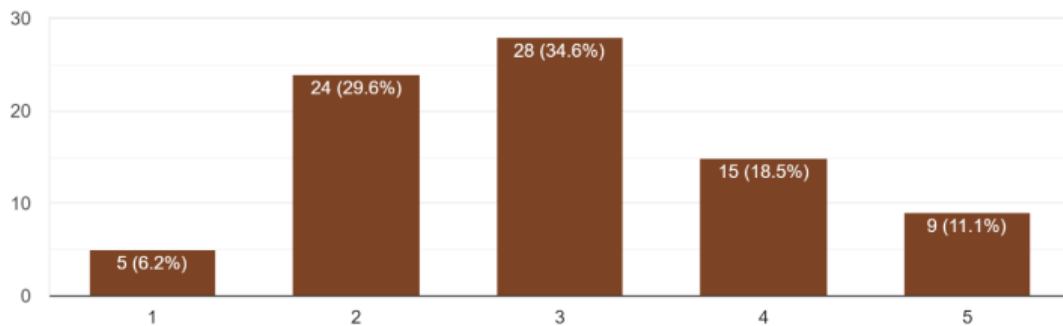


Fig. 12 The Crime Rate and Public Safety in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4- Poor, 5- Very Poor



**M)** Most people rated the energy consumption to be “Average” followed by “Good”

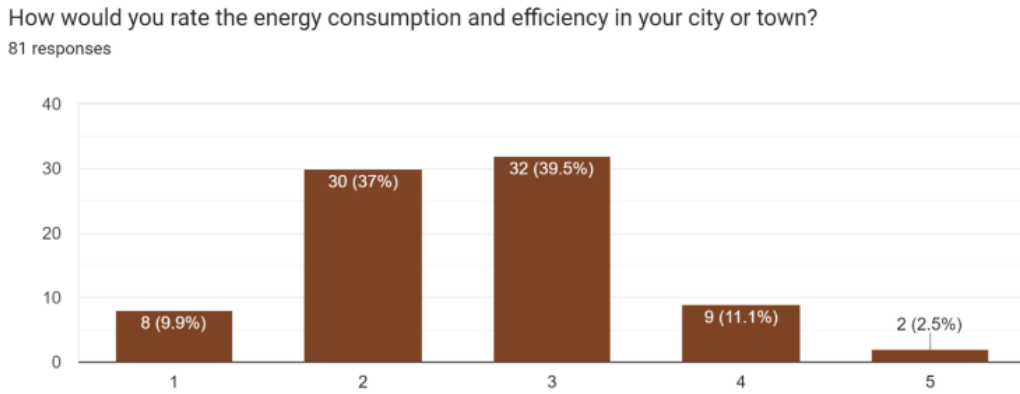


Fig. 13 Energy Consumption and Efficiency in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4- Poor, 5- Very Poor

**N)** According to survey participants most reported the waste management to be “Average” followed by “Good”

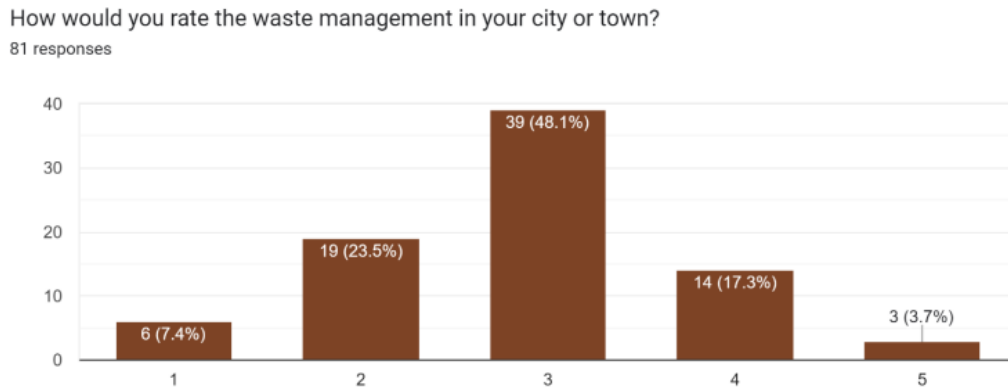


Fig. 14 Waste Management in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4- Poor, 5- Very Poor

**O)** Most people rated the water supply and sanitation to be “Average” followed by “Good”

**O)** Most people rated the water supply and sanitation to be “Average” followed by “Good”.

How would you rate the water supply and sanitation in your city or town?  
81 responses

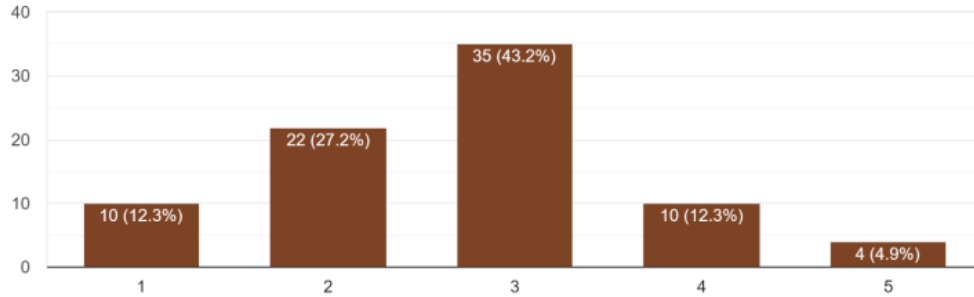


Fig.15 Water Supply and sanitation in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4- Poor, 5- Very Poor

**P)** Most people rated the air quality to be “Very Poor” followed by “Average” and then “Poor”

How would you rate the air quality in your city or town?  
81 responses

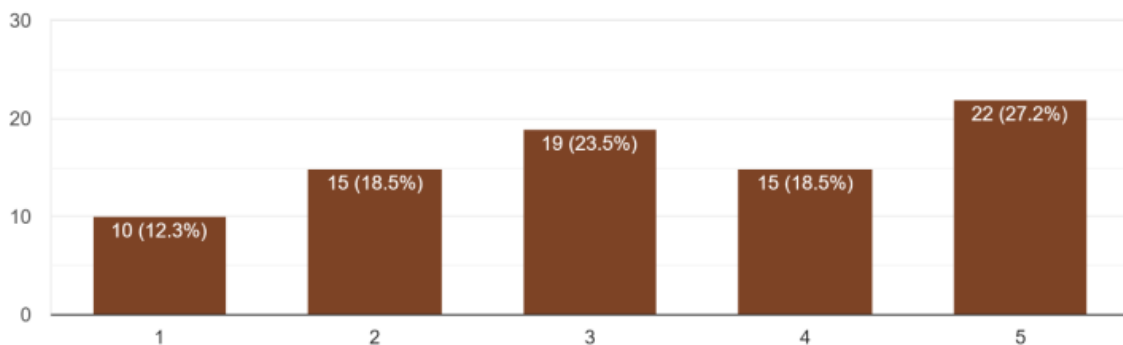


Fig. 16: Air Quality in your City/Town.

Here, 1-Excellent, 2- Good, 3-Average, 4-Poor, 5-Very Poor

## 4.2 Multiple Linear Regression of the Collected Data

Linear regression is a simple and widely used technique in data science and machine learning. It is a supervised learning method and the most basic type of regression used to investigate the mathematical connection between variables.

### What exactly is Multiple linear regression?

Linear regression is a statistical method used to show a relationship between different variables. It looks at multiple data points and creates a trend line. Discovering that the expense of repairing a machine increases as time passes is a simple illustration of linear regression.

Linear regression is employed to evaluate the type and extent of the connection between a dependent variable and a group of independent variables. Prior to fitting a linear model to the given dataset, it is crucial to establish the relationship between the variables. Certainly, this doesn't suggest that one factor leads to the other, but there must be some form of connection between them.

Greater college grades, for example, do not always imply a greater wage package. However, there may be a link between the two factors.

### 4.2.1 Relation between Environmental Sustainability, Air Quality, Water supply & sanitation and Waste Management

By using SPSS we have drawn the results from the analysis which are listed below in table 4.2.1.1 and table 4.2.1.2:

<b>Model Summary</b>				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.599 <sup>a</sup>	.359	.334	.881

a. Predictors: (Constant), How would you rate the waste management in your city or town?, How would you rate the air quality in your city or town?, How would you rate the water supply and sanitation in your city or town?

Table 4.2.1.1: Model Summary for dependable variable Environmental Sustainability.

**Coefficients<sup>a</sup>**

Model				Standardized Coefficients	t	Sig.
				Beta		
1	(Constant)	0.855	0.334		2.556	0.013
	How would you rate the air quality in your city or town?	0.212	0.093	0.269	2.278	0.025
	How would you rate the water supply and sanitation in your city or town?	0.187	0.141	0.174	1.322	0.019
	How would you rate the waste management in your city or town?	0.295	0.156	0.251	1.895	0.032

a. Dependent Variable: How would you rate the level of environmental sustainability in your city or town?

Table 4.2.1.2: Coefficients for dependable variable Environmental Sustainability.

**Finding & Recommendation:**

According to the data drawn from the analysis, environmental sustainability is the dependent variable that is influenced by independent variables such as air quality, water supply and sanitation, and waste management. The value of significance should lie below 0.05 in order to qualify to be rejected. The rejection of the null hypothesis implies that there is a substantial link between environmental sustainability and its independent factors. As a result, air quality, water supply and sanitation, and waste management all have statistically significant effects on environmental sustainability. As a result, politicians and environmental organizations may use this data to develop effective plans and policies to increase environmental sustainability.

**4.2.2 Relation between Public Transport, Environmental Sustainability, Air Quality, Crime rate & Public safety and Affordable housing.**

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.308 <sup>a</sup>	.095	.047	1.128

a. Predictors: (Constant), How would you rate the availability of affordable housing in your city or town?, How would you rate the crime rate and public safety in your city or town?, How would you rate the air quality in your city or town?, How would you rate the level of environmental sustainability in your city or town?

Table 4.2.2.1: Model Summary for dependable variable Public Transport.

Model		Coefficients		Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.288	.496		2.598	.011
	How would you rate the level of environmental sustainability in your city or town?	.094	.149	.088	.633	.529
	How would you rate the air quality in your city or town?	.045	.115	.053	.387	.700
	How would you rate the crime rate and public safety in your city or town?	.107	.130	.101	.818	.416
	How would you rate the availability of affordable housing in your city or town?	.210	.156	.173	1.343	.183

a. Dependent Variable: How would you rate the availability and quality of public transportation in your city or town?

Table 4.2.2.2: Coefficients for dependable variable Availability & Quality Public Transport.

**Finding & Recommendation:**

According to the data drawn from the analysis, the dependent variable is the availability and quality of public transportation, while the independent variables are environmental sustainability, public safety, and affordable housing. In this example, the null hypothesis asserts that there is no meaningful association between the dependent and independent variables. However, the statement implies that the null hypothesis cannot be rejected based on the outcomes of the research. This means that environmental sustainability, public safety, and affordable housing may not have a large impact on the availability and quality of public transportation. The relevance of this research conclusion is that policymakers and stakeholders may need to investigate other aspects that may affect public transit availability and quality. It may also suggest that gains in environmental sustainability, public safety, and affordable housing do not always result in an increase in public transportation availability and quality. As a result, authorities may need to take a more complex and diverse approach to resolving challenges connected to the availability and quality of public transport. It is crucial to highlight that the conclusions of this research may vary depending on the context and may not be generalizable across other areas or nations. Furthermore, the extent and quality of the data utilised, as well as the technique used, may limit the scope and quality of the study. As a result, more investigation is required.

### 4.2.3 Relation between Energy Consumption, availability and quality high speed internet, Air Quality, and Affordable housing

#### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.524 <sup>a</sup>	.274	.246	.786

- a. Predictors: (Constant), How would you rate the air quality in your city or town?, How would you rate the availability and quality of high-speed internet in your city or town?, How would you rate the availability of affordable housing in your city or town?

Table 4.2.3.1: Model Summary of Dependable variable energy consumption.

#### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.833	.338		2.466	.016
	How would you rate the availability and quality of high-speed internet in your city or town?	.193	.086	.228	2.250	.027
	How would you rate the availability of affordable housing in your city or town?	.258	.102	.272	2.538	.013
	How would you rate the air quality in your city or town?	.166	.068	.251	2.444	.017

- a. Dependent Variable: How would you rate the energy consumption and efficiency in your city or town?

Table 4.2.3.2: Coefficients of Dependable variable energy consumption

#### Finding & Recommendation:

As per the data drawn from the analysis, energy consumption and efficiency are the dependent factors, while high-speed internet availability and quality, cheap housing, and air quality are the independent variables. In this example, the null hypothesis asserts that there is no meaningful association between the dependent and independent variables. However, the phrase implies that the null hypothesis is rejected based on the test's significance. This means that there is a link between energy usage and efficiency, as well as the availability and quality of high-speed internet, affordable housing, and air quality. This discovery has major consequences for policymakers and stakeholders concerned with energy use and efficiency. It implies that advances in the availability and quality of high-speed internet, inexpensive housing, and air travel would be beneficial. Improved high-speed internet connection, for example, may lead to higher use of smart home technologies, which may assist optimize energy consumption. Improvements in air quality and inexpensive housing, on the other hand, may

minimize the demand for energy-intensive cooling and heating systems, resulting in energy savings. It should be noted that the link between energy consumption and efficiency, as well as the independent factors, can be complicated and diverse. More study may be required to investigate the underlying causal processes of this connection and to uncover potential trade-offs and synergies between different policy approaches. Nonetheless, the rejection of the null hypothesis shows that increases in the availability and quality of high-speed internet, cheap housing, and air quality can have a major impact on energy usage and efficiency.

#### 4.2.4 Relation between Energy Consumption, availability and quality high speed internet, Air Quality, and Affordable housing

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.708 <sup>a</sup>	.502	.489	.719

a. Predictors: (Constant), How would you rate the waste management in your city or town?, How would you rate the availability of affordable housing in your city or town?

Table 4.2.4.1: Model Summary for dependable variable Water supply & Sanitation

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.211	.306		.689	.493
	How would you rate the availability of affordable housing in your city or town?	.200	.092	.189	2.176	.033
	How would you rate the waste management in your city or town?	.670	.095	.612	7.037	.000

a. Dependent Variable: How would you rate the water supply and sanitation in your city or town?

Table 4.2.4.2: Coefficients of dependable variable Water supply & Sanitation

### Finding & Recommendation:

The dependent variables are water supply and sanitation, whereas the independent variables are affordable housing and waste management. In this example, the null hypothesis asserts that there is no meaningful association between the dependent and independent variables. However, the phrase implies that the null hypothesis is rejected based on the test's significance. This means that there is a strong link between water supply and sanitation, as well as cheap housing and waste management. This discovery has substantial implications for water supply and sanitation policymakers and stakeholders. It implies that improvements in affordable housing and waste management might result in an increase in water supply and sanitation. Improving waste management practices, for example, can help to prevent pollution and water contamination, while improving affordable housing can increase access to safe and reliable water supply and sanitation services. It should be noted that the link between water supply and sanitation, as well as the independent variables, can be complicated and diverse. More study may be required to investigate the underlying causal processes of this connection and to uncover potential trade-offs and synergies between different policy approaches. Nonetheless, the rejection of the null hypothesis suggests that improvements in affordable housing and waste management can have a significant impact on water supply and sanitation, and policymakers and stakeholders may need to take a more integrated approach to addressing these interrelated issues.

### 4.2.5 Relation between Skilled Labour, Availability of funds, interests among citizens and political stability

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.615 <sup>a</sup>	.378	.354	.536

a. Predictors: (Constant), How do you perceive the political stability in your city or town?, What is the level of interest among citizens in your city or town in participating in smart city initiatives?, How do you perceive the availability of funds for smart city initiatives in your city or town?

Table 4.2.5.1: Model Summary for dependable variable Skilled Labour

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.407	.273		1.492	.140
	How do you perceive the availability of funds for smart city initiatives in your city or town?	.303	.108	.282	2.795	.007
	What is the level of interest among citizens in your city or town in participating in smart city initiatives?	.307	.083	.372	3.712	.000
	How do you perceive the political stability in your city or town?	.122	.069	.163	1.757	.083

a. Dependent Variable: How would you rate the availability of skilled labor in your city or town?

Table 4.2.5.2: Coefficients of dependable variable skilled labour



### Finding & Recommendation:

Skilled labour is the dependent variable, while the availability of finances for smart cities and citizen interest are independent factors. Furthermore, political stability is an independent variable that is believed to have no link with skilled labour. However, based on the study's significance, the null hypothesis for skilled labour is rejected, with the availability of funding for smart cities and citizen interest as independent variables. This shows that there is a considerable link between the availability of cash for smart cities and the amount of citizen interest. The null hypothesis for skilled labour and political stability, on the other hand, is kept, implying that there is no substantial association between these two variables. This means that political stability may not be as important in recruiting skilled labour to a region or city. This discovery has significant implications for policymakers and stakeholders that are interested in attracting skilled labour to their area or city. It implies that investments in smart city projects and public participation might help recruit competent labour. Offering incentives to digital firms or constructing research and development centres, for example, might entice qualified labour to relocate to an area or city. Involving individuals in decision-making and public policy discussions may also contribute to the development of a lively and innovative community. Other factors, including as infrastructure, education, and social welfare programs, may impact the link between skilled labour and the independent variables. More study may be required to investigate the underlying causal processes of this connection and to uncover potential trade-offs and synergies between different policy approaches. Nonetheless, the rejection of the null hypothesis for skilled labour in relation to the availability of money for smart cities and the amount of public engagement implies that these factors can have a major impact on the availability of skilled labour in an area or city.

#### 4.2.6 Relation between Political stability, availability of funds for smart city, interests among citizens and Affordable housing

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.305 <sup>a</sup>	.093	.058	.866

a. Predictors: (Constant), How would you rate the availability of affordable housing in your city or town?, What is the level of interest among citizens in your city or town in participating in smart city initiatives?, How do you perceive the availability of funds for smart city initiatives in your city or town?

Table 4.2.6.1: Coefficients of dependable variable Political Stability.

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.156	.463		2.500	.015
	How do you perceive the availability of funds for smart city initiatives in your city or town?	.217	.174	.151	1.249	.021
	What is the level of interest among citizens in your city or town in participating in smart city initiatives?	.107	.133	.097	.806	.043
	How would you rate the availability of affordable housing in your city or town?	.171	.103	.183	1.657	.012

a. Dependent Variable: How do you perceive the political stability in your city or town?

Table 4.2.6.2: Coefficients of dependable variable Political Stability

**Finding & Recommendation:**

Political stability is the dependent variable, whereas funding availability, citizen interest, and affordable housing are independent factors. The null hypothesis asserts that no meaningful link exists between the dependent and independent variables. The null hypothesis, however, is rejected based on the test's significance, demonstrating that there is a substantial association between political stability and the independent variables. This discovery has far-reaching consequences for policymakers and stakeholders concerned with political stability. It implies that the availability of cash, the degree of interest among individuals, and the availability of inexpensive housing may all have a substantial impact on political stability in an area or country. A shortage of affordable housing, for example, can contribute to social discontent and political instability, whereas a high degree of citizen involvement in public affairs can assist establish a more stable and democratic society. Furthermore, the availability of fund can have an influence on the government's ability to provide fundamental services and infrastructure, which in turn can have an impact on political stability. For example, if a government is unable to provide fundamental services such as healthcare, education, and transportation, residents may become dissatisfied, undermining political stability. However, other factors like as economic development, social welfare programs, and international ties may alter the association between political stability and the independent variables. More study may be required to investigate the underlying causal processes of this connection and to uncover potential trade-offs and synergies between different policy approaches. Nonetheless, the rejection of the null hypothesis implies that the availability of finances, the degree of interest among residents, and cheap housing can all have a major impact on political stability. In order to foster political stability and build a more resilient society, policymakers and stakeholders may need to take a more integrated approach to addressing these interconnected concerns.

### 4.3 Limitation of the study

As with any research work, various limitations must be addressed while analyzing the findings. Some of the possible limits of a research on the problems and concerns of smart cities in India may include:

- Sampling bias: The sample for this study is likely to be limited to people who have internet connection and are willing to take an online survey. This might skew the results since people who are less engaged or involved in the issue may not participate, resulting in an unrepresentative sample.
- Self-selection bias: Those who choose to participate in the survey are more likely to have strong opinions on the subject, which might skew the results one way or the other.
- Response bias: Even with proper language and instructions, there is always the possibility that respondents will perceive questions differently or answer incorrectly.
- Limited scope: While the poll includes a variety of smart city characteristics, it may not cover all of the intricacies and complexity of the issue. Furthermore, the study is confined to a set time period, thus future improvements in the subject may be missed.
- Reliance on self-report data: As with any survey, the data collected is based on respondents' self-reports, which may or may not be completely accurate or indicative of their real behaviors or experiences.
- The study is confined to a specific community (Indian inhabitants) and may not be generalizable to other communities or circumstances.

Despite these limitations, the study might nevertheless give useful insights into the problems and concerns confronting India's smart cities. Researchers may guarantee that the results are as accurate and relevant as feasible by being honest about the limits and taking measures to minimize any biases. Furthermore, future research may build on this study's findings and broaden the scope to include other characteristics or populations, furthering our understanding of smart cities and their administration

## CHAPTER 5

### CONCLUSION

In conclusion, the Smart Cities Mission has provided a framework for Indian cities to modernize and develop further by leveraging technology and innovation. The initiatives taken by smart cities in India, such as Surat, Bhubaneswar, Indore, and Pune, are a testament to the potential of the Smart Cities Mission to transform Indian cities into sustainable, resilient, and livable urban centres. The study found that population density, availability of skilled labour, digital literacy, availability of funds, and citizen participation were significant factors affecting the success of smart city initiatives in India. The availability and quality of public transportation and digital literacy level, availability of funds for smart city initiatives and political stability, and availability of skilled labour and level of interest in participating in smart city initiatives were identified as key factors that influence the success of smart city initiatives in India.

Smart city initiatives require significant investments in infrastructure and technology. However, in India, the availability of funds for smart city initiatives is limited. Therefore, attracting private investments and exploring alternative sources of funding is crucial to managing smart cities in India. The government should also consider providing incentives to private investors to encourage them to invest in smart city projects. The study also found that citizen participation is a critical factor in the success of smart city initiatives. Citizens should be involved in the planning and implementation of smart city projects to ensure that their needs and preferences are taken into account. The government should also provide citizens with the necessary tools and resources to participate in smart city initiatives, such as digital literacy programs and online platforms for feedback and engagement.

Another crucial aspect for the success of smart city projects is the presence of qualified workforce. The government ought to allocate funds towards training initiatives aimed at cultivating the essential skills and knowledge needed for effectively executing and overseeing smart city initiatives. The private industry has the potential to make a substantial contribution by offering training and job prospects for skilled workers in the smart city field. The research also indicated that the success of smart city projects depends significantly on the accessibility and standard of public transportation. The government ought to put resources into enhancing public transportation infrastructure and services in order to promote the use of public transportation over privately owned vehicles. This will not just decrease traffic jams and air pollution but also enhance the overall quality of urban life. In conclusion, the research determined that the success of smart city initiatives relies heavily on digital literacy. It is important for the government to fund digital literacy programs so that citizens can acquire the right skills and knowledge for effective use of digital technologies. This will enhance involvement of citizens in smart city projects, as well as boost digital equality and decrease the digital gap within urban areas.

In conclusion, the Smart Cities Mission has the potential to transform Indian cities into sustainable, resilient, and livable urban centres. However, the successful implementation of smart city initiatives requires addressing several challenges and issues, such as the availability of funds, skilled labour, and citizen participation. The government should take a holistic approach to managing smart cities in India, involving citizens, private investors, and the public sector to ensure the long-term sustainability and success of smart city initiatives.

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## Appendix

### Questionnaire Survey

#### **1. Age Group**

1. 10-20
2. 20-30
3. 30-40
4. 40-50

#### **2. What is the population density of your city or town?**

1. Less than 5,000 people per square kilometer
2. 5,000 - 10,000 people per square kilometer
3. 10,000 - 20,000 people per square kilometer
4. More than 20,000 people per square kilometer

#### **3. How would you rate the availability and quality of public transportation in your city or town?**

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

#### **4. What is the percentage of the population in your city or town that is digitally literate?**

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

#### **5. How would you rate the availability and quality of high-speed internet in your city or town?**

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

#### **6. How do you perceive the availability of funds for smart city initiatives in your city or town?**

1. More than enough
2. Adequate
3. Insufficient
4. Very Insufficient

#### **7. How would you rate the availability of skilled labor in your city or town?**

1. abundant
2. Adequate
3. Insufficient

4. Very Insufficient

**8. What is the level of interest among citizens in your city or town in participating in smart city initiatives?**

1. very interested
2. interested
3. Neutral
4. not very interested
5. not interested at all

**9. How do you perceive the political stability in your city or town?**

1. very stable
2. stable
3. moderately stable
4. stable
5. very unstable

**10. How would you rate the level of environmental sustainability in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor
5. Very poor

**11. How would you rate the availability of affordable housing in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor
5. Very poor

**12. How would you rate the crime rate and public safety in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor
5. Very poor

**13. How would you rate the energy consumption and efficiency in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor
5. Very poor

**14. How would you rate the waste management in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor

5. Very poor

**15. How would you rate the water supply and sanitation in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor
5. Very poor

**16. How would you rate the air quality in your city or town?**

1. Excellent
2. Good
3. Average
4. Poor
5. Very poor