Major Research Project

on

Analysis on Challenges & Management issues of Smart Cities of India

Submitted By

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2K21/DMBA/052

Under the Guidance of

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Declaration

I, Ishant Mahalwar, hereby declare that the presented report of title **"Analysis on Challenges & Management issues of Smart Cities of India"** is uniquely prepared by me as a part of Master of Business Administration (MBA) curriculum of Delhi School of Management, DTU, 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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CERTIFICATE

This is to certify that **Mr. Ishant Mahalwar**, 2K21/DMBA/52 has completed the project **Analysis on Challenges & Management issues of Smart Cities of India** under the guidance of **Dr. Meha Joshi** as a part of Master of Business Administration (MBA) curriculum of Delhi School of Management, DTU, New Delhi. This is an original piece of work and has not been submitted elsewhere

Signature of Faculty Mentor

Dr. Meha Joshi

(Assistant Professor, DSM, DTU)

Signature of HOD

Dr. Archna Singh

(HOD, DSM,DTU)

Acknowledgement

I would like to express my heartfelt gratitude to Dr. Archna Singh, Head of Department (HOD) at DSM, and Dr. Meha Joshi, Assistant Professor at DSM, for their invaluable support throughout my MBA major research project.

Their unwavering guidance and encouragement have been instrumental in shaping this project and making it a success. Dr. Singh's extensive knowledge, expertise, and experience in the field of business management have been of immense help to me in understanding the intricacies of my research topic. Her continuous feedback and insights have been a great source of motivation and inspiration.

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I am also grateful to the entire faculty and staff at DSM for their support and encouragement during the course of my MBA program. The knowledge and skills that I have acquired under their mentorship will undoubtedly prove to be invaluable assets in my future career.

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. Archna Singh and Dr. Meha Joshi 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

This research project aims to investigate the challenges and issues faced by Smart cities in India. The project focuses on exploring the factors that affect the successful implementation of Smart city initiatives in India, such as the availability of funds, skilled labor, and political stability. The project also examines the impact of various smart city initiatives on the environment, crime rates, public safety, and energy consumption.

Smart cities have emerged as a promising solution to improve the quality of life of urban citizens in India. However, the implementation and management of smart city projects come with several challenges and issues. This research project aims to study the challenges and issues of smart cities in India and provide insights to address them effectively. A survey-based approach was used to collect data from residents of smart cities in India. The collected data was analyzed using various statistical techniques, including descriptive statistics, t-tests, chi-square tests, and regression analysis. 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 findings of this study can be beneficial for policymakers, urban planners, and other stakeholders to enhance the implementation and management of smart city projects in India.

While the concept of smart cities has the potential to bring numerous benefits, the implementation and operation of smart cities in India face several challenges and issues. These challenges include inadequate funding, lack of skilled human resources, political instability, and resistance to change. Additionally, the success of smart cities depends on the acceptance and participation of citizens, and hence, their perceptions and attitudes towards smart city initiatives are also crucial.

This research project aims to study the challenges and issues faced by smart cities in India. The project will utilize a questionnaire-based survey to collect data from residents of selected smart cities in India, which will be analyzed using various statistical techniques, including descriptive statistics, chi-square tests, t-tests, and regression analysis. The results of this research will provide valuable insights into the challenges and issues faced by smart cities in India and help in identifying potential solutions.

List of Figures:

List of Tables:

Table of Content

CHAPTER 1

INTRODUCTION

In recent years, the concept of smart cities has gained significant attention in India as the country rapidly urbanizes. A smart city is a city that utilizes advanced technology and data analytics to optimize its operations and services, enhance the quality of life of its residents, and ensure sustainable development. While smart cities have the potential to bring numerous benefits, they also face several challenges and issues that need to be addressed for their successful implementation and operation.

This research project aims to study the challenges and issues faced by smart cities in India. The project will utilize a questionnaire-based survey to collect data from residents of selected smart cities in India, which will be analysed using various statistical techniques, including descriptive statistics, chi-square tests, t-tests, and regression analysis. The results of this research will provide valuable insights into the challenges and issues faced by smart cities in India and help in identifying potential solutions.

1.1 Background

India has been experiencing rapid urbanization over the past few decades, with an estimated 34% of the population living in urban areas as of 2018. This has led to a host of challenges related to infrastructure, transportation, housing, and sustainability, among others. In response to these challenges, the Indian government launched the Smart Cities Mission in 2015, with the goal of developing 100 smart cities across the country. India is one of the fastest-growing economies in the world, and its urban population is expected to reach 600 million by 2030. The rapid urbanization has resulted in significant challenges related to infrastructure, traffic congestion, air pollution, and access to basic services such as water and sanitation. The concept of smart cities is seen as a potential solution to these challenges, as it utilizes advanced technology and data analytics to optimize the use of resources and services, enhance the quality of life of residents, and promote sustainable development.

The Smart Cities Mission is a comprehensive program aimed at transforming Indian cities into sustainable and liveable urban centres that can provide a high quality of life to their residents. The mission is based on the principles of citizen participation, smart solutions, and integrated planning, and aims to leverage technology and innovation to address the complex challenges facing Indian cities. The Government of India launched the Smart Cities Mission in 2015, with

the objective of developing 100 smart cities across the country. Under the Smart Cities Mission, each city is required to develop a Smart City Proposal, which outlines a roadmap for its transformation into a smart city. The proposals are based on a set of core infrastructure elements, including water supply, sanitation, solid waste management, efficient urban mobility, affordable housing, and robust IT connectivity and digitalization. The Smart Cities Mission has attracted significant private sector investment, with companies such as Cisco, IBM, and Siemens partnering with Indian cities to develop and implement smart solutions. The mission has also generated interest from international organizations and governments, with countries such as the United States, Japan, and Germany offering technical and financial support.

As of 2021, 100 cities have been selected under the Smart Cities Mission, with projects worth over INR 2 lakh crore ($26.8 billion) in various stages of implementation. While the mission has faced some challenges, including delays in project implementation and limited citizen participation, it has the potential to transform Indian cities into more sustainable, resilient, and liveable urban centres. The Smart Cities Mission aims to transform Indian cities into sustainable and liveable urban centres by leveraging technology and innovation to address the complex challenges facing them. The mission has identified a set of core infrastructure elements that are critical to the development of smart cities, including water supply, sanitation, solid waste management, efficient urban mobility, affordable housing, and robust IT connectivity and digitalization. Several smart cities in India have initiated projects in these areas to modernize and develop further. For instance, the city of Surat in Gujarat has implemented a smart water management system that uses sensors and real-time monitoring to reduce water wastage and ensure efficient distribution. The city has also developed a mobile app that allows citizens to track their water usage and pay bills online. Similarly, the city of Bhubaneswar in Odisha has implemented a smart traffic management system that uses real-time data to regulate traffic flow and reduce congestion. The system also includes a mobile app that provides citizens with real-time information on traffic conditions and suggests alternate routes.

In the area of solid waste management, the city of Indore in Madhya Pradesh has implemented a smart waste management system that uses GPS-enabled trucks and sensors to track waste collection and disposal. The system also includes a mobile app that allows citizens to report any waste-related issues in their locality. Another example is the city of Pune in Maharashtra, which has implemented a smart parking system that uses sensors to monitor parking spaces and provides citizens with real-time information on parking availability. The system also

allows citizens to book parking spaces in advance and pay for them using a mobile app. Apart from these specific initiatives, many smart cities in India are also working on developing sustainable and eco-friendly urban infrastructure, promoting public transportation and active mobility, and enhancing citizen engagement and participation in city planning and governance.

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 liveable urban centres.

1.2 Problem Statement

While the concept of smart cities has the potential to bring numerous benefits, the implementation and operation of smart cities in India face several challenges and issues. These challenges include inadequate funding, lack of skilled human resources, political instability, and resistance to change. Additionally, the success of smart cities depends on the acceptance and participation of citizens, and hence, their perceptions and attitudes towards smart city initiatives are also crucial.

1.3 Objective of the study

The objective of this 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 project will focus on smart cities in India, and the findings may not be generalizable to other cities or regions in the country. The study will utilize a questionnaire-based survey to collect data from residents of smart cities in India, and hence, the findings will be based on self-reported data. Additionally, the study will not cover the entire spectrum of challenges and issues faced by smart cities in India, but will focus on selected variables identified through the questionnaire.

CHAPTER 2
LITERATURE REVIEW

Smart cities are an innovative way of managing urban growth and development. Smart cities leverage the power of digital technologies and data-driven decision-making to create sustainable, liveable, and inclusive urban spaces. India is one of the fastest-growing economies in the world, with a rapidly growing population. The Indian government has launched the Smart Cities Mission to transform 100 cities into smart cities. However, the success of this mission depends on several factors. In this literature review, we will examine the challenges and management of smart cities in India based on various data analysis techniques.

- **Population Density**
  India is the second-most populous country in the world, and its population is expected to reach 1.7 billion by 2050. This rapid growth is putting immense pressure on cities, resulting in overcrowding and urban sprawl. The high population density in cities leads to a shortage of resources, including housing, water, and sanitation. Therefore, the availability of affordable housing is one of the most significant challenges in managing smart cities in India.

  Using descriptive statistics, we can analyse the population density in Indian cities. For example, we can calculate the mean, median, and mode of population density in different cities. This can help us identify cities that are more densely populated and, therefore, have a greater need for smart city initiatives. We can also use a chi-square test to examine the relationship between population density and the availability of affordable housing. This can help us understand the extent to which population density affects the availability of affordable housing.

- **Availability and Quality of Public Transportation**
  The availability and quality of public transportation is essential in smart cities. It is a critical factor in reducing traffic congestion and air pollution. However, in India, the public transportation system is not adequately developed. The majority of people still rely on private vehicles, leading to traffic congestion and increased air pollution. Therefore, the availability and quality of public transportation need to be improved to make Indian cities smarter. Using descriptive statistics, we can analyse the availability and quality of public transportation in different cities. For example, we can calculate the mean, median, and mode of the number of buses, trains, and other forms of public

transportation in different cities. We can also use a correlation test to examine the relationship between the availability of public transportation and air pollution. This can help us understand the extent to which the availability of public transportation affects air pollution levels.

- **Digital Literacy Level**
  Digital literacy level refers to the ability of individuals to use digital technologies effectively. It is a critical factor in the success of smart cities, as most smart city initiatives rely on the use of digital technologies. However, in India, the digital literacy level is low. Only a small percentage of the population has access to high-speed internet and the necessary digital skills. Therefore, improving digital literacy levels is a significant challenge in managing smart cities in India.

  Using descriptive statistics, we can analyze the digital literacy level in different cities. For example, we can calculate the mean, median, and mode of the percentage of the population with access to high-speed internet and digital skills in different cities. We can also use a t-test to examine the difference in digital literacy levels between different age groups. This can help us understand the extent to which age affects digital literacy levels.

- **Availability and Quality of High-Speed Internet**
  High-speed internet is a critical component of smart cities. It enables the use of digital technologies and data-driven decision-making. However, in India, the availability and quality of high-speed internet are not adequate. The majority of the population still relies on low-speed internet, leading to slow data transfer and processing. Therefore, improving the availability and quality of high-speed internet is a significant challenge in managing smart cities in India.

  Using descriptive statistics, we can analyze the availability and quality of high-speed internet in different cities. For example, we can calculate the mean, median, and mode of internet speeds in different cities. We can also use a correlation test to examine the relationship between the availability of high-speed internet and the level of interest in participating in smart city initiatives. This can help us understand the extent to which the availability of high-speed internet affects the level of interest in smart city initiatives.

- **Availability of Funds for Smart City Initiatives**
  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.

  Using descriptive statistics, we can analyze the availability of funds for smart city initiatives in different cities. For example, we can calculate the mean, median, and mode of the amount of funds allocated for smart city initiatives in different cities. We can also use a t-test to examine the difference in the amount of funds allocated for smart city initiatives between cities with high and low GDP. This can help us understand the extent to which GDP affects the availability of funds for smart city initiatives.

- **Availability of Skilled Labor**
  Smart city initiatives require skilled labor to implement and maintain. However, in India, the availability of skilled labor is limited. Therefore, developing skills among the workforce and attracting skilled workers is essential to managing smart cities in India. Using descriptive statistics, we can analyze the availability of skilled labor in different cities. For example, we can calculate the mean, median, and mode of the percentage of the population with the necessary skills for smart city initiatives in different cities. We can also use a chi-square test to examine the relationship between the availability of skilled labor and the level of interest in participating in smart city initiatives. This can help us understand the extent to which the availability of skilled labor affects the level of interest in smart city initiatives.

- **Level of Interest in Participating in Smart City Initiatives**
  The success of smart city initiatives depends on the level of interest and participation from citizens and stakeholders. Therefore, understanding the level of interest in participating in smart city initiatives is crucial to managing smart cities in India. Using descriptive statistics, we can analyze the level of interest in participating in smart city initiatives in different cities. For example, we can calculate the mean, median, and mode of the percentage of the population interested in participating in smart city initiatives in different cities. We can also use a correlation test to examine the relationship between the level of interest in participating in smart city initiatives and the level of political stability. This can help us understand the extent to which political stability affects 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

8

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 and interviews. 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 qualitative data for this study is collected through semi-structured interviews with experts in the field of urban planning and development, smart city project managers, and government officials responsible for the implementation of smart city initiatives. The interviews are conducted 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 quantitative data collected from the survey questionnaire is analyzed using SPSS. Descriptive statistics are used to analyze the demographic characteristics of the respondents and the variables of interest. Inferential statistics, such as t-tests and chi-square tests, are used to test the hypotheses and examine the relationships between the variables. The qualitative data collected from the interviews is analyzed using thematic analysis. The transcribed data is coded and grouped into themes and sub-themes. The themes and sub-themes are then analyzed and interpreted to draw conclusions and insights from the data.

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 on Challenges and Management issues of Smart Cities in India", 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.
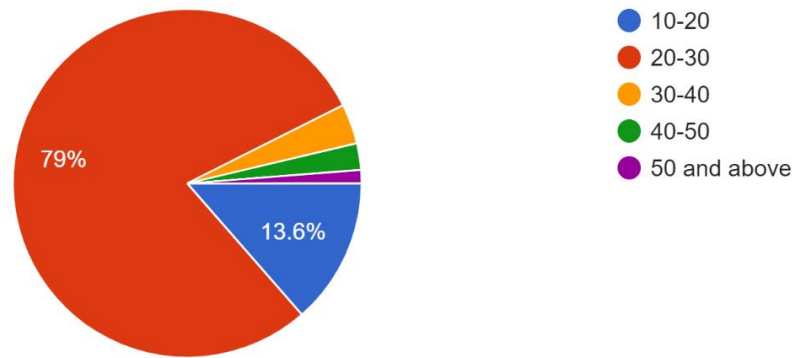
Age Group
81 responses

Figure 4.1.1: Age group of survey Participants.

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

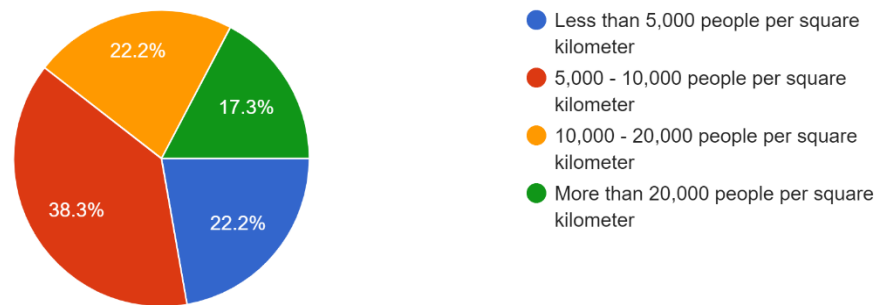What is the population density of your city or town?
81 responses

Figure 4.1.2: population density of city or 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

Figure 4.1.3: availability and quality of public transportation in city or 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
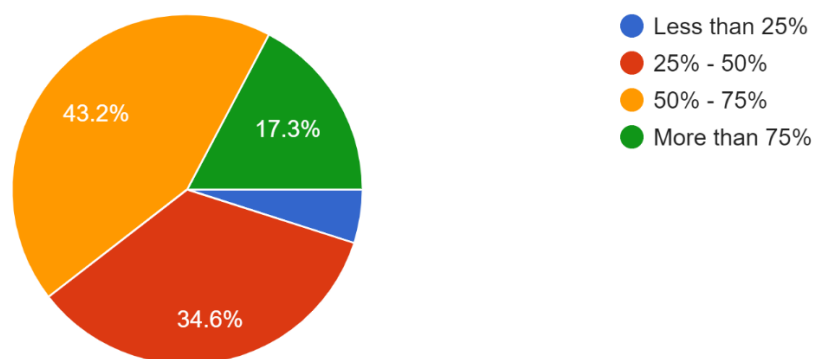
Figure 4.1.4: percentage of the population in city or town that is digitally literate.

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

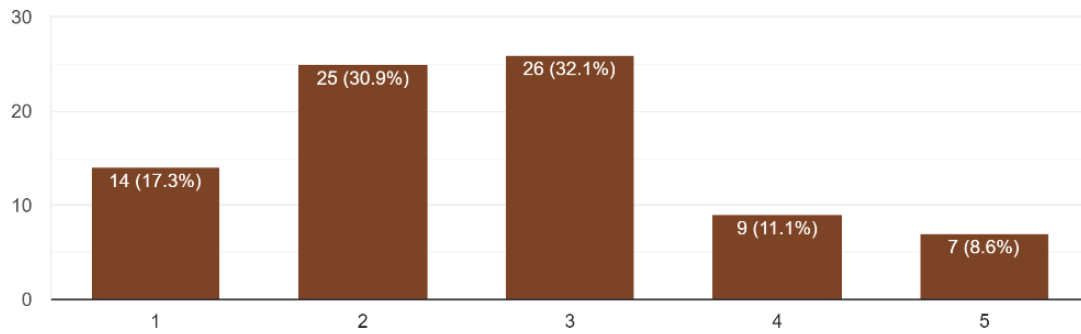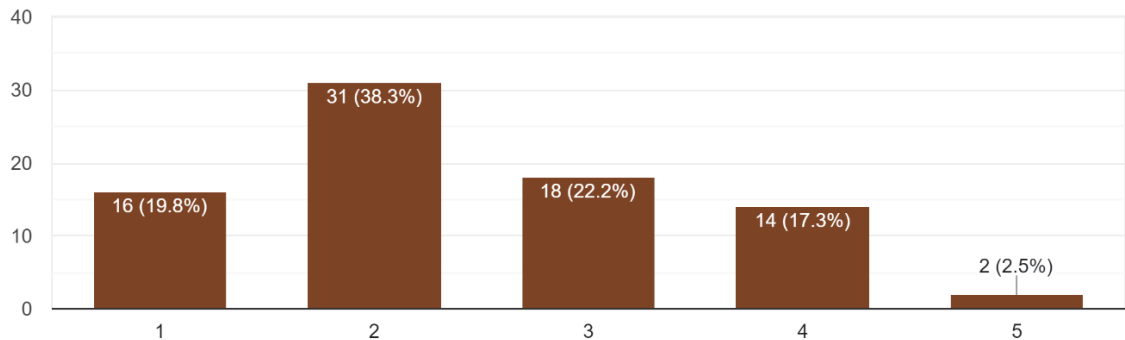
Figure 4.1.5: availability and quality of high-speed internet in city or town.

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
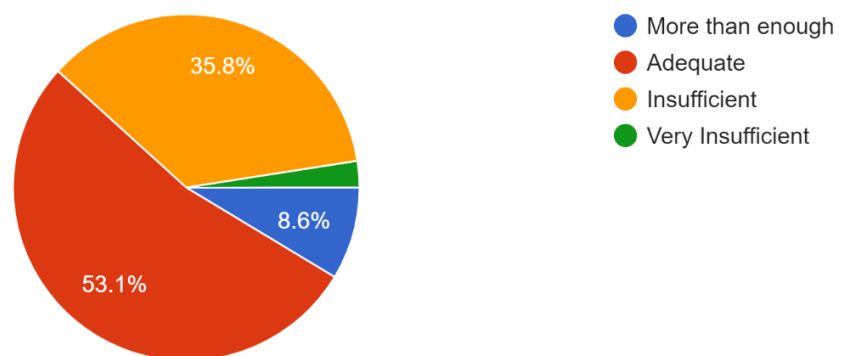
Figure 4.1.6: availability of funds for smart city initiatives in city or town.

G) "Adequate" level of availability is reported in participants smart cities followed by "Insufficient", where as people also thought the availability to be "Abundant"

How would you rate the availability of skilled labor in your city or town?
81 responses
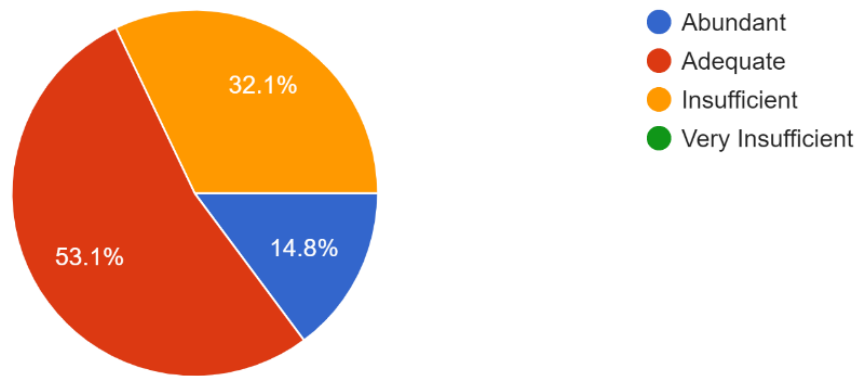
Figure 4.1.7: availability of skilled labour in city or town.

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
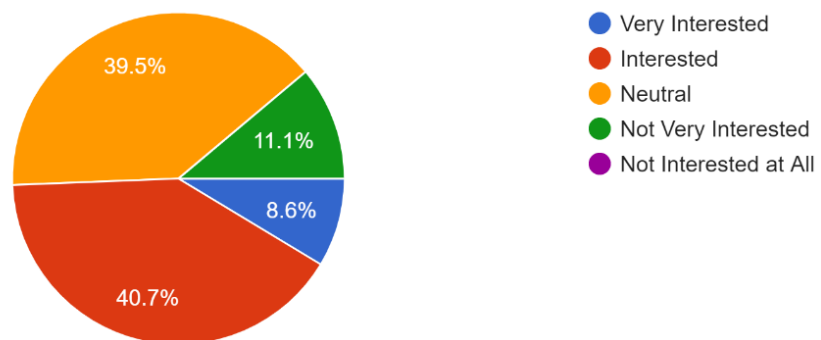
Figure 4.1.8: level of interest among citizens in your city or town in participating in smart city initiatives.

I) Most of the participants reported the political stability in their region to be majorly "Stable" followed by "Moderately Stable" and then "very stable".

How do you perceive the political stability in your city or town?
81 responses
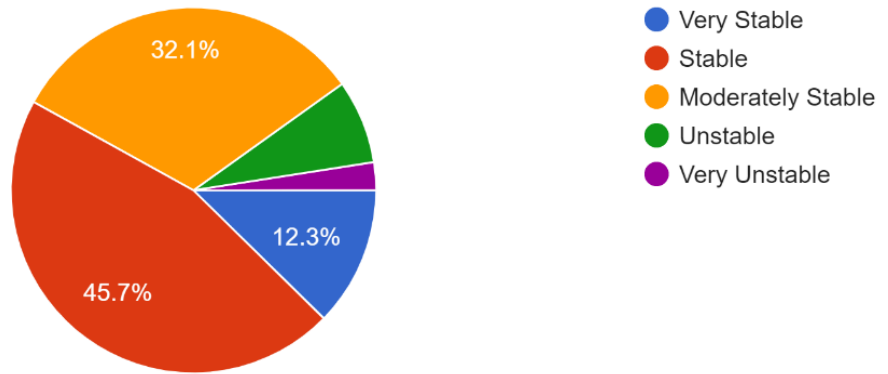
Figure 4.1.9: political stability in your city or town.

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

How would you rate the level of environmental sustainability in your city or town?
81 responses
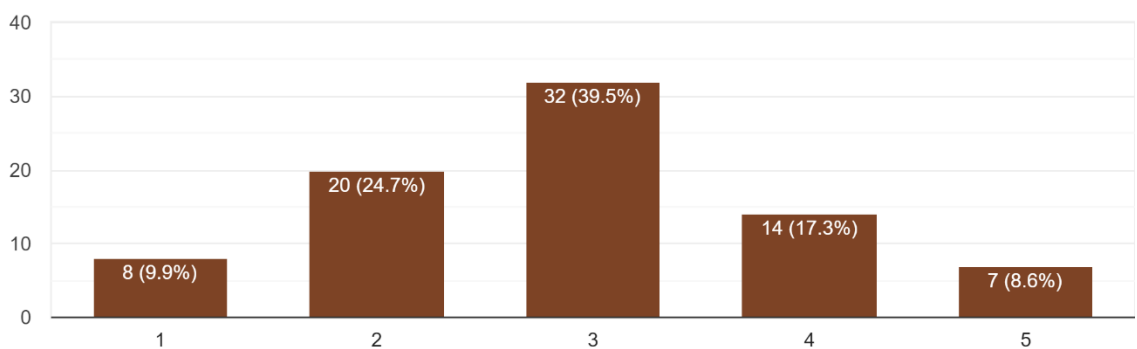
Figure 4.1.10: level of environmental sustainability in your city or town.

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
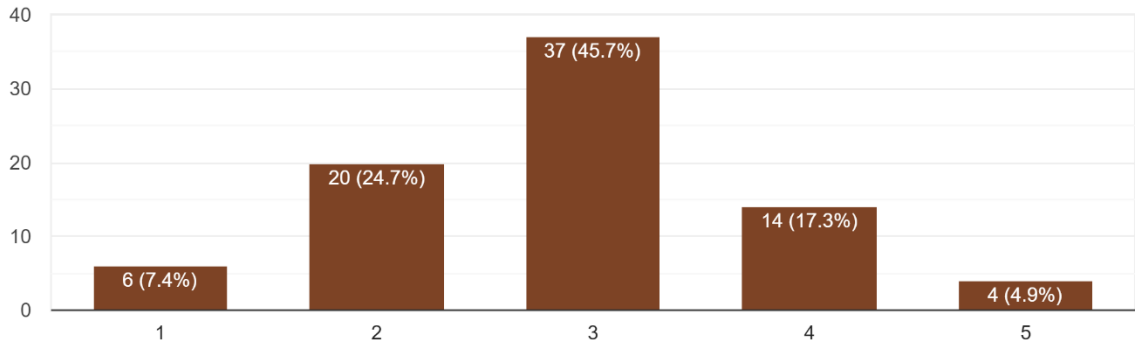
Figure 4.1.11: availability of affordable housing in your city or town.

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
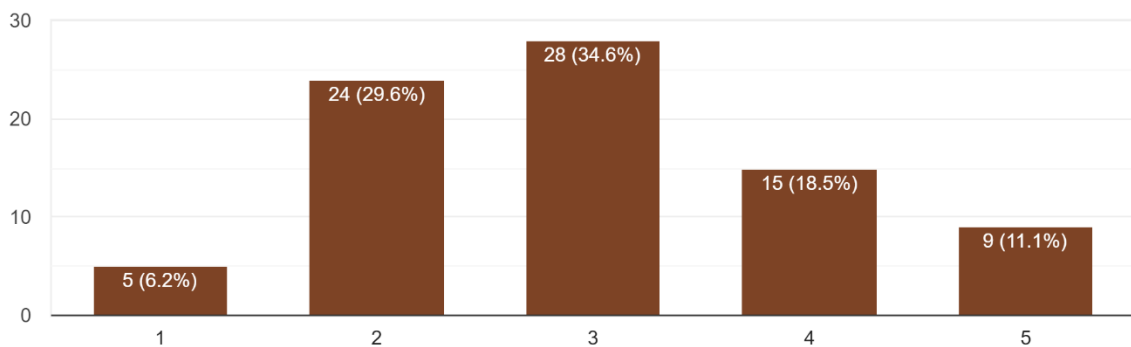
Figure 4.1.12: the crime rate and public safety in your city or town.

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".

How would you rate the energy consumption and efficiency in your city or town?
81 responses
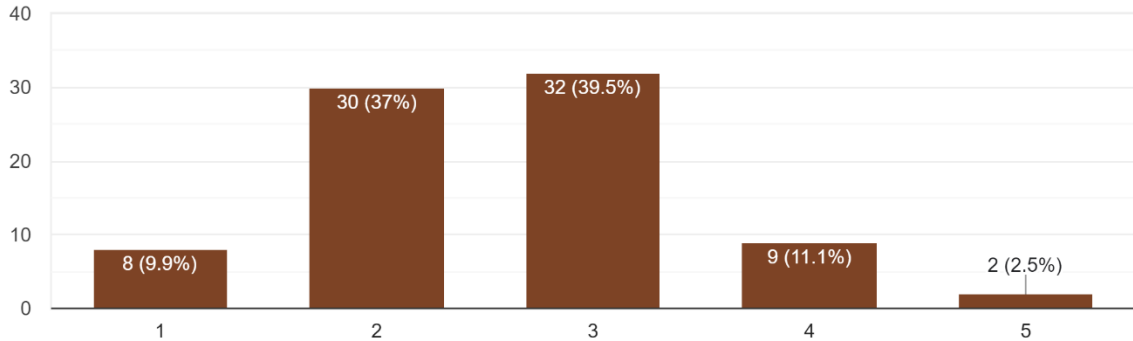
Figure 4.1.13: energy consumption and efficiency in your city or town.

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".

How would you rate the waste management in your city or town?
81 responses
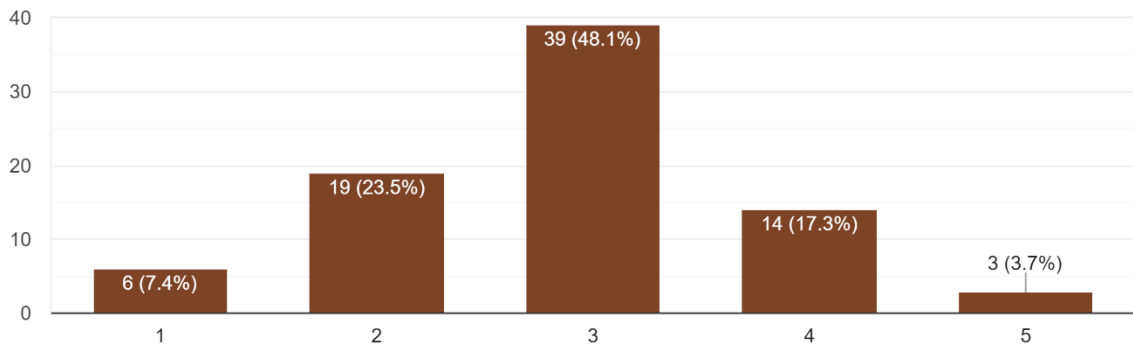
Figure 4.1.14: waste management in your city or town.

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".

How would you rate the water supply and sanitation in your city or town?
81 responses
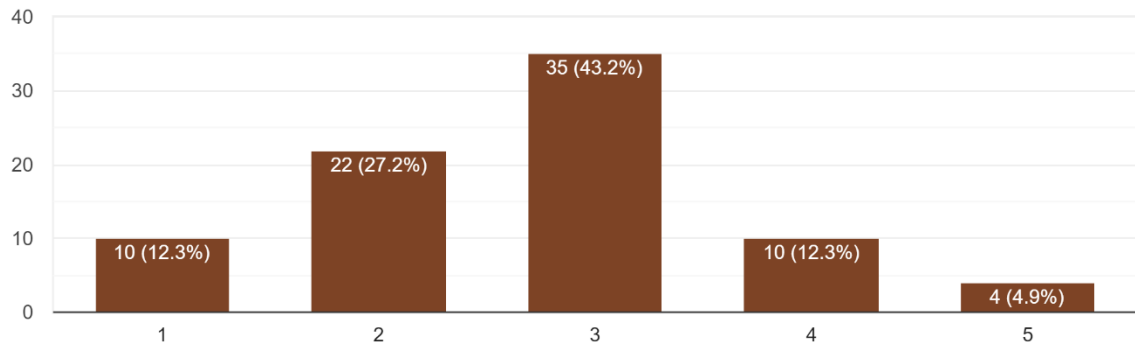
Figure 4.1.15: water supply and sanitation in your city or town.

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
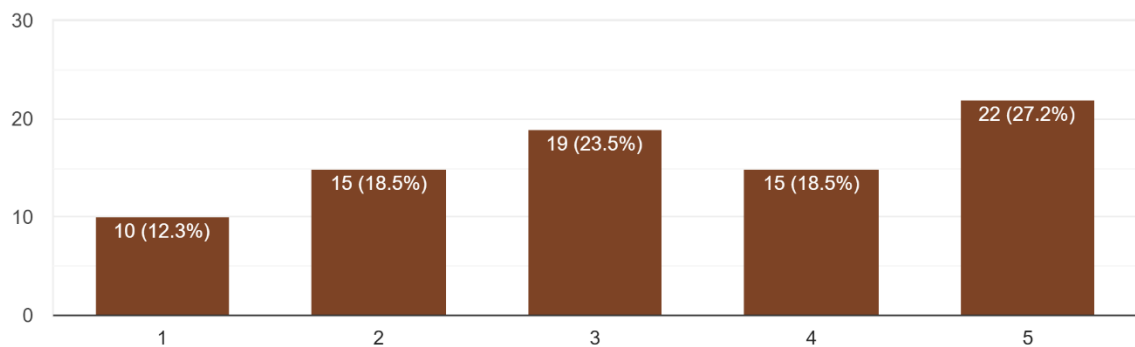
Figure 4.1.16: air quality in your city or town.

Here,

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

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.

<u>What exactly is Multiple linear regression?</u>

Linear regression is a statistical technique that attempts to demonstrate a link between variables. It examines several data points and draws a trend line. Finding that the cost of fixing a piece of machinery grows over time is a basic example of linear regression.

Linear regression is used to assess the nature and degree of the relationship between a dependent variable and a set of other independent variables. Before attempting to fit a linear model to the observed dataset, it is necessary to determine whether or not the variables are related. Of course, this does not imply that one variable causes the other, but there should be some sort of relationship 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 :

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.599ª	.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.

Coefficientsª

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 organisations 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	.308ª	.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.

Coefficientsª

Model		Unstandardized Coefficients		Standardized 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[a]	.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[a]

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 optimise energy consumption. Improvements in air quality and inexpensive housing, on the other hand, may minimise 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[a]	.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[a]

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 practises, 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[a]	.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[a]

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' 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 programmes, 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 Summary

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

Table 4.2.6.1: Coefficients of dependable variable Political Stability.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
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 programmes, 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 analysing 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 behaviours 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 minimise 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 liveable 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 critical factor in the success of smart city initiatives is the availability of skilled labour. The government should invest in training programs to develop the necessary skills and expertise required for the successful implementation and management of smart city projects. The private sector can also play a significant role in providing training and employment opportunities for skilled labour in the smart city sector. The study also found that the availability and quality of public transportation are essential factors in the success of smart city initiatives. The government should invest in improving public transportation infrastructure and services to encourage citizens to use public transportation instead of private vehicles. This will not only reduce traffic congestion and air pollution but also improve the overall quality of life in cities.Finally, the study found that digital literacy is a critical factor in the success of smart

city initiatives. The government should invest in digital literacy programs to ensure that citizens have the necessary skills and knowledge to use digital technologies effectively. This will not only improve citizen participation in smart city initiatives but also promote digital inclusion and reduce the digital divide in cities.

In conclusion, the Smart Cities Mission has the potential to transform Indian cities into sustainable, resilient, and liveable 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.

REFERENCES

Attaran, H., Kheibari, N., & Bahrepour, D. (2022, January 20). *Toward integrated smart city: A new model for implementation and design challenges - geojournal*. SpringerLink. https://link.springer.com/article/10.1007/s10708-021-10560-w

A review on Smart Cities in India: Mission and challenges - ijcrt.org. (n.d.). https://ijcrt.org/papers/IJCRT2105996.pdf

Kemu Digital Repository Home. (n.d.). http://repository.kemu.ac.ke:8080/xmlui/

Price competition between supply chains under crossed structure | IEEE ... (n.d.-b). https://ieeexplore.ieee.org/document/5317419/

Cable News Network. (n.d.). *All about: Cities and energy consumption*. CNN. http://edition.cnn.com/2007/TECH/12/31/eco.cities/.

Smart city: Challenges and opportunities' experiences from European ... (n.d.-c). https://www.researchgate.net/publication/321635702_Smart_City_Challenges_and_Op portunities'_Experiences_from_European_Smart_Cities_Projects

Ethos - researchgate. (n.d.-b). https://www.researchgate.net/profile/Shrikrishna-Mahajan/publication/318380515_Women_Empowerment_through_SHGs_-_A_Case_Study_in_Kolhapur_District/links/59666dd6458515e9af9912a1/Women-Empowerment-through-SHGs-A-Case-Study-in-Kolhapur-District.pdf

Nathvani, R. (2017, April 29). *Smart Cities in India: Key issues of management and challenges*. Academia.edu. https://www.academia.edu/32720179/Smart_Cities_in_India_Key_Issues_of_Managem ent_and_Challenges

Development of Smart Cities in India – dream to reality - researchgate. (n.d.-b). https://www.researchgate.net/publication/306140084_Development_of_Smart_Cities_i n_India_-_Dream_to_Reality

Smart Cities in India - terienvis.nic.in. (n.d.-e). http://www.terienvis.nic.in/WriteReadData/links/Smart%20Cities%20in%20India_Rep ort_pagewise-5937837909069130880.pdf

Core – aggregating the world's Open Access Research Papers. (n.d.-b). https://core.ac.uk/download/pdf/199214854.pdf

The implementation of sustainability in highway projects - wit press. (n.d.-h). https://www.witpress.com/Secure/ejournals/papers/SDP040101f.pdf

Smart Cities in India: Practices, policies, current status and gaps. (n.d.-g). https://eudl.eu/pdf/10.4108/eai.27-2-2020.2303203

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