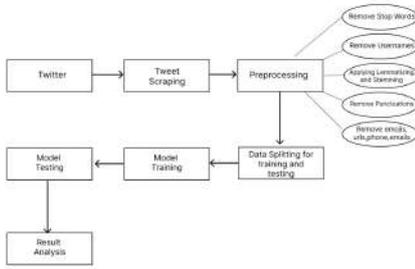


Abstract

The aim of this project is to examine the government policies aimed at implementing digitalization in the current government processes and their impact on the lives of the general public. This study involves a comparative analysis of five cities in Europe that are known for their effective execution of smart city policies. This includes examining correlations between various smart city parameters in cities in India and Europe. A smart city index has been developed based on the outcomes, which indicates the relative positioning of both economies. To gain insight into the public's reaction and reviews of the measures taken by the government to bring digitalization to its offering, a sentiment analysis based on tweets posted on Twitter has been conducted. An attempt has been made to identify the key factors that the public considers vital for smart cities by classifying and quantifying probability in past surveys. Paris has the highest rating among its peers due to its continuously improving policies that strive for efficiency. India urgently needs to direct more of its resources towards building a smart ecosystem, as people still look up to its western contemporaries for better living standards. To build effective smart cities, economic expansion needs to be practiced within a framework.

Sentiment Analysis Workflow



Methodology

Parameter	Index Used
Population	Population Density
Education	Literacy Rate
Development	Per Capita Income
Employment	Employment Rate
Energy	CO2 Emissions
Health	Life Expectancy Rate
Infrastructure	GDP
Sustainability	Inflation Rate
Crime	Crime Rate
Environment	Air Quality Index

Various socio-economic development factors against their evaluation indexes

The analysis examines the correlation between socio-economic development factors, including population, education, development, employment, energy, health, industrialization, crime, economy, and environment. The Pearson Correlation Coefficient is utilized to generate heatmaps and quantify the strength of the linear relationship between two variables. The heat maps offer insights into how changes in one factor can impact others, aiding in policy development aimed at promoting socio-economic development and enhancing well-being. The selected time period for analysis is between 2016-2022.

Introduction

The emergence of digital technologies has transformed the way governments operate, leading to more efficient and effective service delivery. However, prior to the widespread use of technology, government operations were mostly manual and paper-based, with data and information stored in physical files and folders. This often led to slow and bureaucratic processes, long waiting times, and inefficiencies in service delivery. The lack of technology also created challenges in accessing government services, communication with government officials, and participating in the democratic process. In this context, this article explores the impact of digital governance on service delivery, citizen satisfaction, and the overall efficiency of government operations.

Study Area

This study analyzes the impact of digitalization on governance in ten smart cities worldwide: Delhi, Chennai, Kolkata, Mumbai, Indore, Paris, London, Barcelona, Berlin, and Amsterdam. These cities were chosen based on their efforts towards implementing smart city technologies and their diverse demographic, geographic, and economic characteristics. The research focuses on publicly available data, reports, and case studies related to digital governance in the selected cities, comparing Europe and India, with India looking to Europe for its governance practices, social welfare systems, and experience in implementing digital solutions.

Category ID	Category Name	Items
1	Spices	No less than 100gms (ground)
2	Masala	A concoct of your favorite blend
3	Aromatics	A bouquet of your favorite herbs and spices
4	Books	A bouquet for your favorite bookish
5	Accessories	An addition about your favorite author
6	Restaurants	A bouquet for your favorite restaurant
7	Information Services	The best of your web, blog, or online (in real-time)
8	News and Current Affairs	The globalized reader for the year
9	Events	Local news
10	Crimes	Cultural activities for the general public

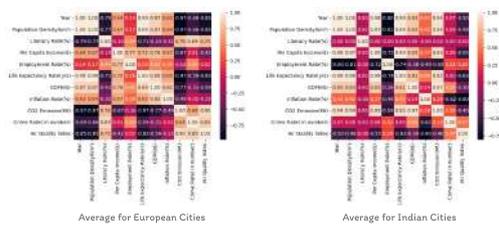
Clustering different items into the above given categories

A dataset was selected for the year 2022 to analyze cities around the world, excluding India. The dataset was analyzed based on six factors, namely Smart Mobility, Smart Environment, Smart Government, Smart Economy, Smart People, and Smart Living. To calculate the Smart City Index of Indian cities, a linear regression model was created using the dataset, and the resulting values were scaled down to a range of 0 to 1. This approach allows for a more comprehensive and comparative analysis of the selected cities and provides a framework for assessing their smart city capabilities.

Parameter	Index
Smart Mobility	Index calculated from assessment of city-wide public transportation systems, ICT accessibility in structures.
Smart Environment	Index calculated from environmental sustainability, recycling, renewable resources and energy management.
Smart Government	Index calculated from transparency and management of services, e-governance, citizen participation in decision-making, and budget allocation.
Smart Economy	Index calculated through global comparison of city-wide productivity, economic vitality and support for entrepreneurship and innovation.
Smart People	Index calculated by considering social and cultural stability, education systems and its supporting facilities, health care services, and quality of life.
Smart Living	Index calculated for assessing public safety and security, social services, and housing quality.

Various smart city evaluation factors against their calculation indexes

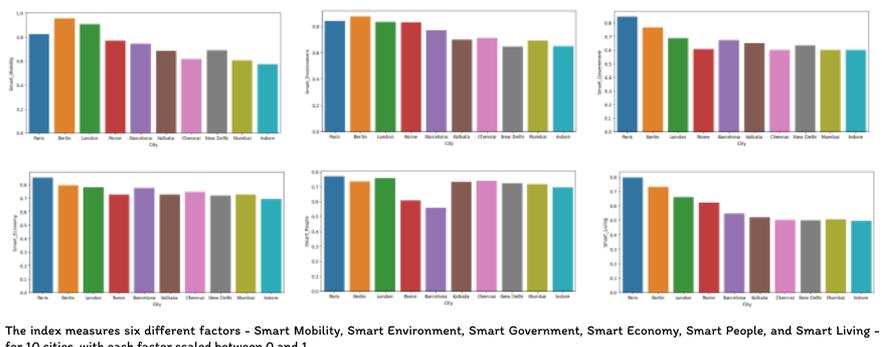
Result



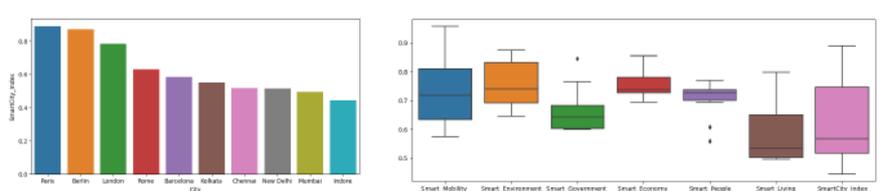
These figures represent two heatmaps, one representing the average of top five smart cities globally (Fig. 1) and the other representing the average of Indian cities (Fig. 2). The heatmaps display correlations between variables with darker colors indicating stronger positive correlations and lighter colors indicating negative correlations.

There are some similarities between the two heatmaps. Firstly, both figures display a positive correlation between year and GDP, as well as between population density and various economic indicators. Secondly, both figures demonstrate that literacy rate is positively correlated with economic and environmental indicators, while it is negatively correlated with crime rate.

The two heatmaps have some differences. In Fig. 1, the employment rate is positively correlated with GDP and inflation rate, while in Fig. 2, it is negatively correlated with GDP and CO2 emissions. CO2 emissions are negatively correlated with most variables in Fig. 1, but in Fig. 2, they are positively correlated with year, population density, and GDP. Crime rate is negatively correlated with most variables in Fig. 1, while in Fig. 2, it is positively correlated with employment rate.

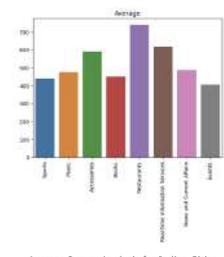


- The index measures six different factors - Smart Mobility, Smart Environment, Smart Government, Smart Economy, Smart People, and Smart Living - for 10 cities, with each factor scaled between 0 and 1.
- Smart Mobility** - Smart Mobility is a crucial factor for a city's development as it focuses on providing efficient, sustainable, and accessible transportation systems. According to the table, Berlin has the highest score for Smart Mobility. Among Indian cities, New Delhi has the highest score.
 - Smart Environment** - Smart Environment focuses on creating sustainable living conditions and promoting a healthier environment. Berlin has the highest score for Smart Environment, followed by Paris and Rome. Among Indian cities, Chennai has the highest score for Smart Environment.
 - Smart Government** - Smart Government focuses on utilizing technology to provide better public services and governance. Paris has the highest score for Smart Government, followed by Berlin and London. Among Indian cities, Kolkata has the highest score for Smart Government.
 - Smart Economy** - Smart Economy focuses on promoting economic growth, creating job opportunities, and improving living standards. Paris has the highest score for Smart Economy, followed by Berlin and London. Among Indian cities, Chennai has the highest score for Smart Economy.
 - Smart People** - Smart People focuses on promoting education, health, and social inclusion. Paris has the highest score for Smart People, followed by London and Berlin. Among Indian cities, Chennai has the highest score for Smart People, followed by Kolkata and New Delhi.
 - Smart Living** - Smart Living focuses on providing a comfortable and safe living environment for citizens. Paris has the highest score for Smart Living, followed by Berlin and London. Among Indian cities, Kolkata has the highest score for Smart Living, followed by Mumbai and Chennai.



The analysis shows that Paris and Berlin are the smartest cities overall, while Kolkata is the smartest Indian city and Indore has the lowest overall score. Factors like Smart Mobility, Smart Environment, and Smart People were common strengths among high-scoring cities. Indian cities could improve in Smart Economy and Smart Living.

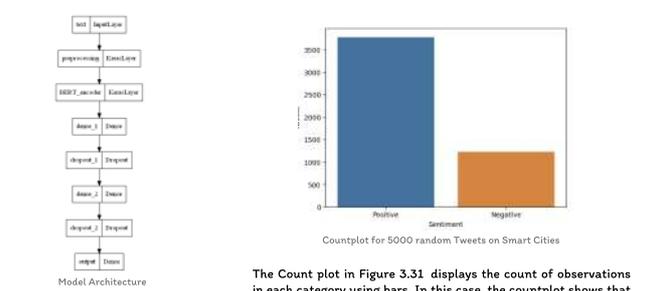
Survey



This bar chart displays the results of a survey conducted in five Indian cities to determine the level of satisfaction among residents in relation to the concept of smart cities. The sample size for the survey was 860 respondents in each city.

- Mumbai & Chennai consistently has the highest satisfaction rates across most categories, except for Books.
- Indore has high satisfaction rates for Accessories and Books, but ranks lower in other categories.
- Delhi and Kolkata have lower satisfaction rates overall, ranking last in most categories.
- Restaurants are the most satisfying category overall, followed by Accessories, Real-time Information Services, and Music.
- Sports and Events are the least satisfying categories overall, with satisfaction rates below 45% in all cities.

Model



After being trained on 7000 tweets, the model attained a training accuracy of 0.8921 and loss of 0.2914. Subsequently, it was tested on 3000 tweets and achieved a testing accuracy of 0.9203. The f1 score for both classes was 0.92, indicating that the model is performing well in terms of precision and recall for both classes.

The Count plot in Figure 3.31 displays the count of observations in each category using bars. In this case, the countplot shows that there were 3782 positive responses (represented by the value 1) and 1218 negative responses (represented by the value 0) for a sample of random tweets on smart cities. This countplot signifies the sentiment of the sample of tweets towards smart cities. The majority of the responses were positive, which could suggest that people generally have a favorable view towards smart cities and the idea of incorporating technology and innovation into urban development.

Conclusion

In conclusion, this study has highlighted the importance of digitalization in transforming the economy and improving the lives of the general public. Through a comparative analysis of five cities in Europe, a smart city index has been developed to indicate the relative positioning of India and Europe. The results showed that India needs to direct more resources towards building a smart ecosystem, as its western contemporaries are ahead in terms of smart city policies and implementation. The sentiment analysis based on Twitter has provided insight into the public's reaction and reviews of the measures taken by the government, and the key factors considered vital for smart cities have been identified through past surveys. The findings of this study can assist policymakers and stakeholders in making informed decisions to improve the implementation of digitalization policies and build effective smart cities. Economic expansion needs to be practiced within a framework to ensure sustainable development and to address the challenges faced by cities in the future. Further research can focus on exploring the challenges and opportunities for implementing digitalization policies in developing countries and how to ensure inclusivity and equity in the process.