A Study on Assessment of Smart Cities in Select Sectors - Hyderabad Vs Select Cities

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ABSTRACT: *A smart city is referred as an urban region which is spectacularly advanced in terms of infrastructure, communication, technology and sustainability.If India has to truly derive the full potential of the scheme of 'smart cities', it is very important to do an all-inclusive assessment to reveal a clear situation of the current state, technology contribution and contribution towards smart city of the identified smart cities with regard to the defined sectors.*

The present paper focuses on comprehensive assessment of the scores (considering weights) of the identified ten smart cities with regard to the defined sectors. The present article analyses the quality of life in the city on the basis of sectors like power, water, transportation and sustainability. The paper also presents Hyderabad's position amongst the select cities with regard to the transformation towards smart city. The study is based on secondary, the literature on the subject and relevant information available in the World Wide Web. For statistical analysis, Two-way ANOVA has been used. The suggestions would help city administrators and policymakersto comprehend thepresent and emerging needs of the city and help in formulating strategies to make it more prosperous, sustainable and attractive while proceeding towards the welfare of its inhabitants and communities.

Keywords: Smart Cities, scores, urban, sectors and development

I. INTRODUCTION:

A Smart city can be identified as the integrated management of the information which helps in creating a value by the use of advanced technologies. A city is referred as smart in terms of infrastructure quality, planned and better quality of life along with the various provisions of transportation, water supply, entertainment, safety and security and good government governance. In our country, it is evident that the shift in population from rural area to urban areas is in large numbers. This aspect is predominantly referred as urbanization.
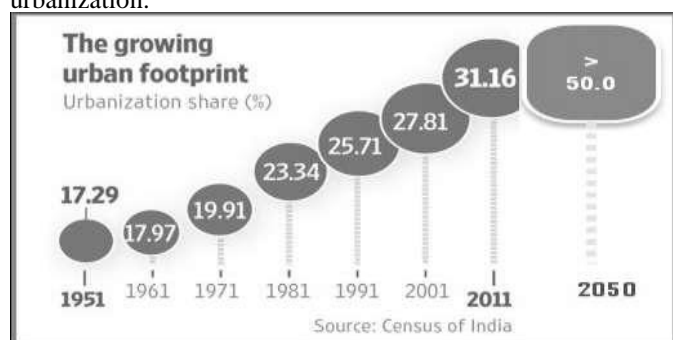
As per the census of India, urban population increased from 286 million in the year 2001 to 377 million in the year 2011 which accounts to 31.2% and it is estimated that the population would increase to 40% by 2030 and more than 50% by 2050.

In India the phase wise evolution from good to smart cities started in the year 2000. Later in the year 2010 the concept of smart governance gained importance.

In the year 2014-15 our Prime Minister Narendra Modi set a vision to build 100 smart cities in the country. Eight pillars of India's smart city program are Smart Governance, Smart Environment, Smart Transportation, Smart Energy Smart IT & Communications, Smart Buildings, Smart Education and Smart Health Hospitals. Smart cities are referred as the engines of economic growth.

A. **Key concepts**:

Current state is the level of city's performance and quality of service delivery across the selected benchmark. It includes various components such as smart city proposal interventions as preparedness to transform into a smart city.

State of technology or technological interventions refers to the state and use of technological solutions for various operations of the city in providing services. Consideration for the use of electronic and digital technologies in communities and the use of ICT to transform life and working environment. Contribution to smart city refers to the contribution made by individual benchmarks related to city operations.

II. LITERATURE REVIEW:

Many research papers focused on the evolution of the concept smart cities, communities and urbanization, ICT and SCM.

"The cities of the 21st century are the largest sites of human settlement today, and are increasingly acting as critical nexus points of, economic, ecological, social and technological change." - United Nations Environment Program (UNEP).

GOI (2014) The main goal of Smart Cities Mission (SCM), to create cities with smart physical, social institutional and economic infrastructure. Smart cities would offer a good quality and affordable housing, cost efficient infrastructure with adequate water and electric supply, health care, security, quality education and efficient urban mobility.

Parishwad, singh (2014) focused on anlaysing the ideal variables for rating a smart city. Unique factors were considered for the study – Human diversity, city resilience, ICT impact on urban area and physical- social networks. The paper attempted to arrive at a line of action for urban planning in infrastructure sector.

Chandramouli, 2011 India is urbanizing at the rate of 2.47% and Nearly 31.3% that is 37.71 million of its total 1.21 billion populations is now stays in urban area.

According to McKinsey Global report ,2010 by 2025 it will add 215 million to its total cities which will raise the urban population to 38 percentages. Not only this, by 2025 Mumbai and Delhi, its two megacities will become number two and three in the world ranking with expected population of 26.4 and 22.5 million respectively.

Caragliu et al.,(2011), In mid 2000s the concept of ICT , E-governance and smart cities was first embraced in Europe.

Aijaz and Hoelscher (2015) role of current government plays a major part to clear issues related to participation, improved local governance and to strengthen civil society participation.

Dupont(2015) Smart cities mission is focused mainly towards area – based approach and elimination of middle and upper class which have been prevailing in India.

Earlier researchers focused on theoretical aspects of smart cities covering definitions, variables, strategies, issues and challenges towards smart cities. This paper mainly focuses on assessment of select smart cities based on few selected parameters.

III. OBJECTIVES OF THE STUDY:

- ➢ To study and assess the scores of the select smart cities in India.
- ➢ To analyse the quality of life in the smart cities bases on identified sectors.
- ➢ To compare the smart cities and identify the position of Hyderabad city based on defined sectors.

IV. RESEARCH METHODOLOGY:

At Present around 31% of the total population lives in cites. By 2030 it is projected that almost 50% of the population will live in cities. With respect to smart cities, an initiative to convert 100 cities to smart cities by 2018, it is crucial to do a comprehensive assessment to reveal a clear situation of the current state, technology contribution and contribution towards smart city of the identified smart cities with regard to the defined sectors.

The present paper focuses on comprehensive assessment of the scores (considering weights) of the identified ten smart cities with regard to the defined sectors. The present paper analyses the quality of life in the city on the basis of sectors like power, water, transportation and hospitals. The paper also presents Hyderabad's position amongst the select cities with regard to the transformation towards smart city. The entire study is based on the secondary data as given in PwC (PricewaterhouseCoopers) Report for 2016 and literature on the subject and relevant information gathered from the World Wide Web. Data is analysed by statistical analysis using Two-way ANOVA .The recommendations would help policymakers and city administrators to understand current state and emerging needs of the city which assist in developing various strategies to make it more attractive, prosperous and sustainable while advancing towards the well being of its citizens and communities.

V. HYPOTHESES

A. *Transport Sector*:
H01: There is no significant difference between the components relating to Transport Sector.
H11: There is a significant difference between the components relating to Transport Sector.
H02: There is no significant difference between regions relating to Transport Sector.
H12: There is a significant difference between regions relating to Transport Sector.

B. *Power Sector*
H03: There is no significant difference between the components relating to Power Sector.
H13: There is a significant difference between the components relating to Power Sector.
H04: There is no significant difference between the regions relating Power Sector.
H14: There is a significant difference between the regions relating to Power Sector.

C. *Water Sector*
H05: There is no significant difference between the components relating to Water Sector.
H15: There is significant difference between the components relating to Water Sector.
H06: There is no significant difference between regions Water Sector.
H16: There is significant difference between regions Water Sector.

D. *Sustainability*
H07: There is no significant difference between the components relating to Sustainability Dimension.
H17: There is significant difference between the components relating to Sustainability Dimension.
H08: There is no significant difference between regions Sustainability Dimension.
H19: There is significant difference between regions Sustainability Dimension.

VI. DATA ANALYSIS AND INTERPRETATION

The data on the select sectors, viz., Transport, Power, Water and Sustainability for India and other Geographical regions are given in Table 1. The data relate to the average unweighted score obtained from the Current state, Technology intervention and Contribution towards smart city. The data are given city-wise, comprising Hyderabad, Mumbai, Delhi, Ahmedabad, Surat, Kolkata, Pune, Jaipur, Chennai and Bengaluru.

While numerous state governments have announced their smart city plans, the approach to become a 'smart city' has been different. The select cities have been doing well or have the potential to the idea of smart cities. The above cities are considerably doing good in economic, urban and social components.

The effectiveness of the strategies of tenselect cities in one-year period is evaluated which provides an indication of the study for other cities to emulate.

The data in Table 1-4 shows that in the case of Transport Sector, Hyderabad ranks 2nd amongst the various cities. In Power section,Hyderabad stands in the 2nd position when compared to other citiesas well. It is observed that Hyderabad is in 3rd position in case of Water sector. For the dimension of Sustainability, Hyderabad's rank is overall 3rd.

Table I: Transport Sector Average Weight Scores for Hyderabad and other Cities

	Hyderabad (Hyd)	Mumbai	Delhi	Ahmedabad	Surat	Kolkata	Pune	Jaipur	Chennai	Bengaluru	Rank of Hyd
Transport Surveillance: Traffic violation detection,speed violation detection, traffic signal violation detection	2	1.7	1.7	2	2	1.7	1.4	1.4	1.7	2.6	2
Challan management	1.7	2	2	2	1.7	1.7	1.4	1.7	2.6	1.7	2
Traffic management system	2.4	2.4	2.4	2.4	2.4	2.1	1.8	2.1	2.4	2.4	1
Parking management	1.4	1.4	1.7	1.7	1.7	1.7	1.4	1.7	1.7	1.7	2
Access to para-transit	1.4	2	1.7	1.7	1.7	1.4	1.7	1.4	1.4	1.7	3
Availability and frequency of mass transport	1.4	2.3	2	1.7	2	1.7	1.7	1.4	2.3	2	4
Availability of bicycle tracks	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1
Unobstructed footpaths of minimum 2m width on either side of all streets	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1
Adherence to building and parking standards	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.7	1.4	2

Table II: Electricity Sector Average Weight Scores for Hyderabad and other Cities

	Hyderabad (Hyd)	Mumbai	Delhi	Ahmedabad	Surat	Kolkata	Pune	Jaipur	Chennai	Bengaluru	Rank of Hyd
24*7 electricity supply	2	3	3	2.7	2.7	3	3	2.4	2.7	2.4	4
Quality	3	2.3	2	2.3	2.3	2.3	2.3	2	2	2	1
Distribution losses	2.4	3	2.7	2.4	2.7	3	3	2.4	2.7	2.4	3
Energy consumption details	3	2.7	2.7	2.1	2.4	2.7	2.7	2.4	3	2.7	1
Online payment facility	2.7	3	3	3	3	3	3	2.4	3	3	2
Grievance redressal or CRM for citizens	2.7	3	2.7	2.7	3	3	3	2.4	3	3	2
Metering	2.7	2.7	2.7	2.4	2.4	3	2.7	2.4	2.7	2.4	2
Energy efficiency intiatives:Street, renewable,subsidy and green buildings	2	1.7	2	2	1.7	2	1.7	1.4	1.7	2	1
Billing efficiency	2.3	2	2.3	2.3	2.3	2.3	2	2.6	2	2.3	2
Revenue realisation	2	2	2.3	2	2.3	2.3	2	2	2	2.3	2

Table III: Water Sector Average Weight Scores for Hyderabad and other Cities

	Hyderabad (Hyd)	Mumbai	Delhi	Ahmedabad	Surat	Kolkata	Pune	Jaipur	Chennai	Bengaluru	Rank of Hyd
24*7 water supply	1.8	2.4	2.4	2.1	1.8	2.4	2.4	1.8	2.1	2.1	3
Metering of water connections	1.4	1.7	1.7	1.7	1.7	1.7	1.7	1.4	1.7	1.7	2
Billing efficiency	1.7	1.7	1.7	1.7	1.4	2	1.4	2	2	2	2
Online payment facility	2.7	2.7	3	2.7	3	2.4	2.1	1.8	2.4	2.4	2
Water losses	2.4	2.1	2.1	2.1	1.8	2.7	1.8	1.8	1.8	1.8	2
Revenue realisation	1.4	2.3	2.3	2	1.4	2	1.7	1.4	2	1.7	4

Table IV: Sustainability Average Weight Scores for Hyderabad and other Cities

	Hyderabad	Mumbai	Delhi	Ahmedabad	Surat	Kolkata	Pune	Jaipur	Chennai	Bengaluru	Rank of Hyd
Noise pollution	1.4	1.4	1.7	1.7	2	1.7	1.4	2	1.7	1.7	3
Air pollution	1.7	1.4	1.4	1.7	1.4	1.4	1.4	2.1	1.7	1.4	2
Adherence to the green building norms	2.1	2.1	1.8	1.8	1.7	1.8	1.8	2.1	1.8	1.8	1
Water pollution	1.8	1.4	1.4	1.7	2.1	2	1.4	2.7	2	2	4

Overall for the all the four sectors referred above Hyderabad stands above the average level and is moving towards Smart City.

The hypotheses taken for the study has been tested using Two-way ANOVA tools. The output is given in tables 5-12. The results are summarised in Table- 13.It is also observed that there is a significant difference between various components relating to Transport Sector. This is due to the fact that different components are covered in the sector which gives the holistic picture of the sector.It is seen that there is significant difference between regions relating to Transport Sector. From Table 5,we find the average for Hyderabad as 1.611 across the regions i,e 5th position. Developmentis observed towards smart city due to the Government initiatives like traffic signal camera, Metro rail project and intelligent transport system.

Table V: Transport Sector: Descriptive Statistics

SUMMARY	Count	Sum	Average	Variance
Transport surveillance: Traffic violation detection,speed violation detection, traffic signal violation detection	10	18.2	1.82	0.124
Challan management	10	18.5	1.85	0.105
Traffic management system	10	22.8	2.28	0.044
Parking management	10	16.1	1.61	0.021
Access to para-transit	10	16.1	1.61	0.041
Availability and fequency of mass transport	10	18.5	1.85	0.105
Availability of bicycle tracks	10	14	1.4	5.4782E-32
Unobstructed footpaths of minimum 2m width on either side of all streets	10	14	1.4	5.4782E-32
Adherence to building and parking standards	10	14.3	1.43	0.009
Hyderabad	9	14.5	1.6111	0.13111
Mumbai	9	16	1.7777	0.166944
Delhi	9	15.7	1.74444	0.1152778
Ahmedabad	9	15.7	1.74444	0.1152778
Surat	9	15.7	1.74444	0.1152778
Kolkata	9	14.5	1.61111	0.056111
Pune	9	13.6	1.51111	0.0286111
Jaipur	9	13.9	1.54444	0.0602778
Chennai	9	16.6	1.84444	0.217778
Bengaluru	9	16.3	1.81111	0.1936111

Table VI: Transport Sector: ANOVA Results

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	6.646222	8	0.830777778	20.23545332	1.19461E-15	2.069831642
Columns	1.085	9	0.120555556	2.936400541	0.005047098	2.012704841
Error	2.956	72	0.041055556			
Total	10.687222	89				

Ahmedabad	10	23.9	2.39	0.107666667
Surat	10	24.8	2.48	0.150666667
Kolkata	10	26.6	2.66	0.156
Pune	10	25.4	2.54	0.249333333
Jaipur	10	22.4	2.24	0.122666667
Chennai	10	24.8	2.48	0.250666667
Bengaluru	10	24.5	2.45	0.125

It is also observed that there is a significant difference between various components relating to Power Sector. This is due to the fact that various components are covered in the sector which gives the overall picture of the sector. There is a significant difference between the regions relating to Power sector. From Table 7, we find the average for Hyderabad as 2.48 across the regions i,e 3rd position. Hyderabad is incorporating models based on principles of smart power generation, smart power grids, smart storage, and smart consumption.

Table VII: Power Sector: Descriptive Statistics

SUMMARY	Count	Sum	Average	Variance
24*7 electricity supply	10	26.9	2.69	0.114333333
Quality	10	22.5	2.25	0.091666667
Distribution losses	10	26.7	2.67	0.069
Energy consumption details	10	26.4	2.64	0.076
Online payment facility	10	29.1	2.91	0.041
Grievance redressal or CRM for citizens	10	28.5	2.85	0.045
Metering	10	26.1	2.61	0.041
Energy efficiency intiatives:Street, renewable,subsidy and green buildings	10	18.2	1.82	0.044
Billing efficiency	10	22.4	2.24	0.036
Revenue realisation	10	21.2	2.12	0.024
Hyderabad	10	24.8	2.48	0.157333333
Mumbai	10	25.4	2.54	0.249333333
Delhi	10	25.4	2.54	0.136

Table VIII: Power Sector: ANOVA Results

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	11.202	9	1.244667	24.3521 7391	1.37437E-19	1.9976091 47
Columns	1.098	9	0.122	2.3869 6522	0.0188412 68	1.9976091 47
Error	4.14	81	0.051111111			
Total	16.44	99				

There is a significant difference between various components relating to Water Sector. This is due to the fact that comprehensive picture of the sector is observed through the different components which are covered in the sector. It is seen that there is significant difference between regions relating to Water Sector. From Table 9, we find the average for Hyderabad as 1.9 across the regions i,e3rd position. It shows that there is a significant improvement in this sector. "Smart Water" which points to water and wastewater infrastructure and the energy which used to transport the same is managed effectively in Hyderabad.

Table IX: Water Sector: Descriptive Statistics

SUMMARY	Count	Sum	Average	Variance
24*7 water supply	10	21.3	2.13	0.069
Metering of water connections	10	16.4	1.64	0.016
Billing efficiency	10	17.6	1.76	0.056
Online payment facility	10	25.2	2.52	0.144
Water losses	10	20.4	2.04	0.096
Revenue realisation	10	18.2	1.82	0.124

Hyderabad	6	11.4	1.9	0.288
Mumbai	6	12.9	2.15	0.159
Delhi	6	13.2	2.2	0.24
Ahmedabad	6	12.3	2.05	0.135
Surat	6	11.1	1.85	0.351
Kolkata	6	13.2	2.2	0.132
Pune	6	11.1	1.85	0.123
Jaipur	6	10.2	1.7	0.06
Chennai	6	12	2	0.06
Bengaluru	6	11.7	1.95	0.075

Table X: Water Sector: ANOVA Results

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	5.0715	5	1.0143	14.99704288	1.1668E-08	2.422085466
Columns	1.5015	9	0.1668333	2.46673238	0.02217847	2.095755094
Error	3.0435	45	0.067633333			
Total	9.6165	59				

It is observed that there is a significant difference between various components relating to Sustainability dimension. This is due to the fact that different environmental issues have to be looked into to study the overall dimension. It is seen that there is significant difference between regions relating to Sustainability Dimension. From Table 11, we find the average for Hyderabad as 1.75 across the regions i,e 2nd position. It shows that there is a significant improvement in this dimension. The Government of Telangana has initiated various schemes to make Hyderabad liveable, connected, safe, clean and affordable.

Table XI: Sustainability Sector: Descriptive Statistics

SUMMARY	Count	Sum	Average	Variance
Noise pollution	10	16.7	1.67	0.049
Air pollution	10	15.6	1.56	0.056
Adherence to the green building norms	10	18.8	1.88	0.024

Water pollution	10	18.5	1.85	0.165
Hyderabad	4	7	1.75	0.083333333
Mumbai	4	6.3	1.575	0.1225
Delhi	4	6.3	1.575	0.0425
Ahmedabad	4	6.9	1.725	0.0025
Surat	4	7.2	1.8	0.1
Kolkata	4	6.9	1.725	0.0625
Pune	4	6	1.5	0.04
Jaipur	4	8.9	2.225	0.1025
Chennai	4	7.2	1.8	0.02
Bengaluru	4	6.9	1.725	0.0625

Table XII: SustainabilityDimension: ANOVA Results

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	0.69	3	0.23	5.069387755	0.00649057	2.960351318
Columns	1.421	9	0.1578889	3.48	0.00568 9009	2.250131477
Error	1.225	27	0.04537037			
Total	3.336	39				

Table XIII: Hypothesis – Conclusion

Sector	Null Hypothesis	P Value	Decision
Transport	1) There is no significant difference between the components relating to Transport Sector	1.19461E-15	Rejected
	2) There is no significant difference between regions relating to Transport Sector	0.005047098	Rejected

Power	1)There is no significant difference between the components relating to Power Sector	1.37437E-19	Rejected
	2) There is no significant difference between regions relating to Power Sector	0.018841268	Rejected
Water	1)There is no significant difference between the components relating to Water Sector	1.1668E-08	Rejected
	2)There is no significant difference between regions relating to Water Sector	0.02217847	Rejected
Sustainability	1)There is no significant difference between the components relating to Sustainability Dimension	0.006499057	Rejected
	2)There is no significant difference between regions relating to Sustainability Dimension	0.005689009	Rejected

VII. CONCLUSION

The analysis relating to Smart City in a national context reveal differences across regions and components in the case of Transport, Power, Water and Sustainability. Hyderabad is developing at a faster pace and moving towards Smart City. The city has taken various initiatives in order to promote urban development by being smart. Still, it has to focus on sectors on Transport and Power when compared to other city so that there would be a smooth transition of the city towards Smart City.

REFERENCES:

Parish wad, Singh "analysing and rating smart city development in India", journal of Civil Engineering and Environmental Technology. Vol. 1 no. 6 Aug, 2914 PP. 54-59.

Chandramouli, C. Rural urban distribution of population.<http://censusindia.gov.in/2011-prov results/paper2/data_files /india/Rural_Urban_2011.pdf>

Caragliu A, Del Bo C and Nijkamp P (2011) Smart Cities in Europe. *Journal of Urban Technology* 18(2):65–82.

Aijaz R and Hoelscher K (2015) *India's Smart Cities Mission: An Assessment*. ORF Issue Brief 124. ObserverResearcher Foundation: New Delhi.

DuPont V (2015) Secured residential enclaves in the Delhi region: Impact of indigenous and transnational models. *City, Culture and Society* (in press).

https://www.pwc.in/assets/pdfs/publications/2017/how-smart-are-our-cities.pdf