Challenges and Opportunities to Develop smart Cities In India: Case Study Of Kaval Cities, Uttar Pradesh

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Introduction

Urbanization has been a key driver of change in human societies, and previous two centuries have clearly observed the great change from mainly rural way of life to urban way of life. Around five percent of world population inhabited the urban areas in eighteenth century (Nel-lo, 2016;History Database of the Global Environment, 2010). But more people are living in cities currently. According to UN World Urbanization prospect, there was 55.3 percent of population lived in urban areas and projected to increase 60 percent up to 2030 and 70 percent till 2050. World has observed creation of more cities in past and it is expected that hundred more will be built in near future. These will be caused by tremendous increase in urban population due to excess of birth over death in cities, rural to urban migration and urbanization of suburbia and rural (Lerch, 2017). These phenomena will be more pronounced in case of developing countries like India, where the increase in the number of secondary and tertiary cities will retain most of the growing urban population that is around 2.5 billion people which accounts 90 percent of total addition urban population (United Nations, 2019).

Despite all the social, economic, political and environmentalproblem cities in India are experiencing, these have been emerged as strong centres of economic growth. To sustain the growth and managing the crumbling urban infrastructure and degrading intuitions has been the fascinating idea to rest upon. Transformation of the city is importantwith respect toupgradingliving standards and to attract human and financial capital towards the city. Indian government has taken great initiative to developa hundred smart cities by 2023 under the Smart City Mission which has been praised as major step in the direction of socio-economic transformation of urban areas (MoUD, 2015). KAVAL (Kanpur, Allahabad, Varanasi, Agra, Lucknow) cities have emerged as winner cities in nationwide city challenge competition organized by Ministry of Housing and Urban Affairs, Government of India. KAVAL cities are five out of thirteen future smart cities to be built in Uttar Pradesh state (Press Information Bureau, 2015). The paperexplores challenges and opportunities to develop Indian smart cities with special reference to KAVAL cities.The main objective of the paper is

to evaluate the present condition of KAVAL cities by analysing several socio-economic and city parameters and their prepredness for smart cities conversion.

Study area

The KAVAL (Kanpur, Agra Varanasi, Allahabad and Lucknow) cities, the five prominent cities of Uttar Pradesh province of India, accounting for approximately 23 per cent of the population residing in urban areas, dominate the urban landscape of the state (Figure 1). These cities are of great socio-economic, historical and cultural importance as well as exert great influence on nearby towns and villages. According to Census of India (2011), Kanpur is the biggest inhabited city in the Uttar Pradesh followed by Lucknow, Varanasi, Agra and Allahabad.
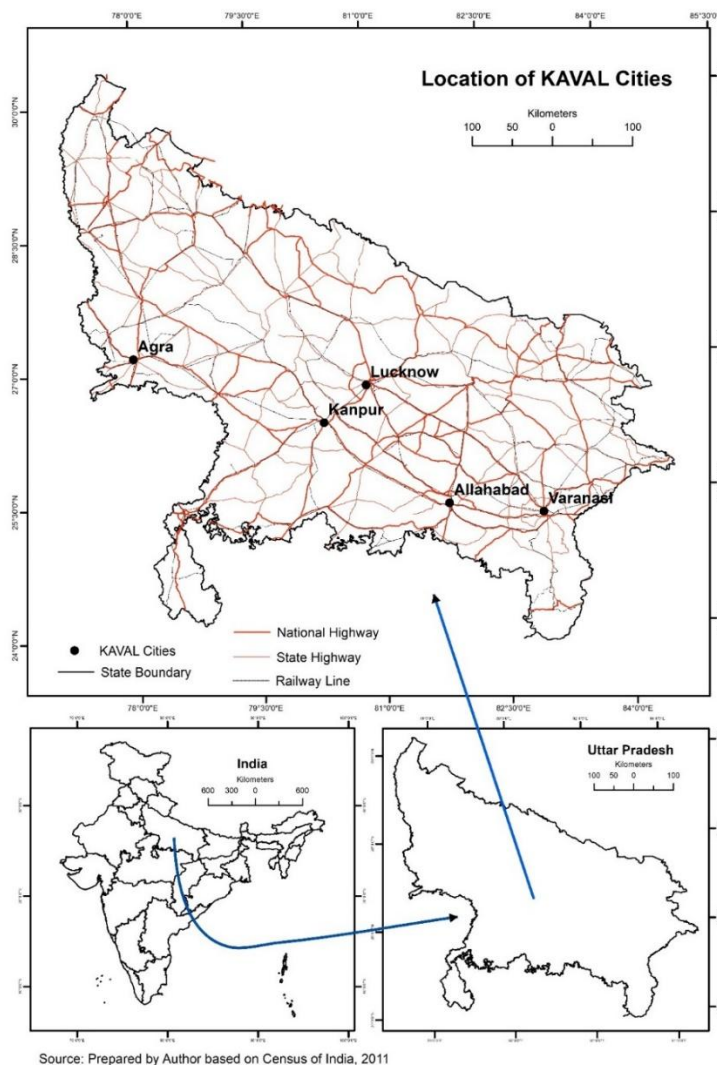

Source: Prepared by Author based on Census of India, 2011

Figure 1: Location of KAVAL cities

Data Base and Methodology

Both primary and secondary data are used in the study. Open and close-ended questionnaires survey is carried out to obtain primary data. Secondary data have been received from various central, state, city departments.A structured approach in the form Multi criteria decision analysisistaken into consideration to carry out data analysis, that includesthorough assessment of most basic and significant parameters of smart urbanization. (Hall, 2000; Rios, 2008; PricewaterhouseCoopers, 2015; Giffinger et al., 2007;) (Table 1).

Table 1: Importantparameters of smart city acknowledged for study of KAVAL cities

Social	Urban	Economic
Health and Well-being Education Civic Protection Disaster management	Energy Water Transportation	Municipal corporation Environmental Sustainability

Nine parameters and forty sub-parameters have been identified. These parameters areevaluated and rated for three criteria namely present condition, Technology involvement and significance for developing smart cities (Table 2).Most performing indicators have been allotted three while lowest as one on a scale of three to one. Weights are also given according to importance and contribution in evaluating readiness of smart city transformation. For each parameter, consolidated score on ascale of one to ten is also calculated.

Table 2: Outline for rating the criteria

Criteria / Rating	Rating 3	Rating 2	Rating 1
Present Condition	High service provision	Medium service provision	Low service provision
Technology Involvement	High technology Intervention	Medium technology Intervention	Low technology Intervention
Significance for developing smart cities	Most significant for creating a smart city	More significant for creating a smart city	Least significant for creating a smart city

The component scoringis calculated as per the bellow given formula:

> **Final score = (Present Condition× 4) + (Technology Involvement × 4) + (Significance for Developing**
> **Smart Cities× 5)**

 Result and Discussion

4.1 Evaluation of present condition of the KAVAL cities and theirpreparedness for smart city conversion

In the study, Scoresare computed for nine parameters including energy, water, civicprotection, disaster management, transportation, health and well-being, education, municipal corporation and environmental sustainability(Table 3). With respect to energy sector,KAVAL cities have consolidated scoresof 8.21, 7.84, 8.21, 7.38 and 9.38out of ten respectively. In terms of water, the cities have consolidated scores of 6.09, 5.38, 7.18, 4.74 and 7.62 respectively. With regard to civic protection, the cities have consolidated scores of 5.21, 5.29, 6.67, 5.89 and 6.32 respectively. With respect to disaster management, the cities have consolidated scores of 6.32, 5.98, 6.66, 6.67 and 7.52 respectively. In terms of transportation, the cities have consolidated scores of 4.32, 3.81, 3.52, 3.66 and 3.33 respectively. With respect to health sector, the cities have consolidated scores of 7.43, 5.98, 5.98, 5.81 and 8.89 respectively. In terms of education,the cities have consolidated scores of 5.25, 6.67, 6.08, 4.74 and 7.82 respectively. With regard to Municipal Corporation, the cities have consolidated scores of 7.95, 7.43, 7.94, 7.94 and 7.94 respectively. In terms of sustainability, the cities have consolidated scores of 5.19, 4.61, 4.42, 5.06 and 5.28 respectively.

**Table 3: Component scoring of smart city parameters in KAVAL cities**

Components/Sub-components	Score (considering weights)				
City	Kanpur	Allahabad	Varanasi	Agra	Lucknow
ENERGY					
24×7 electric supply	30	35	30	30	35
Energy consumption details	39	39	39	31	39
Online payment facility	39	35	39	26	39
Metering	35	31	35	35	35
Grievance redressal for citizens	17	13	17	22	35
WATER					

24x7 water supply	22	26	30	18	31
Metering of water connections	26	22	26	17	31
Online payment facility	30	18	30	26	35
Water losses minimization	17	18	26	13	22
CIVICPROTECTION					
City surveillance	13	22	26	17	26
Online FIR, complaints registration	22	18	26	22	22
Complaint response time	26	22	26	30	26
DISASTER MANAGEMENT					
Early warning system	26	22	26	26	35
Disaster alarm and response system	22	22	26	22	27
Fire stations basis population density	26	26	26	30	26
TRANSPORTATION					
Traffic signal violation detection	22	13	13	13	13
Challan management	18	22	18	18	13
Traffic management system	26	13	13	13	13
Parking management	13	13	13	17	13
Use of mass transport	13	17	13	13	13
Availability of bicycle tracks	13	13	13	13	13
Two meters footpath both side	13	13	13	13	13
HEALTH AND WELL-BEING					
No of hospitals against population density	35	22	22	25	39
Healthcare facilities	26	22	26	26	39
Emergency services	26	26	22	17	26
EDUCATION					
Total number of schools	26	31	26	22	30
School for the specially abled	13	13	13	13	22
Colleges against population density	13	30	26	13	35
Professional colleges against population density	30	30	30	26	35
MUNICIPAL CORPORATION					
Property tax payment	34	34	34	34	34
Complaint registration	26	26	26	26	26
Registration of births and deaths	34	34	34	34	34
Online sanction of plan for	30	22	30	30	30

buildings					
ENVIRONMENTAL SUSTAINABILITY					
Noise pollution control	13	13	13	22	13
Air pollution control	13	13	13	22	13
Adherence to the green building norms	13	13	13	13	13
Water pollution control	13	22	13	13	13
Sewer network	23	22	17	23	35
Treatment of waste water	26	22	26	26	26
Population with regular solid waste collection (residential)	35	26	26	26	35
Recycling of solid waste	26	13	17	13	17

Source: Compiled by author

Figure 2: Present condition of smart city components in KAVAL cities
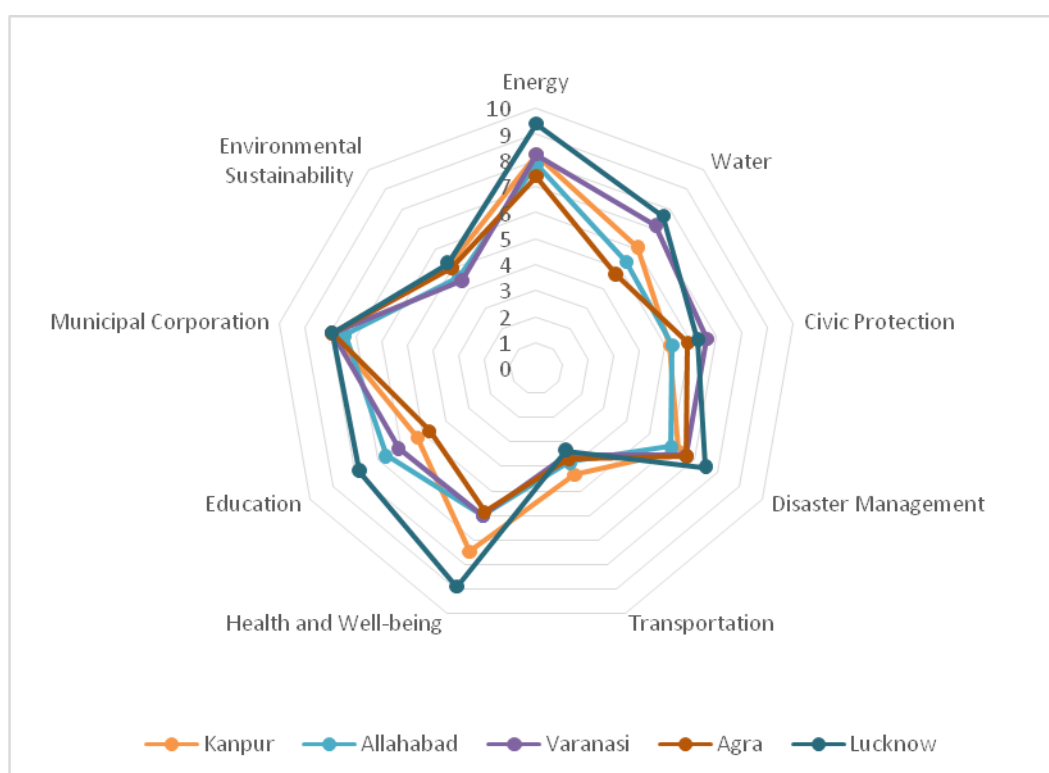
Source: Compiled by author

Figure 2presents the present conditionof all nine smart city parameters in KAVAL cities. The performance of energy sector is very high in all five cities. The performance of transportation is worst among all components followed by environmental sustainability, health and well-being, education and civic protection. Performance of all these parameters can be enhancedthroughbetterinvolvement of information technologyas well as emphasis on root problems by city administrators. Great amount of considerationmust be taken to

people'sinvolvement because of its supremesignificance in developingthe urban areassustainable and smart. The higher status of education of theinhabitantsinthese citiesis going to be instrumental in successful smart city transformation

Conclusion

The paperexhibits that creating smart city in India is a challengingjob. The KAVAL cities requirecomprehensiverefurbishing of socio-economic and city infrastructure. Overall, KAVAL cities havenot achievedsatisfactory scores on various parameters such as water, transportation, civicprotection, and environmental sustainability. With regard toinvolvement of information technology, KAVAL cities have to accomplish more. Some parameters like energy, education, health and well-being and Municipal Corporation are displayingencouraging signs, still considerablelacunas in efficientoperation and management can be observed, where city administrators must focus immediately. To fill the gaps, various ministries of Government of India has have initiated several schemes related to digital empowerment, cleanliness programs, electricity connection and distribution, Make in India and skill development mission. In conclusion, conversion of KAVAL cities into smart cities requires great collaborationbetween city officials, corporate sector, academics and citizens.

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