Deprivation Indicators for BBMP Wards

(a) Socio-Economic Deprivation: In order to determine the socio-economic condition in the BBMP wards, following five indicators were identified: (i) Percentage of Households availing Banking Services, (ii) Percentage of Households with Assets (TV, Computer/Laptop, Telephone/Mobile Phone and Scooter/Car), (iii) Percentage of Scheduled Caste and Scheduled Tribe Population, (iv) Percentage of Illiterate Population, and (v) Workforce Participation Rate.

Methods: The data related to the above five indicators were taken from Census of India, 2011. All the above indicators are percentages and not absolute counts because the ward size and population differ largely.

(i) Min, Max, Mean and *Standard Deviation:* The first step is to calculate the minimum, maximum, mean and standard deviation for all the indicators for the BBMP wards. The value of minimum and maximum is important to give the range of the indicators. Further, calculation of mean is done to measure the central tendency of the data set and standard deviation is calculated to understand how spread out a data set is from the mean.

	HH with Banking	*HH with Assets*	*Percent SC & ST Pop*	*Percent ILL Pop*	*Workforce Participation*
Min	12.6	2.3	0.67	12.37	33.92
Max	94.9	59.8	53.33	35.38	59.77
Mean	69.39	26.59	13.51	20.51	43.22
STD DEV	16.48	14.00	8.21	4.52	4.17

(ii) Data Correlation: The second step towards the construction of an index is to construct a correlation matrix of all the involved indicators. In the correlation matrix below, it can be observed that there is a high positive correlation between households with banking services and household with assets. There is a high negative correlation between households with banking services and percentage of illiterate population. Therefore, if the indicator “HH with Banking” is omitted, it will not impact the index.

	HH with Banking	*HH with Assets*	*Percent SC & ST Pop*	*Percent ILL Pop*	*Workforce Participation*
HH with Banking	1				
HH with Assets	0.859463297	1			
Percent SC & ST Pop	-0.397328844	-0.277308041	1		
Percent ILL Pop	-0.868291903	-0.716841378	0.337697903	1	
Workforce Participation	0.041749844	-0.026874174	-0.051470141	-0.017094684	1

(iii) Data Normalisation: The third step is to normalise the data prior to any data aggregation as data set often have different measurement units. Standardisation (or z-scores) has been used to normalise the data as it converts indicators to a common scale.

$$\mathbf{z = (x - \mu) / \sigma}$$

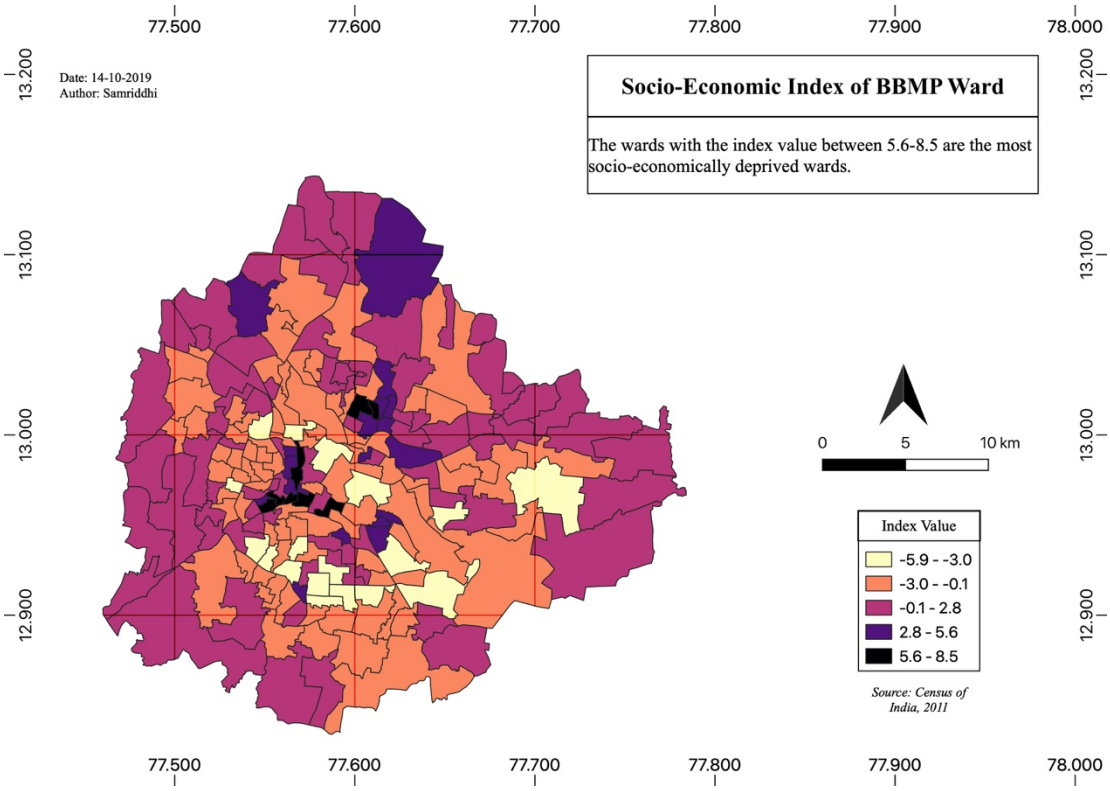
Here, z stands for z-score, x is the value of the indicator for the particular ward, μ is the mean value for all wards and σ is the standard deviation.

(iv) Socio-Economic Index: The final step it to develop the relationship between socio-economic deprivation (SED) and the standardised value of the above-mentioned five indicators.

$$SED = -Z_{(HH\ with\ Assets)} + Z_{(Percent\ SC\ \&\ ST\ Pop)} + Z_{(Percent\ ILL)} - Z_{(Workforce\ Participation)}$$

Socio-economic deprivation is inversely proportional to “HH with Assets” and “Workforce Participation” and directly proportional to “Percent SC & ST Pop” and “Percent ILL” i.e., socio-economic deprivation of a ward is higher when households have less assets, there is high percentage of scheduled caste, scheduled tribe population, high percentage of illiterate population and workforce participation is low. The 10 wards that have been mentioned in the table below are the **most socio-economically deprived wards**.

Ward No.	Ward Name	Socio Economic Index
0138	Chalavadipalya	8.519377923
0139	K.R.Market	7.344859186
0137	Rayapuram	7.191022827
0118	Sudam Nagar	6.888383772
0048	Muneshwara Nagar	6.422324268
0095	Subhash Nagar	6.1411503
0136	Jagareevanram Nagar	5.866541298
0047	Devarajeevanahalli	5.790936034
0011	Kuvempu Nagar	5.498273594
0135	Padarayanapura	5.485295708



(b) Quality of Infrastructure: Further, in order to determine the quality of infrastructure in the BBMP wards, following four indicators were identified: (i) Percentage of Households with Main Source of Drinking Water as Tap Water from Treated Source, (ii) Percentage of Household with Material of Wall as Concrete (iii) Percentage of Households with Main Source of Lighting through Electricity, and (iv) Percentage of Household with Waste Water Outlet connected to Closed Drainage.

Methods: The data related to the above five indicators were taken from Census of India, 2011. All the above indicators are percentages and not absolute counts because the ward size and population differ largely.

(i) Min, Max, Mean and *Standard Deviation:* The first step is to calculate the minimum, maximum, mean and standard deviation for all the above indicators for all BBMP wards. The value of minimum and maximum is important to give the range of the indicators. Further, calculation of mean is done to measure the central tendency of the data set and standard deviation is calculated to understand how spread out a data set is from the mean.

	HH Tap Water Treated Source	*HH Concrete Walls*	*HH Electric Lighting*	*HH Closed Drainage*
Min	14.7	1.6	84.5	25.3
Max	98.80	53.70	99.80	100.00
Mean	76.34	20.58	98.40	86.39
STD DEV	23.22	9.51	1.46	19.17

(ii) Data Correlation: The second step towards the construction of a quality of infrastructure index is to construct a correlation matrix of all the involved indicators like we did for socio-economic indicators. In the correlation matrix below, it can be observed that there is a moderate positive correlation between households with households with tap water from treated source and households with closed drainage. However, in this case neither of the two indicators can act as a proxy for each other and therefore neither of them should be omitted.

	HH Tap Water Treated Source	*HH Concrete Walls*	*HH Electric Lighting*	*HH Closed Drainage*
HH Tap Water Treated Source	1			
HH Concrete Walls	-0.041339466	1		
HH Electric Lighting	0.333019879	0.03007389	1	
HH Closed Drainage	0.799206101	0.019858788	0.336779177	1

(iii) Data Normalisation: The third step is to normalise the data prior to any data aggregation as data set often have different measurement units. Standardisation (or z-scores) has been used to normalise the data as it converts indicators to a common scale.

$$\mathbf{z = (x - \mu) / \sigma}$$

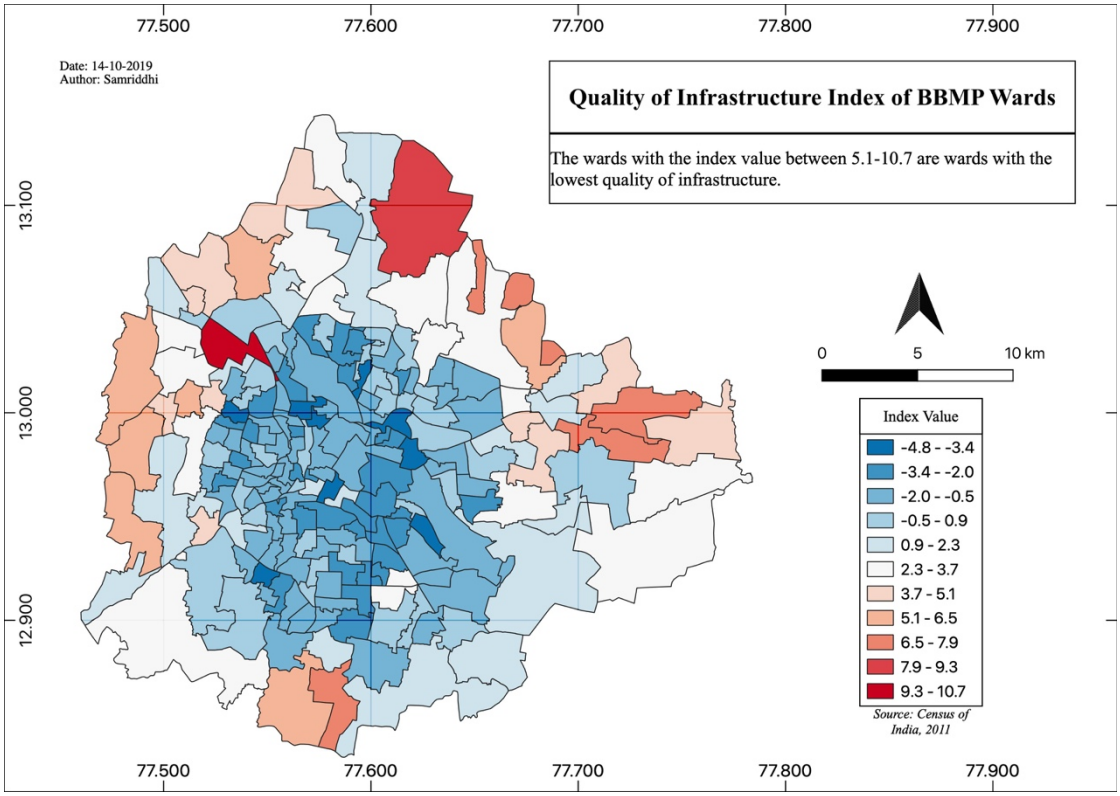
Here, z stands for z-score, x is the value of the indicator for the particular ward, μ is the mean value for all wards and σ is the standard deviation.

(iv) Quality of Infrastructure Index: The final step it to develop the relationship between infrastructural deprivation (ID) and the standardised value of above-mentioned four indicators.

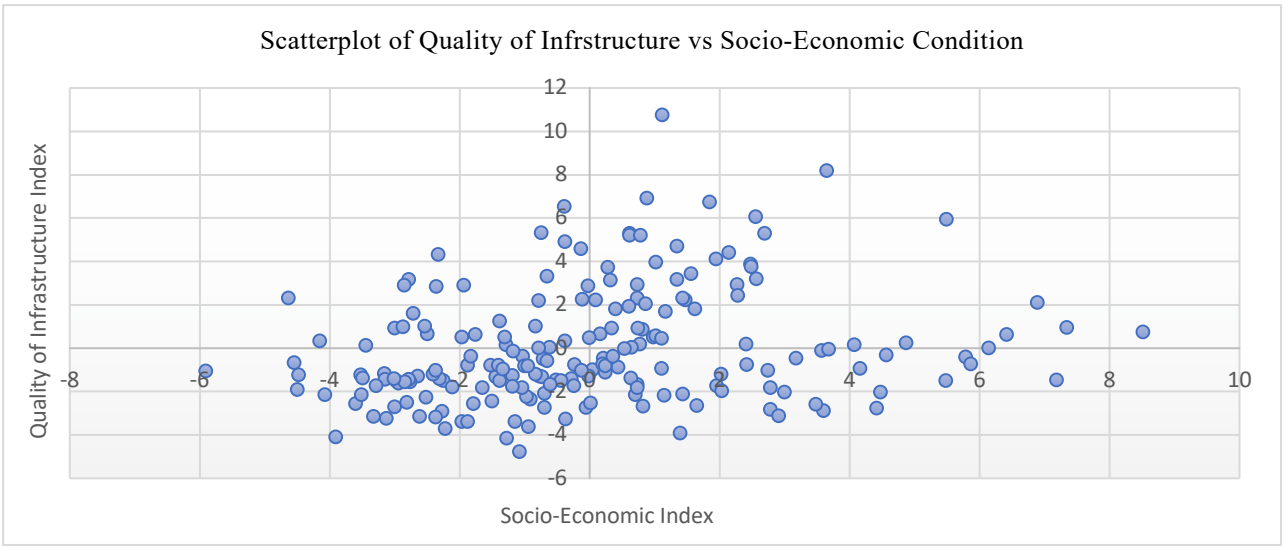
$$ID = -Z_{(\text{HH Tap Water Treated Source})} - Z_{(\text{HH Concrete Walls})} - Z_{(\text{HH Electric Lighting})} - Z_{(\text{HH Closed Drainage})}$$

Infrastructural deprivation is inversely proportional to "HH Tap Water Treated Source", "HH Concrete Walls", "HH Electric Lighting" and "HH Closed Drainage" i.e., infrastructure deprivation of a ward is higher when large number of households don't have tap water from a treated source, concrete walls, electricity and closed drainage. The 10 wards that have been mentioned in the table below are the **most infrastructurally deprived wards**.

Ward No.	Ward Name	Quality of Infrastructure Index
0038	H.M.T	10.73675739
0005	Jakkur	8.166635991
0054	Hoodi	6.897458151
0194	Gottigere	6.730551874
0082	Garudacharpalya	6.522863688
0130	Ullalu	6.062490928
0011	Kuvempu Nagar	5.930257565
0070	Rajagopala Nagar	5.317811928
0196	Anjanapur	5.288837268
0026	Ramamurthy Nagar	5.276071215



Conclusion: It has been observed that there is very low degree of correlation between the socio-economic index and quality of infrastructure index with value 0.24. This means that a ward with low socio-economic condition can possibly have a high quality of infrastructure or vice-versa. In some case, a ward with low socio-economic condition might have low quality of infrastructure. In the above list of 10 most socio-economically deprived and infrastructurally deprived wards, the only overlap is ward no. 11 (Kuvempu Nagar). Kuvempu Nagar is both socio-economically and infrastructurally deprived.



Submitted by: Samriddhi