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Changing Urbanisation Scenario & It's Effect on Urban Environment: A Study of Kolkata (KMC), Salt Lake and New Town

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Abstract

The literature of urban history evidenced that, urbanization throughout the world occurred either planned way or unplanned way. Planned urbanization is a consequence of unplanned urbanization of old cities dramatically practiced after the Second World War. This study seeks to investigate the effect of types of urbanization (either planned or unplanned) on the urban environment. Kolkata Municipal Corporation (KMC) is one of the largest and oldest municipal corporation in India and Kolkata is the capital city of West Bengal which emerged not in a planned way whereas Salt Lake and New Town emerged as planned urban segments in the recent past. Several environmental problems i.e., air pollution, rising temperature, shrinking of green space and open space etc. increasing day by day in both the unplanned and planned urban places. This work has been made a comparative study of the urban environment of KMC, Salt Lake and New Town Rajarhat using air quality data of West Bengal Pollution Control Board (WBPCB), percentage of open space and Land Surface Temperature acquired from satellite imageries especially in OLI band. Different statistical techniques, as well as GIS software have been deployed to fulfil the objectives of the work. The outcomes of the present work conclude that the planned city offers a better urban environment to the dwellers than an unplanned city.

Keywords: *Urbanization, Urban Environment, Air Quality, Urban Open Space, Land Surface Temperature*

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Introduction

In the present day the changing urban environment is the foremost issue, because more than half of the world population (54 %) use to live in urban areas. The most noticeable thing is that the developing countries play a leading role in world urbanisation, for example, China and India jointly share 30.81 percent of world urbanization (United Nations, 2015). Indian urbanization has been flourished broadly in two ways namely planed way and unplanned way. Planned urbanization has been experienced both in an independent location as an industrial city (e.g. Durgapur), Capital city (e.g. Chandigarh) etc. and around the old metropolitan city for reducing population pressure (e.g. kalyani, Salt Lake etc. of Kolkata) respectively (Rao, 1990).

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The state of West Bengal has small number of planned cities i.e., Kalyani, Durgapur, Salt Lake, New Town Rajarhat and maximum number of unplanned city, at the same time few small new townships are proposed around KMC, within or outside Kolkata Metropolitan Area (KMA) such as West Howrah Township, Baruipur Township, Dankuni Township etc. (KMDA, 2000; Roy, 2005).

Among developing countries, India's urban environment is not very well and at the same time number of polluted cities in the world are lies in India (Chauhan, 2015), as in India, maximum urban areas are growing in unplanned and haphazard way (Sudarshan et al, 2009). In contrary to the unplanned area, few planned cities of India e.g. Chandigarh, Bhubaneswar, etc. known for good quality urban environments (Bhat et al, 2006). In general urbanization scenario is used to describe through the trend, pattern, growth and tempo of urbanization etc.; but this study focuses urbanization scenario in the view of planning sense and correlates with their environment. Air quality, percentage of green space and percentage of open space are important indicators for urban environment. These indicators of the urban environment can be understood and studied by remote sensing (Yang, 2011), various scholars used Land Surface Temperature (LST) for assessing urban heat island (Kumar et al, 2017) and urban thermal environment. Many scholars showed the relationship between urbanization and land surface temperature in their study (Kumar et al, 2017). As a result, the study of the urban environment is being possible easily with the help of remote sensing and GIS technique. The present study calculates LST from Thermal Infrared Sensor (TIRS) satellite imagery of Landsat 8 (band 10) and considers other parameters and finally draws a conclusion that urban environment depends on the path of urbanization.

Objective of the Study

This study focuses on the relation between types of urbanization with the urban environment. Here an attempt has been taken to compare the urban environment considering few indicators of the unplanned and planned urban area and aims to promote remedy for the better liveable urban environment.

Data source and Methodology

This study uses primary as well as secondary data sources. Urban environment-related data have been collected from West Bengal Pollution Control Board, Kolkata. Thermal Infrared

Sensor (TIRS) satellite imagery of Landsat-8 has been collected from USGS and land surface temperature (LST) has been calculated from those Thermal Infrared data (band 10 of Landsat-8) with the help of ArcGIS 10.2 software.

Table 1 data information of satellite imagery

Imagery Basic Information		Band Information			Remarks
		Band ID	Band Name	Spatial Resolution	
Spacecraft-ID	LANDSAT-8	Band 1	Coastal/ Aerosol	30m	For NDVI calculation used Band-4 and Band- 5 & For calculation of LST used band 10
Acquired Date	24-01-2017	Band 2	Blue	30m	
SENSOR-ID	OLI-TIRS	Band 3	Green	30m	
ROW	44	Band 4	Red	30m	
PATH	138	Band 5	NIR	30m	
		Band 6	SWIR-1	30m	
		Band 7	SWIR-2	30m	
		Band 8	Pan	15m	
		Band 9	cirrus	30m	
		Band 10	TIR-1	100m	
		Band 11	TIR-2	100m	

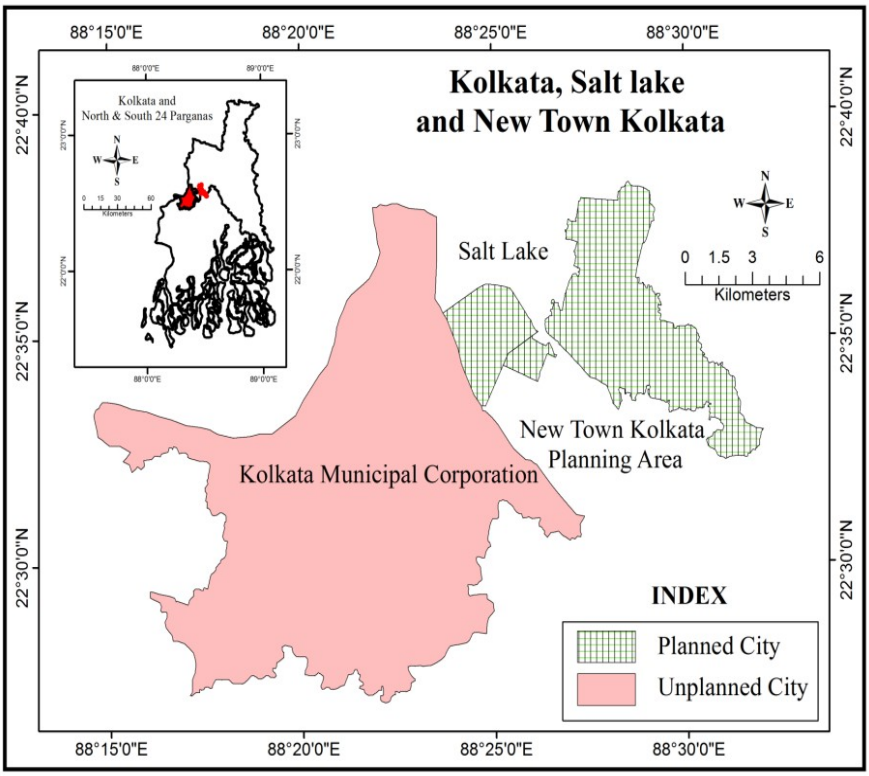
*Source: LANDSAT 8 (L8), Data users handbook 2016, version 2.*0

Selection of Study area

For the study KMC (Kolkata Municipal Corporation) has selected as an unplanned urban centre and adjacent Salt Lake, New Town Rajarhat have been selected as the planned urban units to fulfil the aims of this study. Kolkata Municipal Corporation (KMC) is the largest urban centre of West Bengal emerged and grown as an unplanned way; this city is evidenced negative growth rate during 2001-2011 and suffering from the degradation of the urban environment. Salt Lake city presently known as Bidhannagar is most important satellite town of Kolkata emerged as a planned town between 1958 to 1965 (Patel, 2013) and popularly known for the healthy residential unit and for green space. Salt Lake City is renamed as Bidhannagar on the name of Dr. Bidhan Chandra Roy, the then chief minister of West Bengal.

In the year 1994, the Government of West Bengal proposed for the establishment of the New Town which known as Rajarhat New Town, is a satellite town of Kolkata planned as a solution of over urban congestion, shortage of housing and relocating of CBD of KMC just outside of KMA (KMDA, 2000), as well as future extension of economic activities, traffic congestion, environmental pollution, etc. The Rajarhat new town situated on some part of the

Rajarhat block of the North 24 Parganas district and some part of the Bhangar block of the South 24 Parganas district of West Bengal. The development of New Town got accelerated after the establishment of state-owned development company West Bengal Housing Infrastructure Development Corporation Ltd in (WBHIDCO, 1999a). Previously the entire land was mainly agricultural (WBHIDCO, 1999b; Roy, 2005) and after the implementation of new town planning the land-use change rapidly changed the urban environment.



Source: Census of India, 2011; WBHIDCO, 2012

Figure 1 Location map of study area

Changing urbanization Scenario in West Bengal

Before the independence, major urban centres of India were grown as an unplanned and haphazard way with few exceptions like Jaipur of Rajasthan, Jamshedpur and New Delhi etc. Urbanization scenario of West Bengal, as well as India, experienced a remarkable change after independence, different urban units have emerged in this period with the demand of new cities for several purposes (e.g. Capital city, Industrial city, Business centre and for alleviating the pressure of metropolitan city etc.). After independence government of West Bengal introduce few *New towns* and *Planned towns* (Kalyani, Durgapur) as the counter

magnet of Kolkata city (Ray Chaudhuri, 2001) which reducing overburden urban pressure of capital city Kolkata and other problems like overpopulation, housing shortage, increasing pollution etc. The first new town of West Bengal is Kalyani (former Roosevelt Town or Roosevelt Nagar) developed in the 1950s (Koenigsberger, 1952), after that Durgapur developed as a successful industrial town in erstwhile Bardhaman district in 1962 and upgraded to the status of Municipal Corporation in 1996 (Tah & Ghosh, 2015), now situated in Paschim Bardhaman District after bifurcation of this district (Government of India, 2018). But due to the overburden of capital city Kolkata (Calcutta), the government of West Bengal has to plan for few new towns like Salt Lake, Rajarhat New Town around Kolkata, Dankuni in West Howrah Township and Baruipur etc. in South 24 Paraganas (Roy, 2005) within or outside KMA (Kolkata Metropolitan Area).

Background of Urban Planning and History of Urbanization

Urbanization can happen both in a planned and unplanned way but in recent time urbanization and urban planning is very much interdepended with each other. India evidenced the history of town planning long back since 3000 B.C. and World's first planned town Harappa was built in India (keay, 2013; Mason, 2014; Redfern, 2009). But in the British period, the planning principles were not followed largely for urban development; as a result, a number of towns have emerged in an unplanned way. After the independence of India, number of towns or cities have been built in a planned way and few of them located in West Bengal (i.e., Kalyani, Durgapur, Salt Lake, New town Rajarhat etc.) Figure 2 illustrates the way of urbanization of West Bengal especially in Kolkata Municipal Corporation (KMC) and in few new towns and planned towns.

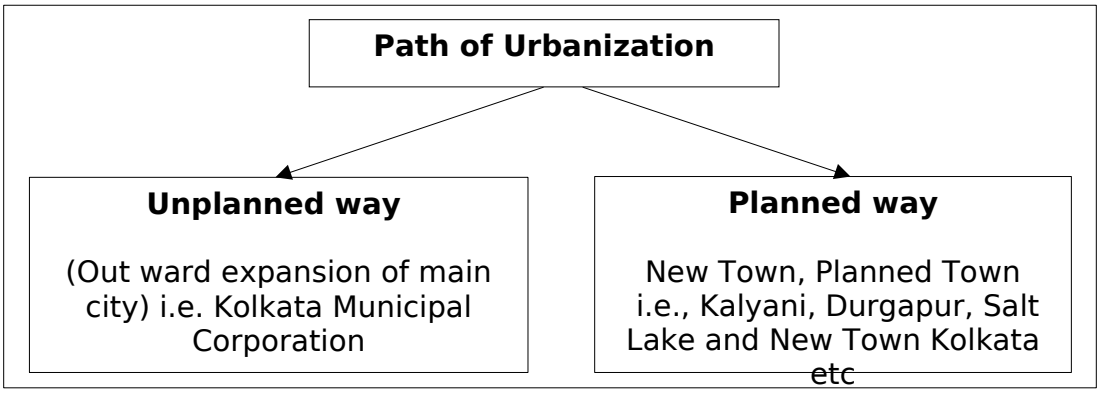


Figure 2 Path of urbanization

Kolkata the expanding city and the emergence of New township

Kolkata (Calcutta) expanded its area several times since its origin through the unplanned way. But the confined condition of Kolkata city between River Ganges in the west and East Kolkata Wetland in east and south-east not permit further expansion; as a result, urban planners proposed few satellite new townships around the Kolkata city (KMC) like Salt Lake, New Town etc. As per the Census of India 2011 the initial area of KMC was 6.8 sq. km in 1706; its expansion occurred in a confined condition which gave it a unique shape and presently the total area reached 185 sq. km in 2011 (Table 2). Figure 3 depicts the expanding phase of KMC since its origin to the present time. The city Kolkata got a unique shape after its last expansion; a similarity has imagined the shape of KMC as an inverse tree (Figure 3).

Table 2 Areal Growth of Kolkata city

Year	1706	1794	1850	1901	1923	1953	1984	2001	2011
Area of KMC (in sq. km)	6.8	20.0	20.0	53.0	78.0	104.0	185	185	185

Source: Census of India, 2001 & 2011

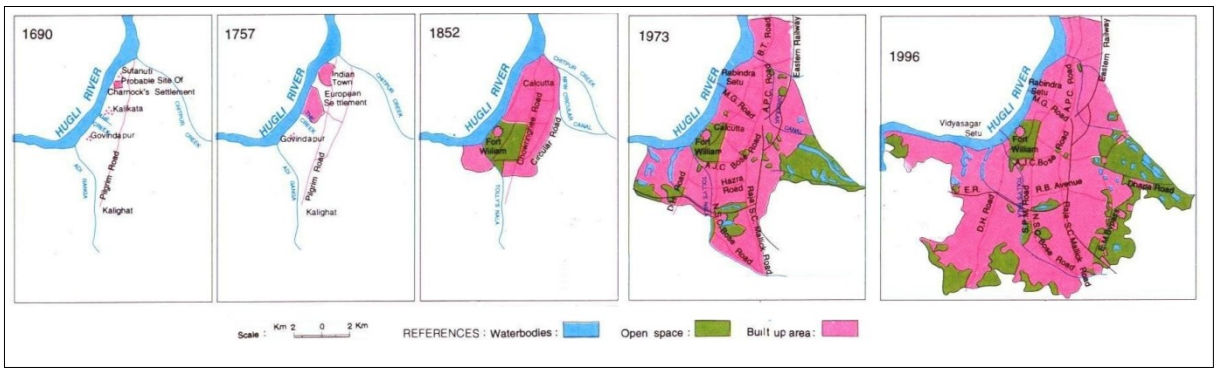


Figure 3 Spatial Growth of Kolkata city

Source: National Atlas and Thematic Mapping Organisation (NATMO), 1998

The city Kolkata expanded several time to accommodate the huge population but these newly added area are not acquired in a planned way. Basically, areal expansion is not a permanent solution of urban problems of KMC; as a result, the government of West Bengal adopted the plan of new township around KMC which may act as a counter magnet (Ray Choudhuri, 2001). Maximum of these newly added towns are planned town in nature and located in the suburban area of KMC, as per the location of these new towns may be categorised as a satellite town of Kolkata. Indeed these new towns (newly emerged town) act as a satellite town of Kolkata city (KMC) but genetically and functionally these are new towns (type of town). Kolkata recorded -1.7 percent decadal growth rate of population during 2001 to 2011

(GoI, 2011), the negative growth of KMC may be attributed with the growth and development of suburban areas of KMC (Sridhar and Kashyap, 2012, p.17). Present day, the migrant who use to come in Kolkata for job, lives in these new towns for nearest distance to Kolkata in one hand and on the other hand these new towns also have own job-generating capacity and offer both live and work (i.e., Salt Lake, New Town Rajarhat) which attract huge migrant to these urban unit. This study empirically observed that New Town Rajarhat offered huge housing infrastructure to the newly migrant but also accommodate people who were once the inhabitant of Kolkata, who use to resettle for the healthy luxurious life-style as well as for the new job opportunity.

Urban Environment

The urban environment of any urban unit can be traced through many components but this study emphasized only 1) Air Quality, 2) Percentage of Open Space and 3) Land Surface Temperature (LST).

Air quality

Air quality is the key indicator of the urban environment of any city. Air quality mainly measured with the proportion Suspended Particulate Matter (SPM), Respiratory Particulate Matter (RPM) etc.

The air quality of Kolkata and other places measured by West Bengal Pollution Control Board (WBPCB) and to acquire the information, different monitoring stations have been built in different places of the state. These stations record Suspended Particulate Matter (SPM/ $PM_{2.5}$), Respiratory Particulate Matter (RPM/ PM_{10}), Nitrogen Dioxide (NO2) and Sulphur Dioxide (SO2) etc. Table 3 represents that over time, the amount of PM_{10}, the most deteriorating factor of the air quality is rapidly increasing in KMC and Salt Lake but the rate of increase is higher in KMC in relation to Salt Lake. Table 3 depicts the air quality of selected cities i.e. Kolkata, Salt Lake and New Town. Kolkata Municipal Corporation (KMC) has several air quality monitoring stations (Government of West Bengal, 2016), among them this study has considered Moulali for its central location in the city. The components in ambient air are considered for representing the air quality PM_{10}/ RPM is very important because it badly affects human health and may cause of death of human beings.

Table 3 shows that the air quality rapidly falls in post-monsoon season or in the winter season causes deterioration of the environment. The highest concentration of PM_{10} recorded in the

month of January in Moulali station of KMC (315.04 & 325.37), the amount of the same particle in New Town and salt lake are (186.83 & 179.93) and (239 & 224.25) respectively in the year 2015-16 & 2017-2018 (Figure 4). Table 3 also describes that the unplanned city KMC recorded an increase of PM_{10} whereas Salt Lake and New Town experienced a decrease of PM_{10}. $PM_{2.5}$ is another important parameter to monitor air quality index, only Moulali recorded $PM_{2.5}$ and other cities do not record $PM_{2.5}$. Though in monsoon season, the air quality index is good for the city as the values of PM_{10} are found very low in the entire area but KMC's Moulali recorded relatively bad air quality index in relation to remaining cities. Considering So2, it is observed that Kolkata recorded greater So2 and shows an alarming increase over time whereas Salt Lake and New Town recorded less amount of So2 and no remarkable changes of the same particle over time is observed. The fact of unplanned and planned urbanisation can be attributed to the air quality index of respective cities. Basically, unplanned city recorded bad air quality index in relation to a planned city because of violation of planning principle.

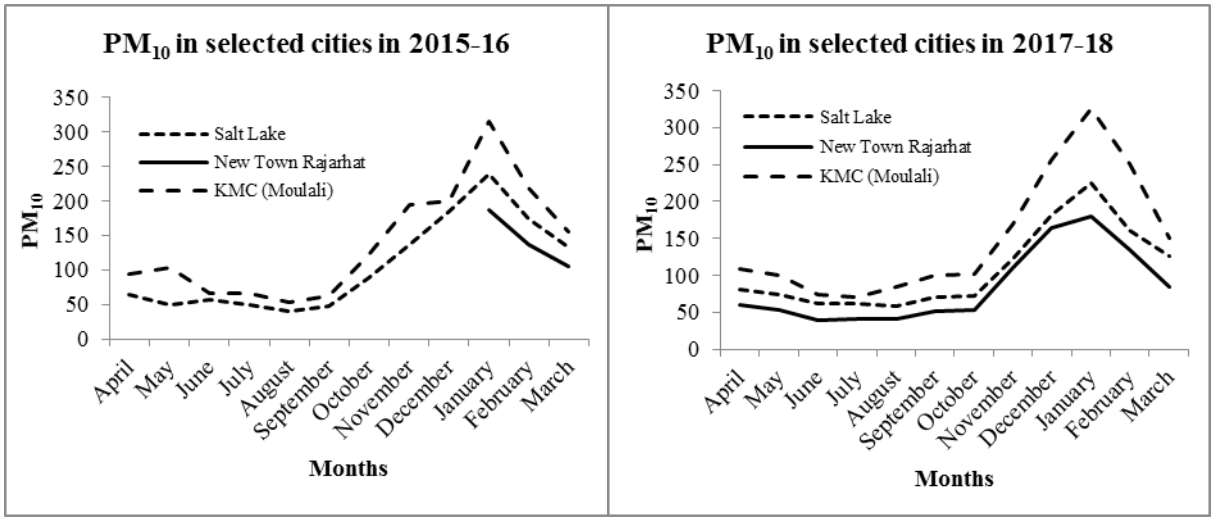


Figure 4 Temporal variation of PM $_{10}$ of Salt Lake, New Town Rajarhat and KMC, 2015-2016 and 2017-18

Source: West Bengal Pollution Control Board, 2016; 2017-18

Figure 4 depicted that the temporal change of PM_{10} of Salt Lake, New Town Rajarhat and KMC (Moulali). The line represent PM_{10} of KMC (Moulali) always take pick position than Salt Lake and New Town Rajarhat. Figure 5 also shows the two planned city recorded less PM_{10} value in 2017-2018 than 2015-16 and KMC recorded increases of PM $_{10}$ value.

Table 3 Air quality (based on selected parameters) of different urban units, West Bengal, 2019

Particulars		Months	April	May	June	July	August	September	October	November	December	January	February	March
Salt Lake	2015-16	RPM / PM_{10}	63.88	50.19	57.199	49.92	40.3	46.76	87.63	136.44	184.5	239	174.19	132.71
		PM2.5	-	-	-	-	-	-	-	-	-	-	-	-
		So2	2.04	2.04	2.15	2.1	2.0	2.07	4.19	4.56	3.42	5.37	4.09	3.21
		No2	28.56	27.61	26.133	23.02	26.28	25.48	43.52	54.15	53.98	60.61	53.37	41.96
	2017-18	RPM / PM_{10}	80.7	73.73	61.29	60.89	58.78	71.22	72.27	122.42	180.89	224.25	160.13	125.63
		PM2.5	-	-	-	-	-	-	-	-	-	-	-	-
		So2	2.35	2.59	2.46	2.37	2.46	3.24	2.82	3.44	5.5	6.87	4.18	3.04
		No2	28.93	27.76	26.002	25.02	24.72	30.06	28.85	35.9	43.69	49.12	39.34	31.57
New Town (Rajarhat)	2015-16	RPM / PM_{10}	-	-	-	-	-	-	-	-	-	186.83	136.11	105.83
		PM2.5	-	-	-	-	-	-	-	-	-	-	-	-
		So2	-	-	-	-	-	-	-	-	-	4.5	2.85	2.25
		No2	-	-	-	-	-	-	-	-	-	55	44.76	36.1
	2017-18	RPM / PM_{10}	59.3	53.83	38.667	40.63	41.67	51.33	53.67	110.96	163.78	179.93	133.94	84.7

		PM2.5	-	-	-	-	-	-	-	-	-	-	-	-
		So2	2.11	2.04	2	2	2.04	2.48	2.29	3	3.89	4.54	3.15	2.22
		No2	24.65	23.23	21.09	21.63	21.37	25.33	25.11	29.24	35.37	41.04	33.77	27.24
KMC (Moulali)	2015-16	RPM / PM_{10}	93.46	103.15	66.33	66.59	53.67	63.08	122.67	194.27	198.9	315.04	218.04	155.8
		PM2.5	-	-	32.56	30.44	26.89	34.63	60.67	103.9	98.43	172.33	112.88	66.1
		So2	3.04	3.39	2.56	2.52	2.15	2.9	7.57	7.37	4.71	9.11	7.08	4.92
		No2	37.5	38.02	30.56	31	32.76	36.06	58.54	69.12	58.48	76.26	67.08	52.58
	2017-18	RPM / PM_{10}	107.7	99.13	73.67	71.15	84.41	100.42	101.86	169.15	256.78	325.37	250.85	150.15
		PM2.5	49.56	45.13	38.44	41.89	48	55.38	56.83	86.56	138.78	170.58	130.21	72.89
		So2	4.33	4.06	3.24	3.31	4.26	5.44	5.36	7.48	10.56	170.58	130.21	72.89
		No2	37.26	34.4	32.2	31.13	32.28	38.71	38.85	47.33	60.96	71.78	57.42	41.76

Source: West Bengal Pollution Control Board, 2016; 2017-18

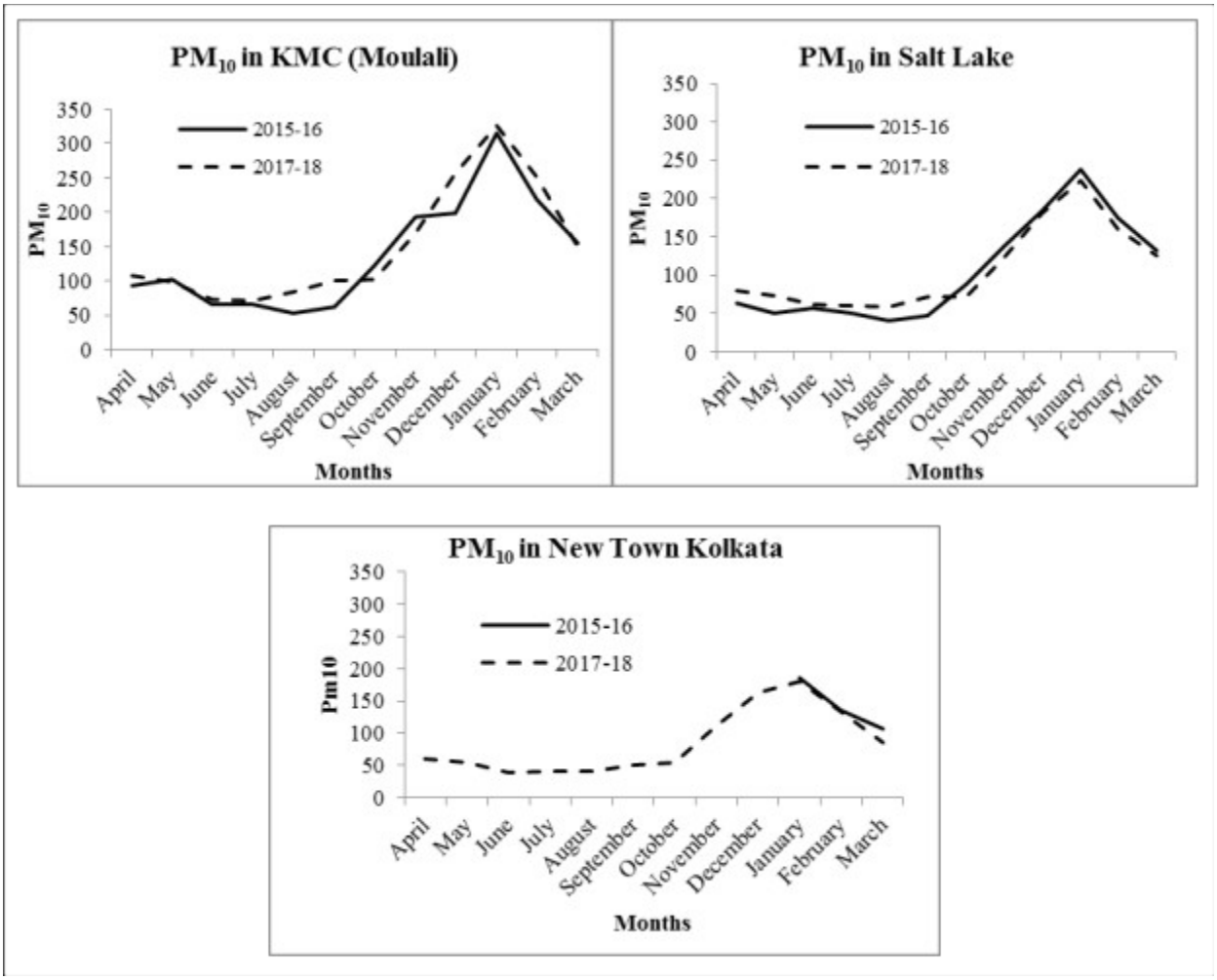


Figure 5 Distribution PM_{10} in KMC (Moulali), Salt Lake, and New Town Kolkata

Source: *West Bengal Pollution Control Board, 2016; 2017-18*

Percentage of Open Space

The percentage of open space not only good for human health rather it is a necessary component of a city. The percentage of open space is a key component of any city that may be planned or unplanned. Park, playground, botanical gardens, and recreational space is categories as Open space or Green space. As per WHO (World Health Organization), 15 percent of the city's total area should be open space. As per the Urban Development Plans Formulations and Implementation (UDPFI) 1996, open space should be 20-25 percent for metropolitan cities, 18-20 percent for medium / large towns and 12-14 percent to small towns. An unplanned city rarely facilitates the more than 15 percent open space of the city's area whereas Kolkata city's open space is only 5.5 percent in relation to the national average of 19.09 per cent, which shows a poor condition of Kolkata in this regard (Mitra, 2013).

Table 4 Percentage of open space of KMC, Salt Lake and New Town Rajarhat

Name of City	Percentage of Open Space
KMC	Green and open space -10 %
Salt Lake	Open Space -12 % (Newly added 15.5 sq. km water body of 20.98 sq. km city under Ramsar Convention)
New Town Kolkata or New Town Rajarhat	Open space/ vacant land -5.15 % , recreation -9.07 % Water body - 6.60 % total 20.82 %

Source: Toskovic (2008); WBHIDCO, 2012; The Telegraph, February 17, 2017

Though, another source has shown that the percentage of open space in Kolkata is 10 percent. Whereas Salt Lake and New Town recorded the same as 12 percent and 20.82 percent respectively (Table 4).

Land Surface Temperature

The calculation of land surface temperature depends on the land use and land cover of surface area. The emission and reflectance of energy depend on the material of the earth surface. Naturally, the built-up portion of the earth surface reflected greater energy than the vegetated portion of the earth.

Table 5 Algorithm for calculation of Land Surface Temperature

Algorithm	Explanation
LST= BT / (1+(Lλ/p)Ln Eλ)	Lλ = Spectral radiance p= h*(c/s) = 1.438 x 10-2mK) Ln= the base e logarithm Eλ= 0.004 * PV + 0.986
Lλ = ML*Qcal + AL	Lλ = Spectral radiance (W/(m2 * sr * μm)) ML = Radiance multiplicative scaling factor for the band AL = Radiance additive scaling factor for the band Qcal = L1 pixel value in DN
BT= K2 / ln (K1 / Lλ+1) -273.15	BT = TOA Brightness Temperature, in degree Celsius . Lλ = Spectral radiance (Watts/(m2 * sr * μm)) K1 = Thermal conversion constant for the band K2 = Thermal conversion constant for the band
P= h*(c/s) = 1.438 x 10^{-2}mK) = 14380	h = Planks Constant (6.626 x 10^{-34}Js C= Velocity of Light (2.998 x 10^{8}m/s) , S= Boltzmann Constant (1.38 x 10^{-23})
Eλ (Emissivity) = 0.004 * PV + 0.986	PV = (NDVI – NDVI min / NDVI max – NDVI min) [2] NDVI = (NIR (Band 5)-Red (Band 4) / (NIR (Band 5 + Red (Band 4)

Source: Landsat 8 Data User Handbook of USGS; Avdan et al 2016

The land surface temperature has been used by several researchers for several years for detecting urban heat island and the thermal environment of the urban area (Gartland, 2008; Komac et al, 2016). The thermal band of Landsat 8 TIRS, OLI series data contain total 11 bands and band 10 represents the thermal band (Landsat 8 data User Handbook, 2016). Whereas band 4 represents the red band and band 5 represents Near Infrared (NIR) band which is used for calculation of NDVI (Normalized Difference Vegetation Index). Land surface temperature (LST) measured with the help of Band 10 of TIRS satellite imagery of Landsat 8 data with the help ArcGIS 10.2 software. The methodologies used for calculation of LST are given in table 5.

NDVI

Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). The formula for calculation NDVI is as follows;

NDVI = (NIR - RED) / (NIR + RED)

Where, as before, NIR and RED (or VIS) are the response in the near-infrared and red (or visible) bands respectively. Ideally, reflectance (corrected for atmospheric effects) are used, but at-sensor values are sometimes used also for NDVI. Unlike the unbounded Simple Ratio, the NDVI has a range limited to a value from -1 to 1. Data from vegetated areas will yield positive values for the NDVI due to high near-infrared and low red or visible reflectance. As the amount of green vegetation increases in a pixel (picture element), NDVI increases in value up to nearly 1. In contrast, bare soil and rocks generally show similar reflectance in the near-infrared and red or visible, generating positive but lower NDVI values close to 0. In the study Normalized Difference Vegetation Index (NDVI) map has been used for LST calculation of study area. Figure 6 depicts the NDVI of study area. The NDVI values area classified into four classes, these are class 1, *from -0.157 to 0.084*, class 2, *from 0.085 to 0.18*, class 3, *0.181 to 0.300* and class 4, *from 0.301 to 0.502*. The overall NDVI value of Kolkata and surrounding area varies between -0.157-0.502. The NDVI value of KMC varies from -0.157-0.084, whereas the same value in salt lake and New Town fall in two classes -0.157 to 0.084 and 0.085 to 0.18 respectively. Low NDVI in KMC represents the minimum presence of vegetation whereas relatively moderate to high NDVI in Salt Lake and New Town depicts the present of good health vegetation in the respective area.

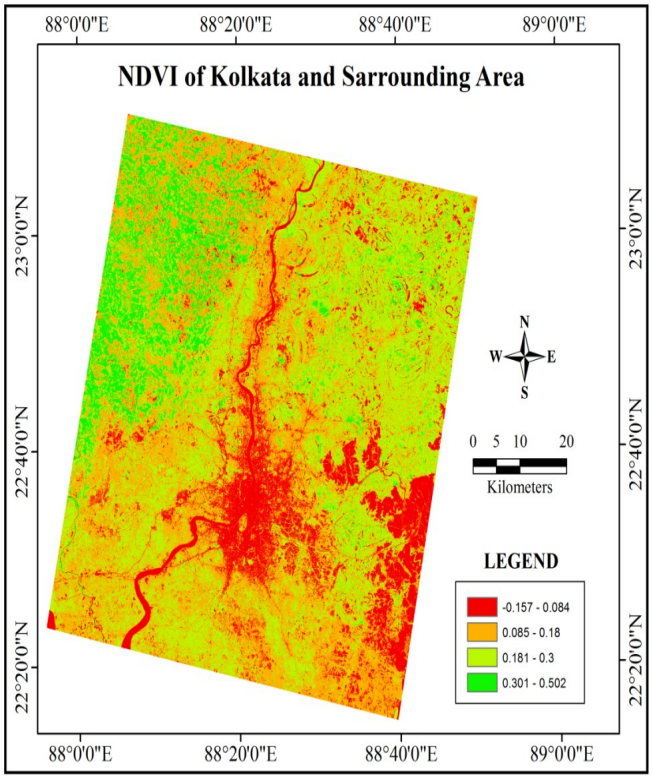


Figure 6 NDVI of Kolkata City and its surrounding area in January, 2017

Figure 7 Land Surface Temperature of Kolkata City and its surrounding area in January, 2017

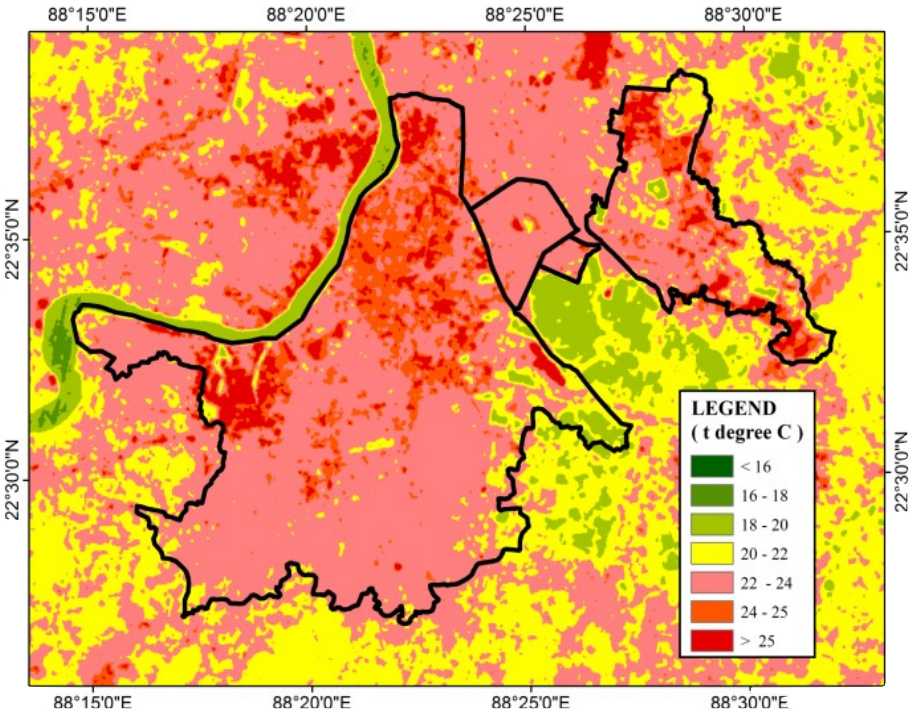


Figure 8 Land Surface Temperature of KMC, Salt Lake and New Town Rajarhat in January, 2017

Source: prepared by Authors based on Landsat Data

Figure 7 depicts the land surface of the temperature of Kolkata city and its surrounding area in month of January, 2017. It is derived that the average temperature of KMC varies from 24-25 to more than 25 degree Celsius, which is relatively high in respect to surrounding area i.e. from Salt Lake and New Town where the average temperature varies between 16 to 24 degree Celsius respectively. This figure 7 depicts that, the LST is relatively good condition in planned city of Salt Lake and New Town Rajarhat. The classified image also shown the presence of urban heat island in the KMC region. Figure 8 minutely discover a great difference of Land Surface Temperature between planned and unplanned urban unit.

Conclusion

This study focuses mainly the way of urbanization and its effects on urban environment and conclude that there is a positive relation between urban environment and planned urbanisation. KMC grown as unplanned urban unit and experienced expansion several time since its origin, which act as a threating to environmental factors for the city and deteriorated the environment condition. As a result the environment quality of KMC is poor than adjacent newly emerged planned urban units i.e., Salt Lake and New Town Rajarhat. Day by day the environmental condition of KMC will be diminishing due to the less quantity and shrinking of open space; simultaneously the bad air quality and high Land Surface Temperature (LST) in respect to surrounding area will caused the increase, the rate of diminishing of urban environment. Whereas the fixed land use i.e., open space and other purposes of city is the key feature of planning town, which help planned urban centre to offer better urban environment to urban dwellers than unplanned city. The environmental condition of unplanned city can be maintained through the conservation of present open spaces, street side tree plantation, roof top gardening, introducing urban forestry etc. Besides technological implementation for reducing the environmental pollution and mass awareness can over shadow the environmental problems of unplanned city. At the same government must ensure that the basic principle of environment is maintained in the planned urban unit in its future expansion otherwise these planned urban units will also experience the same environmental problems faced by the unplanned one.

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