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An analytical study on Krishnanagar, West Bengal, India from the view point of sustainable environment management

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Abstract

Rapid urbanization is the alarming trend for developing world. In country like India where urbanization may be defined as the gathering of people in a specific centre without even fulfilment of characteristics of economic engagement of people in secondary and tertiary sectors, urban centres play the mere role of service providing centres. Such kind of urban centres are specifically common for regions depending upon agro based economy. In present study such an agro based urban centre is been focussed. Krishnanagar, the district head quarter of Nadia District, within the state of West Bengal, India is chosen as the study area with an area of about 15.96sq km. This urban centre became significant in Bengal's History since the beginning of 18th century with its socio-economic and cultural influence. Presently the centre observes a population density of almost 10,000/sq km causing impact on natural environment by compressing the areas under wetlands, pile of garbage, rising level of air pollution. Social environment of the centre is experiencing events like road-congestion, loss of cultural heritage. Urban growth in a sustainable manner integrates all the parameters of environment in a common thread. Present research work runs with the aim to prepare a sustained framework to maintain the holistic environment of this old urban centre based upon modern day GIS techniques along with thorough study of the changing phases of this heritage site.

Key words: sustainable framework, holistic environment, GIS techniques, heritage site

1. Introduction: Sustainable measures to support physical and social environment is the task of balancing the natural and anthropogenic world and to continue the trend of economic development. Whenever we concentrate on the issue of urbanization several episodes like rapid land-use change, growing stress of population, increasing pile of wastes, rising level of air (S.Uttara, 2012) and sound pollution, ill effects on cultural heritage (Jaysawal, 2014) all become the part of observation. Global level strategies to maintain both urbanization and environmental balance should be started at grass root level strategies concentrating on micro level issues with setting a proper balance between development and environment. Considering such broader perspective present research work has been done on a district town serving a vast area and acting as the service providing centre for an agro-based economic region.

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2. About the study area:

The town Krishnanagar is the District Town of Nadia District, West Bengal, India. It covers an area of 15.96 sq km with the latitudinal and longitudinal location of 23.39°N, 88.49°E. From physical perspectives the region is in moribund portion of Gangetic Delta. The Jalangi River which covers the northern boundary of this town is flowing in east-west direction. The river is a tributary of the Ganga and it meets the Bhagirathi almost 10 km north-west of Krishnanagar. Presence of palaeo channels, marshy lands are present within the study area. It is almost on an elevation of 14m.

From socio-cultural point of view the study area has a long tradition from 1750s and earlier. It is of immense cultural importance all over Bengal. The tradition of drama and poetry, a land of many famous personals, identity of the town for delicious sweets, exclusive clay models of this town and special religious festival of *Jagadhatri Puja* provide the centre a unique identity.

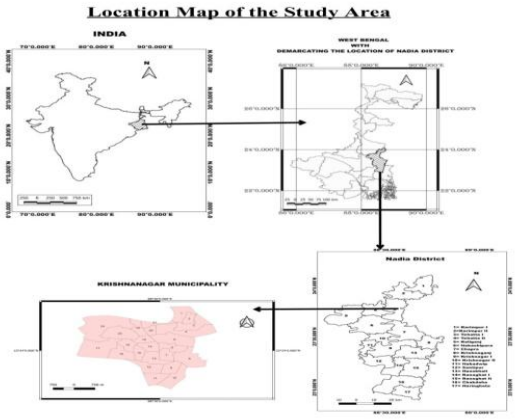

Figure-1

3. Objective: Present research work runs with the objective to focus on:

- Increase of urbanization in the study area and its impact on physical and social environment.
- Issues to make a sustainable planning to support this century old urban centre for coming decades.

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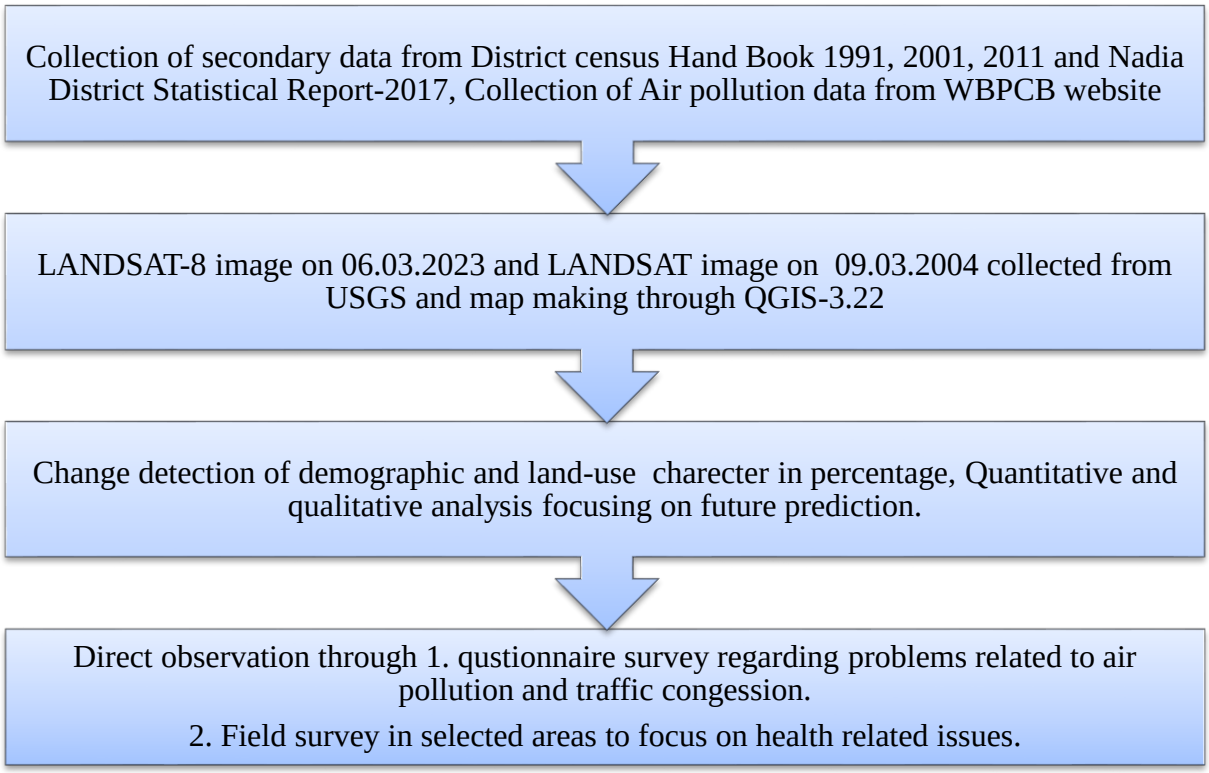
4. Methodology: This work is done on the basis of following steps:



5. Result and Discussion:

Present study runs within the period of almost twenty years mainly focusing land-use changes during 2004 to 2024. In this period major events observed here are:

I. **Demographic Changes:** Present study area being the district head quarter is an important urban centre. A gradual increase of population has been observed for this town from decades, but in recent past the scenario has changed with a faster rate. Overall demographic scenario for this town is as follows:

Table No-1: Demographic scenario from 1991 to 2011

Year	Population	Population density per sq. km
1991	121110	7588
2001	139110	8716
2011	153062	9590

Data source: census report-1991, 2001, 2011

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II. Changes in Land-use:

Present study area is a class-ii urban centre within the state of West Bengal. Such agro-based urban centre covers almost a 50km of distance in its northern and north-eastern direction. Relatively good urban facilities have made the place a centre of attraction majorly for rural centres of Krishnanagar Sadar and Tehatta Subdivision. Very ground level survey shows often it is the facility of better schooling, often medical and transport facilities which are attracting people at rapid rate to this centre. A trend of rapid urbanization which is true for many other district towns (Chumki Shikary, 2020) within the state is also true for present one. This obviously caused newly grown high rise buildings, shopping malls and rapid land-use change. It is evident from following maps and figures:

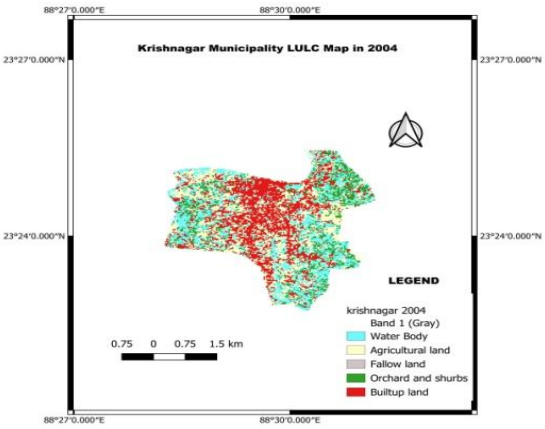

Figure-2

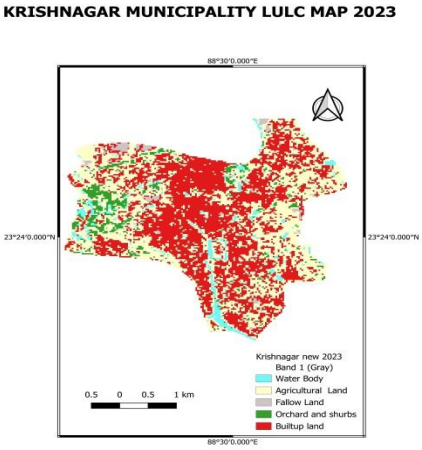

Figure-3

Table No- 2: Land-use scenario within the study area

Year	2004				2023			
Land-use	**Raster Value**	**Pixel Sum**	**Percentage %**	**Area [metre^2]**	**Raster Value**	**Pixel Sum**	**Percentage %**	**Area [metre^2]**
Water body	1	4426	28.44	3983400	1	218	1.4	196200
Agricultural Land with vegetation	2	4638	29.8	4174200	2	7340	47.16	6606000
Fallow land/barren land	3	33	0.21	29700	3	612	3.93	550800
Orchard and shrubs	4	2144	13.78	1929600	4	350	2.25	315000
Built up land	5	4322	27.77	3889800	5	7043	45.25	6338700

Data source: LANDSAT image processing in QGIS-3.22

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Change detection in land use is been done by using the formula:

(Land-use in initial year- Land-use in final year)/ Land-use in initial year

The following figure has been achieved through the calculation:

Table No- 3: Land-use change during 2004-2023:

Type of land-use	Water body	Agricultural Land with vegetation	Fallow land/barren land	Orchard and shrubs	Built up land
Change in %	-95.07	58.25	17.54	83.67	62.95

Data source: LANDSAT image processing in QGIS-3.22 and calculation done by the researcher.

Changes in water bodies under image processing is often subject to seasonal changes, but from above figure it is evident that increase in built-up land and loss of wetland is remarkable for the specific twenty year interval for the study area.

III. Rising wastes and its management:

Rising population has a direct impact on more and more waste production. The urban centre which experienced almost population density of 10,000 per sq km and where newly grown high rise multi-storeyed residential complexes are common increase in solid waste is the obvious episode (TOURE, 2022). Field surveys show piling of wastes inside the wetlands, improper maintenance of waste segregation policy, absence of proper waste management measures in waste treatment plants are all present within the study area. The dumping ground in Godadanga under Krishnanagar Municipality itself demands application of modern techniques to minimise bad odour caused by piles of wastes. Field surveys and interview with the people related to waste collection and maintenance show that application of 5R (Balwan, 2022) like steps to make the area really plastic free is still beyond implementation. Improper maintenance of solid wastes is a real threat to the river Jalangi (Das G. K., 2022), the wetlands and to human health.

IV. Disappearing wetlands:

Wetlands within the Municipality area are a real evidence of anthropogenic impact on natural flow of rivers (Das S. , 2012). Historical evidences show that natural flow of the river Jalangi is interrupted within Krishnanagar. Anjana Khal which like a distributaries could play the key role in maintaining drainage, aquatic ecosystem and natural beauty for the urban centre

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is itself in moribund condition. A related part of it which surrounds the Rajbari in almost a rectangular shape (also the significant example of human impact on natural flow of river) is known as *Rajar Dighi*, after its discontinued flow it tries to move toward South-Western direction. Piling of wastes, capturing of wetlands and their conversion into built-up land is evident throughout the urban centre, specifically covering the areas surrounding Nabadwip Road and Railway line running towards Lalgola. Several palaeo channels of Anjana Khal are present within this urban area which is also being turned into built-up land in a faster rate. Parts of the town covering Kanthalpota, High Street areas which experience waterlogged condition only after a heavy rainfall are just the signature caused by loss of wetlands. Those wetlands were the route for natural flow of water, but are being occupied rapidly. The same experience is true for areas nearby Krishnanagar City Junction covering areas of Segunbagan and Shaktinagar.

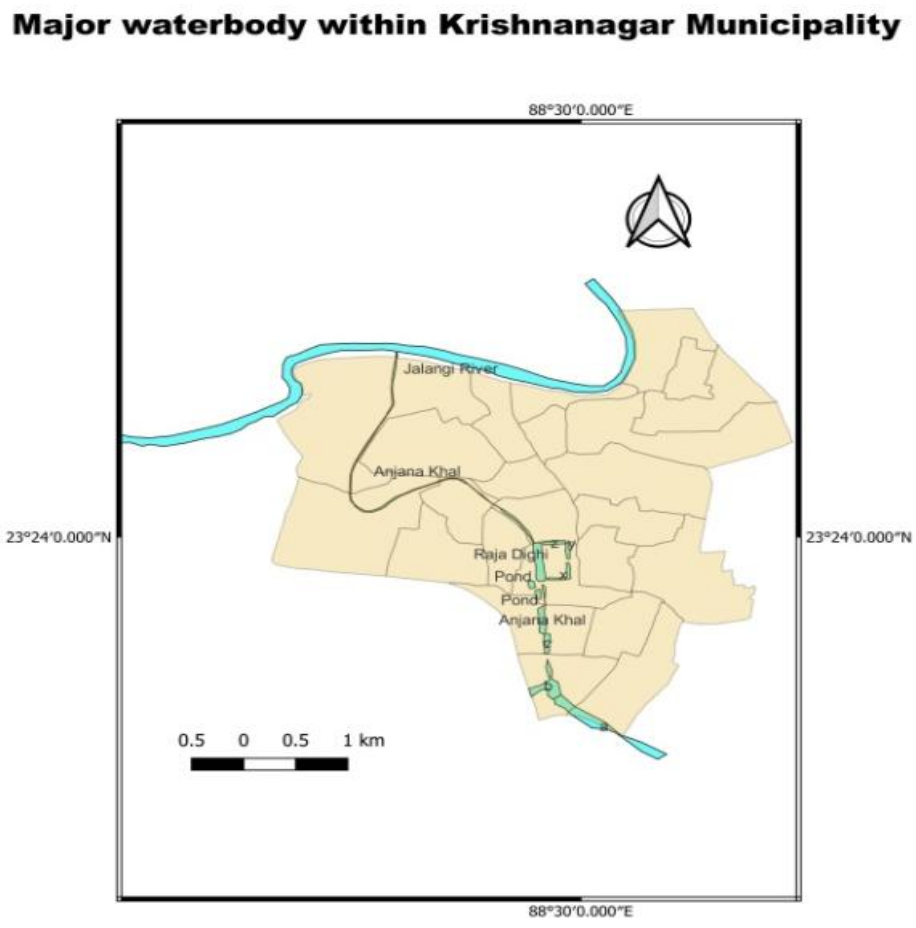

Figure-4

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V. Traffic Congestion:

Traffic congestion is also a common phenomenon for urban centres in developing world with rapid population growth and rising use of vehicles. The same is true for present study area. Field surveys and daily experience as observed by the researcher shows that the ULB has already taken initiatives with direct assistance from traffic control authorities. In spite of steps like maintaining traffic signals, deployment of traffic surgeons in each important crossing, traffic congestion is such a problem within this urban centre which could not be erased till today. Every day a huge number of people have to travel to this town for several administration related official works and as the nearby Railway station for people even from a distance of 80 km. Narrow roads, rising number of vehicles are the key reason for such congestion which still demands improvement.

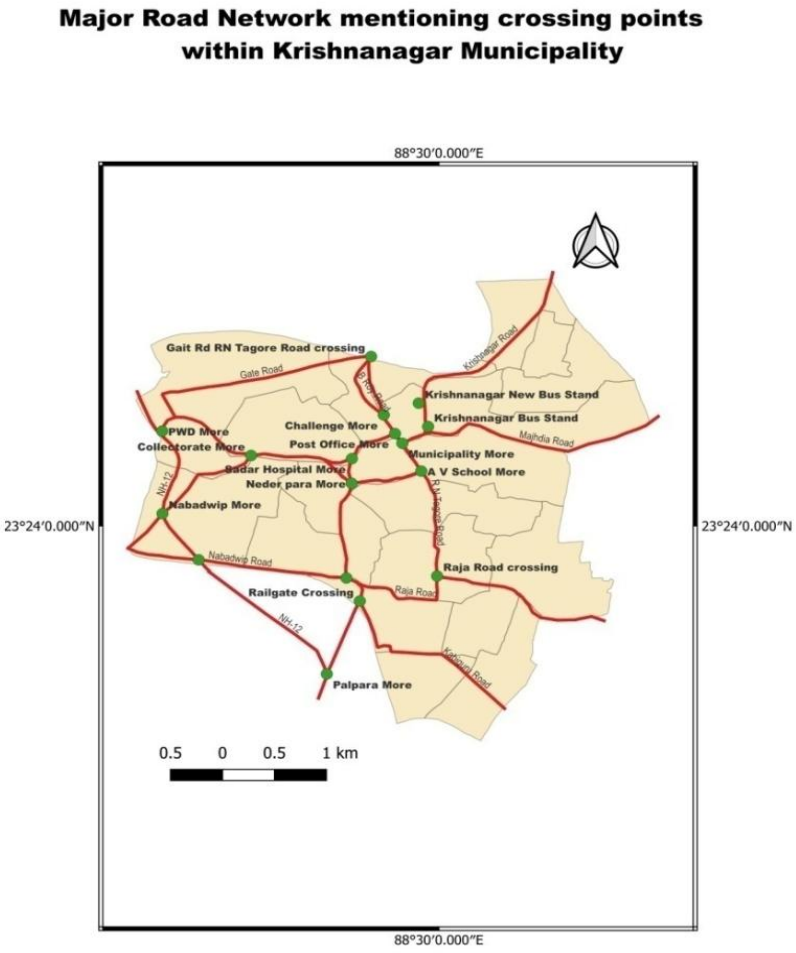

Figure-5

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VI. Air Pollution:

Secondary data sources as collected from West Bengal Pollution Control Board a summarised figure is as follows for Krishnanagar:

Table: Air quality of Krishnanagar at a glance

Duration of observation period		NO2 (µg/m3)	SO2 (µg/m3)	PM10 (µg/m3)
07.12.2016 to 04.01.2023	Highest value	66.47	14.75	408.24
	Lowest value	16.12	2.00	71.72

Data Source: www.wbpcb.gov.in

A field survey and dissertation paper was prepared under the supervision of present researcher for PG Studet of Kanyashree University. The field survey aimed at people's perception on air quality and its health impact, the result as per interview with 30 people is as follows:

Table 4: People's perception on air quality and associated issues

Question	Options	Response in %	Question	Options	Response in %
How would you rate air quality of your locality in comparison to previous year?	Much better	15	Main cause of air pollution in your locality.	More Vehicles	40
	A little better	35		Population growth	30
				Waste disposal	4
	About the same	50		Others including over use of electronic gazettes	26

Data source: Field survey at traffic congested spots

VII. Health status among slum dwellers:

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Several scattered slum areas are observed within this urban area. In another field survey covering the slum areas nearby Manikpara and PWD Road area with the objective to identify health status among slum dwellers and their level of consciousness was done through a survey among 50 households, this shows following result:

Table-5: Health status among slum dwellers

Question	Options	Response in %	Question	Options	Response in %
Do you depend upon govt. hospitals in health related issues?	Yes	70	Diseases you or any of your family members mostly suffer from (based upon priority).	Diarrhea	60
				Fever	74
	No	25		Cold and cough	76
				Respiratory problems	82
	Sometimes	5		Skin diseases	38
				Cancer like critical disease	35
				Neurological diseases	15
				Other	42

Data source: Field survey

VIII. Status of cultural heritage:

The study area is always considered as a significant point within Bengal for its Historical and cultural heredity. This place is carrying a specific culture since 1750s, along with traditional Hindu religious culture, presence of Catholic Church and presence of people from all the different communities, even the presence of centre for *Bramvo Samaj* provided the centre a specific hetero culture and religious identity. The place is always considered as the great contributor of Bengali drama and music. Along with this, world famous clay art of Krishnanagar and special sweet items make the place unique from any other cultural hearth of Bengal.

In present era of urban growth traditional culture of this place is also affected. It is rapid increase of built-up land and easy measures to conserve the heritage which is in fact affecting the soothing cultural touch of this holy land in a negative manner. Loss of wetlands, piles of garbage, high rise buildings covering the traditional sites are affecting both physical and cultural environment.

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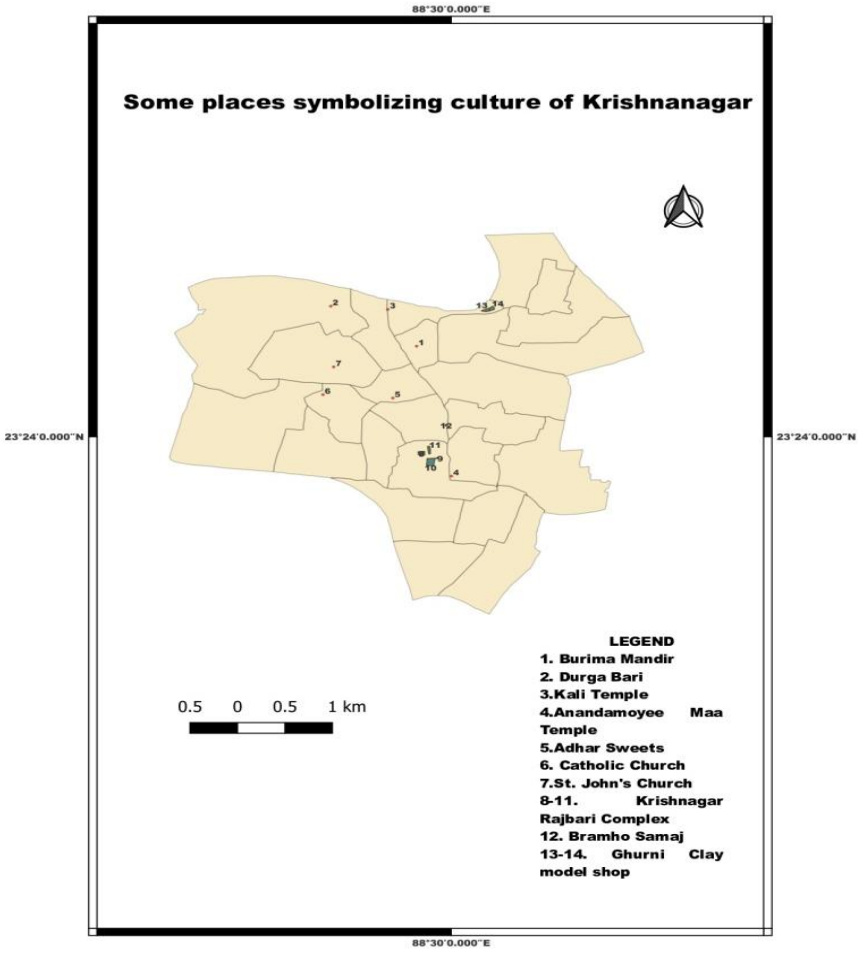

Figure-6

6. Proposals for a sustainable framework:

The proposals are been set based upon the major crisis observed within this urban centre and is an effort to tie the physical, cultural and economic environment in a common thread to sustain the future for such historic site. The proposals include:

- **Systematic waste management with raising awareness among dwellers:**

Waste collection and its management should be done in more systematic and regular manner. Always it is observed that collection procedures neither maintain segregation nor the collectors have actual intentions to make the area clean properly. Processing of collected materials still needs modification. Otherwise the dumping ground itself is becoming a grand polluted place.

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- **Conservation measures to sustain ground water storage:**

The growing number of high rise buildings is no doubt an alternative to support the crisis caused by horizontal expansion of built-up lands, at the same time they are becoming the larger consumer of ground water, concentrated source of wastes. Proper planning to cover those high rise residential complexes under surface water supply as is covered by Municipality throughout the town is needed. Such measures could support ground water storage and supply of arsenic free drinking water within a large number of people. Awareness among those residents (mostly of them are expected well educated) could be a good solution to refuse, recycle and reuse of wastes.

- **A plastic restricted town:**

Restriction in use of plastics is still within a planning stage, with a gap of few years the authorities suddenly become conscious in this issue and for most of time reluctant behavior both on behalf of the authority and citizens is observed. Again it is the need of awareness to cope with the situation.

- **Conservation of wetlands:**

Conservation of wetlands is the utmost need for any inhabited zone to support drainage, eco system, and all the aesthetic and heritage aspects. Rapid land use change, specifically expansion of built-up land in expense of wetlands is a near future threat to the locality from every aspects of sustainable environment. Strict policies to act against land use conversion and more systematic waste management to make the wetlands waste free could support the future to some extent. In this regard steps taken by *Save Jalangi* group are praise worthy.

- **Separate eco-friendly measures for traditional and newly grown business areas:**

Previously few research works which intended to study the urban center from morphological analysis had already declared that growth of new business centers should be apart from the traditional CBD like zone of High Street area (Islam, 2013).

Presently new growth of shopping complex beyond the crowded zone and centering towards NH-12 is a partial solution. Still proper waste management programs in crowded and most traditional markets in Goari and Patrabazar need management.

- **Arrangement for congestion free traffic movement:**

To make the District town a place with smooth traffic movement major needs are-

a) Flyover or underpass at Railway Crossing nearby Krishnagar City Junction connecting the town with NH-12.

b) Control movement of Toto like vehicles and speed limit even for two wheeler motor cycle riders to avoid unexpected congestion and accident like events. Awareness among dwellers and to follow the right traffic rule is true not only for here but at universal level.

c) Proper parking facilities and steps against illegal parking is another need in this regard.

- **Development of a proper tourism circuit:**

Maintenance of local heritage and to support the economic infrastructure of the area through its cultural heritage could be a good solution to improve economic infrastructure and creating job opportunity. A tourism circuit which already is present covering Mayapur Temple, Bethuadahari Forest, heritage sites of Santipur and Nabadwipthis urban center is really in a central location in respect to the circuit. An initiative is needed to provide good transport facility to cover those places with proper tourist guides.

Two most famous and unique symbols for cultural representation of this place ie *Sarpuria* and *Sarbhaja* like sweets and world recognized clay model shops could be part of that circuit as precious souvenir items.

Another cultural tradition of this town is *Jagaddhatri Puja* (worshipping of Hindu Goddess).The days during this festival the area becomes crowded. Proper planning to manage the festive season and to promote the crowd as part of tourism is needed to tribute the heritage and to make it a part of economic support. Maintaining circuits to cover the traditional spots, systematic arrangements for observing the procession during renunciation of idols could be made. It will cause proper representation of uniqueness of local heritage and culture. The association of environment friendly steps during and after the festival could provide a sustainable future.

7. Limitation of the study:

The study started with the aim of a holistic planning to support the future in a sustainable manner. In several sectors where intensive field survey was needed could not be done due to lack of time. In urban land-use often partial agricultural land-use could not be truly separated from vegetation covered zones and barren lands in image classification. This had stopped the researcher from providing complete and exact scenario.

8. Acknowledgement:

The researcher is grateful to her students who supported in field survey and to the people who participated as respondents.

9. Conclusion:

Any micro level initiative is the first step to save the globe. In above discussion a small urban centre is been focused. The centre which has its own story of geomorphic and anthropogenic importance is just represented like a sample within our globe. So very caring, loving and conscious steps towards our land is the key to save our land. In present era when we have to balance both physical and economic world, a conscious attitude to save the environment from a holistic view could only support our future.

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