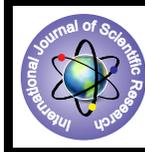


Suitable site selection for small scale industries through GIS analysis: A case study covering Part of Barasat-II, Deganga, Rajarhat block of North 24 Pargana district, West Bengal



Geography

KEYWORDS : Site suitability, multi criteria, discussion makers, planning.

Dr. Nirmalya Das

Assistant Professor P.G. Department of Geography Panskura Banamali College Panskura
RS: Pin – 721152; WB: India

ABSTRACT

GIS played a vital role in analysing the spatial phenomena and prepare a plan for both present and future. The Multi Criteria Decision Analysis (MCDA) process is important in selecting suitable sites for any spatial functions. This paper tries to show a site suitability model using the spatial phenomena like settlement, road network, vegetation, water bodies, agriculture and other land uses to determine the suitable site selection for small scale industries based on local resources. It is also vital for the planners and discussion makers for present and future developmental planning.

1. Introduction:

Site suitability analysis is a key factor in land use study to find out the sites for any economic function which is important for planning and decision-making processes. For site suitability, field study is an important method of spatial analysis which reflects the relation between physical criteria with socio-economic development process of any region of the earth. The spatial distribution of phenomena like settlement, road network, vegetation, water bodies, industries and agricultural activity are related with each other which influence the overall growth and development pattern. In recent day the remote sensing and GIS played a vital role in analysing the spatial phenomena and prepare a plan for both present and future decision making developmental process. The topographical sheet, Inage hard and soft copy of successive periods can help to identify the changing pattern of spatial features. After analysing the map if we verify the present situation through field survey that will gives us a clear picture about any region under study. From this real time analysis the decision maker can prepare the action plan for site suitability, network development and other economic development processes. Geographical Information Systems (GIS) and Multi Criteria Decision Analysis (MCDA) are two important methods through which the site suitability for any function can be determined. Porter (1985) mentioned the coast advantage factor of MCDA and prepared the Five Forces Model for determining the industrial profitability. Malczewsk (2004, 2006) proposed that the MCDA can be applied through GIS process and according to him "The major advantage of incorporating MCDA techniques into GIS-based procedures is that the decision-makers can insert value judgments (their preferences with respect to evaluation criteria and/or alternatives) into GIS-based decision-making procedures, and receive feedback on their implications for policy evaluation. Such feedback can enhance the decision-makers confidence in the results, consistent with general findings in the decision support system literature on the importance of feedback. MCDA provides mechanisms for revealing decision makers' preferences, and for identifying and exploring compromise alternatives. It can help users understand the results of GIS-based decision-making procedures, including tradeoffs among policy objectives, and use those results in a systematic, defensible way to develop policy recommendations". Mendoza (2000) mentioned that "A site suitability assessment is inherently a multi-criteria problem". The site suitability analysis process includes several factors to determine the highest possible suitable sites for economic or other functions. Mighty (2015) has successfully analyzed the site suitability process in the competitive advantage of the Jamaican coffee industry. Bandyopadhyay, Jaiswal, Hegde, and Jayaraman (2009) have uses this process for watershed analysis in South-west India

1.1 Study Area:

The Study area is lies in between 88° 25' 10" to 88° 36' 50" East longitude and 22° 34' 45" to 22° 43' 10" North latitude. The entire area located within North 24 Pgs. District of West Bengal covering the part of Barasat-II, Deganga and Rajarhat block.

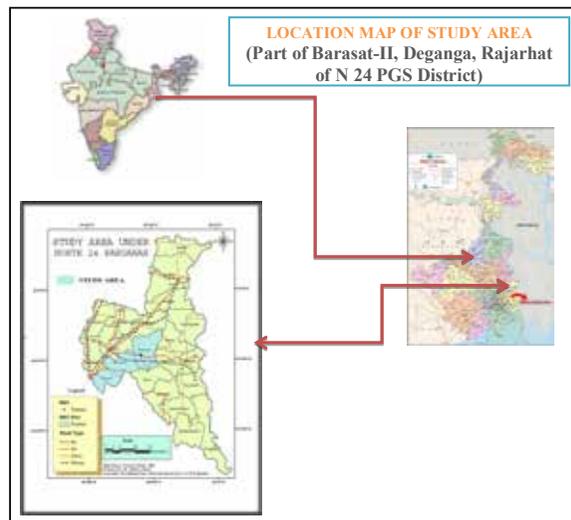


Fig. 1 Location of the study area

1.2 Objectives of the Study: The main objectives of the present analysis are as follows

- To study the socio-economic pattern in relation with physical characteristics of the study region ;
- To analyse the land use and land cover pattern of present study area;
- To study the network development system in relation to settlement distribution of the area;
- To find out suitable sites of tertiary economic development for an overall plan for the study region.

1.3 Database and Methodology:

The present analysis is based on both primary and secondary data sources. The topographical sheet of number 79B/6 of 1956-57, 79B/10 of 1976-77, NRSA image hardcopy of 2009 and Google image of 2013 are the most important secondary sources of data for the present study. The primary data has been collected by the trainee through field work with GPS survey. Field photographs are also important primary information regarding different features that has been collected during the field survey. The entire work is based on remote sensing data that are analysed through GIS platform. Various methods of GIS mainly from Arc GIS module like creation of geo-database, geo-referencing, digitization, feature identification etc. From the above analysis different types geo database has been created regarding land use, transport network, drainage, water bodies, settlement, agricultural zone, aquaculture and other tertiary activities. After analysis of the data a final output map has been sorted out that gives a site suitability analysis for the entire area.

Methodological Flow Chart

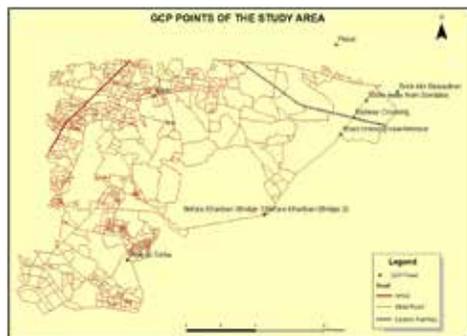
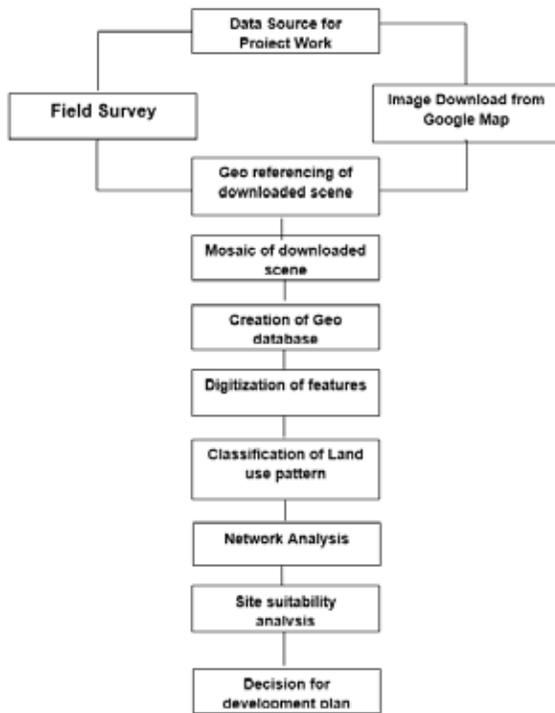


Fig. 2 Ground control point of the study area

2. Physical Characteristics: The entire area is located in the lower part of Bengal which is almost a plain area where maximum contour heights is within 20 meter. Some places looks like a depression area where permanently water logging is an important feature. There are numerous tidal channels spread over the eastern and north eastern part of the study region which are joins with river Noai and Bidyadhari. From the channels and rivers it is clear that the general slope of the region from North-Western to South-East ward. There are two important soil types are found in this region i.e. purely alluvial in the western part and sandy saline alluvial in the N-E and eastern part. The entire area receives more than 250cm of rainfall annually. There are no such particular types of vegetation found in this area. Only some small scrubs and bushes are found in some upland areas. Because of the plain area and tidal influences the whole region is under agricultural and fishing activities.

2.1. Land Use Pattern of the study area: The land use pattern of any region reflects the pattern of Social and economic development as well as the development towards tertiary and quaternary development. The present study area belongs to both rural and urban land use category where primary and tertiary activities are prominent. There are 4 prominent categories of land use

pattern shown in the area and these are settlement, agriculture, wet land and settlement with vegetation and they occupied 29.18, 30.84, 16.26, 16.06 present of total area of study region. The other types of land use pattern shown in the table 1.

Table- 1 Land use types of the study area, 2014

Types of Land use	Area (Sq. Km)	% of Area
Agriculture	71.28	30.85
Airport	5.48	2.37
Brick Kiln	2.11	0.91
Canal	0.85	0.37
Non Agricultural Land	2.22	0.96
River	0.88	0.38
Settlement	67.44	29.19
Settlement With Vegetation	37.11	16.06
Sub-Station	0.38	0.16
Vegetation	3.08	1.33
Water Body	2.64	1.14
Wet Land	37.58	16.26
Total	231.07	100

Source: Google image (2014) and SOI Topographical Sheet

Fig. 3 Percentage share of land use

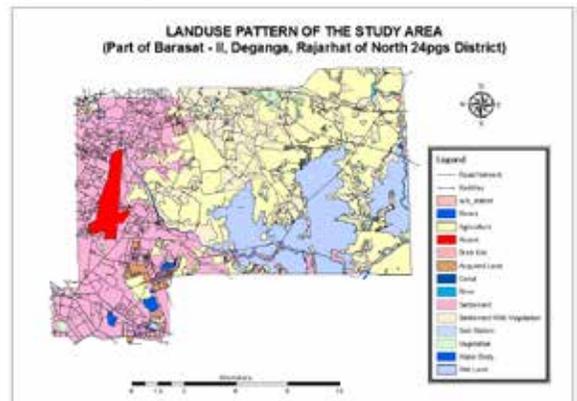


Fig.4. Landuse pattern of the study area

2.2 Transport Network:

1. Except eastern part road density is high because of urban development.
2. Eastern part is under wetland and belongs to rural agricultural activity.
3. Airport, NH34 located in the western part and Eastern Railway (Sealdah- Hasnabad section) located in the north eastern part.
4. South-eastern part of the study area is under wet land and fisheries where transport route development is very low.

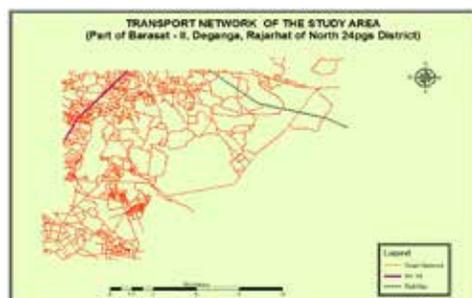


Fig. 5. Transport map of study area

3. Buffer Zone: For selecting the small scale industrial sites within the study area we have prepared the buffer zone for individual spatial phenomenon. This buffer zone is based on the guidelines and recommendation of the Central Pollution Control Board, Govt. of India. Within the small area only one buffer zone is created for individual features as it is mainly concentrating on small scale i.e. Green Industries. After creating the individual buffer zone, aggregation of all buffers is necessary to identify the suitable area for the small scale industries.

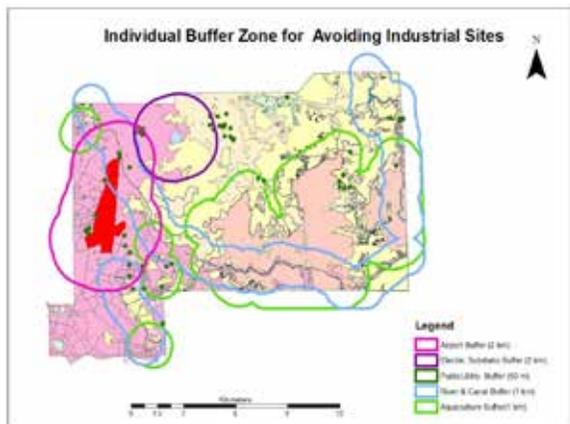


Fig.6. Individual buffer zone of land uses



Fig.7. Avoid area for small industrial location

3.1 Identification of Suitable sites for small scale Industries:

Considering the all the criterion discussed above, the suitable small scale industrial sites has been identified as follows

1. IT Hub near Rajarhat.
2. Cold Storage near Aminpur of Deganga Block.
3. Fish Processing Industry near Kha ribari of Deganga Block.

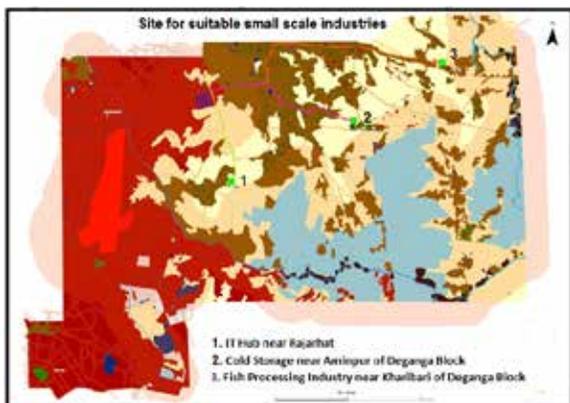


Fig. 8. Identified sites for suitable industries

3.2 Major findings:

Agriculture, settlement and wet land occupies near about 75 percent of land of the study area where major economic function like industrial setup is not possible for legal restriction in environmental perspective.

Some part of the study area is under Greater Kolkata Metropolitan City where settlement is the main land uses pattern and does not allow in developing the large industrial sites.

The present multi-criteria site suitability analysis based on local resources reflects that mainly three small scale economic functions may be developed and these are: a) IT Hub at Rajarhat near the settlement area, b) Cold storage near Aminpur of Deganga Block, and, c) Fish Processing Industry near Kharibari of Deganga Block.

References:

1. Bandyopadhyay, S., Jaiswal, R. K., Hegde, V. S., & Jayaraman, V. (2009). Assessment of land suitability potentials for agriculture using a remote sensing and GIS based approach. *International Journal of Remote Sensing*, 30(4), 879 – 895.
2. Malczewski, J. (2004). GIS-based land-use suitability analysis: a critical overview. *Progress in Planning*, 62(1), 3-65.
3. Malczewski, J. (2006). GIS-based multicriteria decision analysis: a survey of the literature. *International Journal of Geographical Information Science*, 20(7), 703-726.
4. Mendoza, G. A. (2000). GIS-based multicriteria approaches to land use suitability assessment and allocation. *United States Department of Agriculture Forest Service General Technical Report Nc* pp. 89-94, from [m http://ncrs.fs.fed.us/pubs/gtr/other/gtr-nc205/pdffiles/p31.pdf](http://ncrs.fs.fed.us/pubs/gtr/other/gtr-nc205/pdffiles/p31.pdf).
5. Mighty, M. A. (2015). Site suitability and the analytic hierarchy process: How GIS analysis can improve the competitive advantage of the Jamaican coffee industry. *Applied Geography*, 58 (2015), 84-93.
6. Porter, M. E. (2008). The five competitive forces that shape strategy. January 1 pp. 23-43). *Harvard Business Review* Accessed 10.04.12 from <http://hbr.org/2008/01/the-five-competitive-forces-that-shape-strategy/ar/1>