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LAND USE CHANGE AND PERCEPTION MAPPING OF NEW TOWN, RAJARHAT, NORTH 24 PARGANAS, WEST BENGAL

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Abstract:

Land use of a region is the mirror image of the people's livelihood. In rural areas agricultural land play the dominant role in its economy and built-up area i.e. residential, commercial and industrial area which control the economic activities of the region. Land use change occurs due to various reasons in different places and time. In 21st century, rapid urbanization causes not only the changes in land use but also it becomes a threat to the environment and ecology. So the land use change needs a special attention for sustainable development. New Town started to built in part of Rajarhat Block of North 24 Parganas and part of Bhangar Block of South 24 Parganas since 1990. It is located to the north-east of Salt Lake City and just to the north of East Calcutta Wetland. As this planned town is only 7 km from Kolkata, rapid growth of commercial, industrial and residential developments take place in this region. This on-going township project causes a huge change in land use and the changing land use has an enormous effect on the inhabitants of the old rural settlement. Authors aim to investigate the changing pattern of land use of this New Town area and its impact on the existing rural population. As the agricultural land transformed into residential and commercial or other urban functional areas, there is a gradual influx of population from different parts of Bengal and other parts of India as well. Some of rural populations are rehabilitated by the Government of West Bengal in other part of New Town. Some of the people lost their agricultural land and some of them lost their work related to primary activities i.e. agricultural labour, fishing etc. At first (village wise) demographic structure and its related changing occupational pattern have been analysed and a perception survey has undertaken by the authors to measure the level of satisfaction/dissatisfaction and to explain the factors behind it. Author made a careful study to observe the effect of land use change on the socio-economic conditions of the existing rural settlement of that region.

Key words: Land use change, Supervised classification, Perception mapping.

Introduction:

Land use and its change are the burning issues of contemporary Geography. Due to rapid urbanization land use change occurs at fast rate in different place [1]. New Town is an ongoing project, which has given many changes, like land use change, demographic change as well as occupational change in the study area. Due to this urbanization a huge amount of agricultural land transformed into urban utilities. For this reason more than 85% of agricultural labour and cultivator are now in other occupational activities like security guard, construction labour etc. So it is necessary to know the socio-economic condition of the existing rural population of the region.

Study area:

New Town is a satellite town of Kolkata. It has been started covering in part of Rajarhat Block of North 24 Parganas and Bhangar Block of South 24 Parganas. It is located to the north of East Calcutta Wetland and north-east of Salt Lake City. The geographical location is between 22º 30′ 32″ north to 22 º38′ 03″ north of latitude and 88º 26′ 29″ east to 88º 32′ 57″ east of longitude. Total area of New Town is about 6712 hectares. The annual maximum average temperature is 38.5ºC and minimum average is 17.4ºC. The annual rainfall of the study area is 1029 mm [2] [3]. The study area is located only 7 km. from Kolkata city and only 2 km. from Kolkata Netaji Subhas Chandra Bose International Airport.

Objective:

Due to planned urbanization in the study area, there is a significant change in land use and land cover and as well as in demographic structure. The objective of this study is to provide quantitative information about spatial change of land use and to analyse people's perception about this ongoing township project. At the same time another objective is to find out occupational transformation of the dwellers.

Methodology:

Data acquisition:

For the study, IRS satellite imageries of New Town were acquired for 2001 and 2008. Both were obtained from National Remote Sensing Agencies (NRSA). New Town project area map is collected from Bijon Bhavan, West Bengal Housing Infrastructure Development Corporation Ltd. (WBHIDCO), Govt. of West Bengal by the authors.

I. Georeferencing of imageries of 2001:

Georeferencing refers to the process of assigning map co-ordinates to satellite images. In this case, the satellite images of the year 2001 have been geo referenced against the topographical map (S.O.I) scale 1:50000 using the cultural and

physical features of the region as ground control points (GCP). The projection used is the Universal Transverse Mercator's projection (UTM) with WGS84 as datum. Second order polynomial transformation and nearest neighbor resampling method were selected for this process [4].

II. Image to image registration for the image of 2008 and project area map:

The satellite image of the year 2008 is georeferenced against the corresponding satellite image of the year 2001. This process is called image to image registration for time series images. It ensures that the pixel grid of the images of the year 2008 conform with the corresponding images of the year 2001, hence enabling pixel by pixel comparison of the images. Then New Town project area map is georeferenced with the help of cultural and physical features of the region as ground control points (GCP) from rectified images (image to image rectification).

III. Subset of Area of Interest (AOI) from rectified images:

Creating an AOI from rectified municipality map, subset is made for the corresponding area i.e. New Town from 2001 and 2008 images.

IV. Ground truthing:

Authors have a prior knowledge about the study area, and at the same time GPS data were collected from different site of the study area for more accuracy.

V. Supervised classification of land use of imageries of 2001 and 2008:

Supervised classification was performed on both images using Maximum Likelihood algorithm in ERDAS 8.5. The supervised classification technique is preferred, because the author has a prior knowledge of the area and GPS data of the study area are used for that work. Maximum Likelihood decision rule is still one of the most widely used supervised classification algorithms [1]. From there the land use land cover maps were derived with the following six classes: 1. Agricultural land, 2. Developed land, 3.Water bodies, 4. Swamp area, 5.Rural settlement and 6.Green and open space.

Data analysis:

1. Supervised classification:

The result of supervised classification shows there was six main land uses in 2001(Figure 1). Due to this township project agricultural land and swamp area was vanished from this area in 2008 (Figure 2). It indicates agricultural land less and job less of the cultivators and agricultural labours. Water bodies decreases 304.117 hectares within 7 years, in other hand green and open space increases 77.1679 hectares. (Table 1)

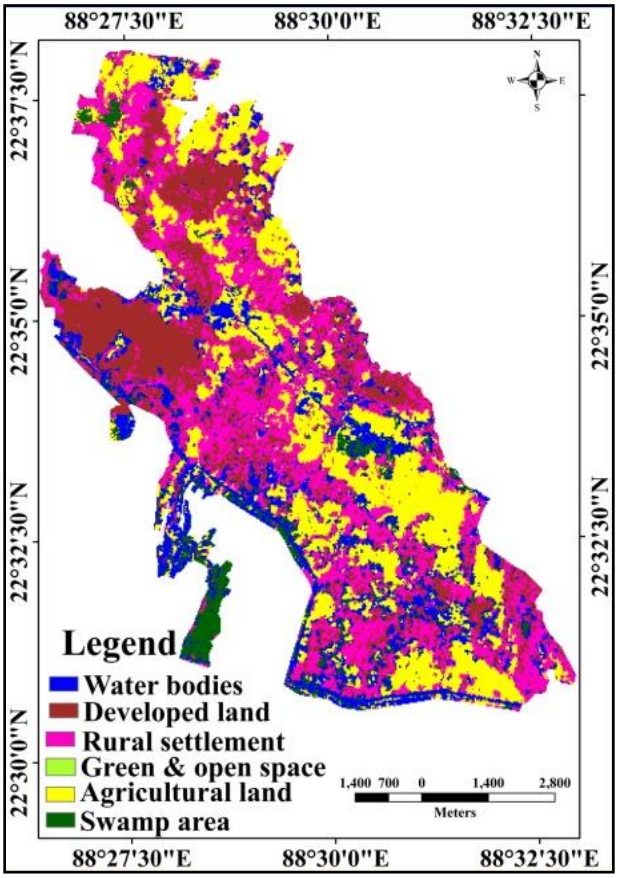

Figure 1: Land use land cover map of New Town, 2001

Land use land cover	2001 Image	2008 Image
Water bodies	1035.03	730.913
Agricultural land	1809.438	0
Developed area	1436.71	3650.59
Rural settlement	1973.48	2243.06
Swamp area	447.8249	0
Green & open space	10.1237	87.2916

Table 1: Supervised classification of land use during 2001 and 2008 (Area in Hectares)

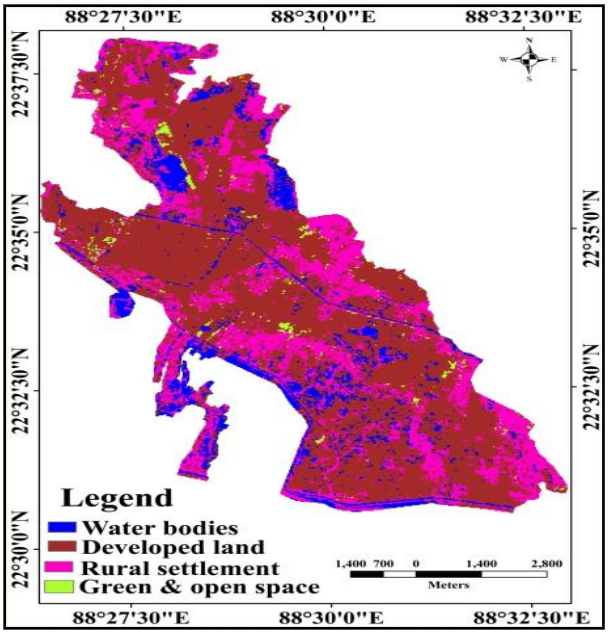

Figure 2: Land use land cover map of New Town, 2008

2. Land use pattern:

On the basis of Survey of India toposheet (1969) a land use map is prepared and supervised classifications have made on two images (2001 & 2008). Comparing these three maps of New Town, conspicuous changes are recorded in this area. There was one only one metalled road connecting few villages i.e. Recjuani, Hatiara, Raigachi with Kolkata. In 2001 it is seen that Phase I of project area was reclaimed/ developed for urban utilities. In 2008 total area was developed with roads and built up areas. Except existing rural settlement area the agricultural land was converted into developed area.

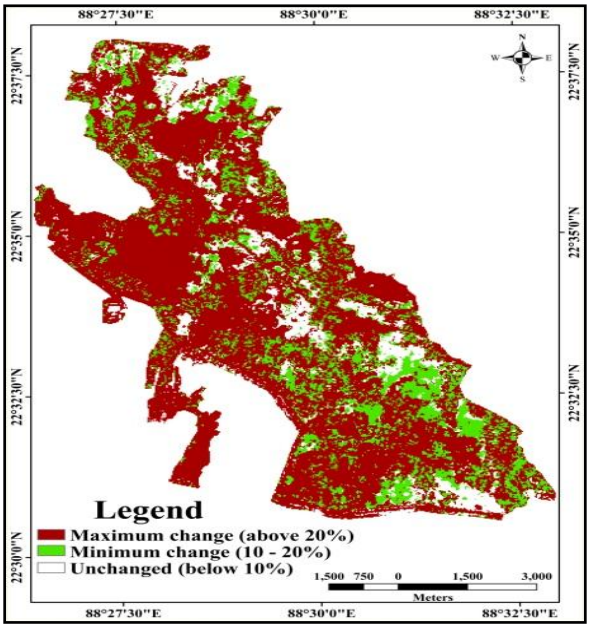

Figure 3: Change detection image

3. Change detection:

The detection of changes involves the comparison between satellite imageries of 2001 and 2008. The method applied in this study is known as 'image differencing' [5] [6], the value of the pixels in 2001 image is simply subtracted from the value of the corresponding pixels in the 2008 image. The value ranges between 0 to ±1, the value closer to zero records no change, whereas higher values show the more change. In order to get the magnitude of changes a meaningful threshold value of changes is applied [7]. It is performed by using the NDVI value of the 2001 and 2008 images (Figure 3).

4. Demographic pattern:

In this project area, nearly 50% population belongs to Scheduled caste and 1.46% belongs to Scheduled Tribe. The concentration of population is high in the northern part due to nearness of the Rajarhat-Gopalpur Municipality. Also the people of this region are mostly engaged in household and other than household activities.

In rest part of New Town area belonged to agriculture. So that most of the people were cultivators or agricultural workers. And a large number of people were marginal agricultural worker or marginal household worker.

5. Impact of land use change:

To understand the impact of this land use change on the socio-economic condition of the existing population, a perception survey (household) has undertaken by the authors. A questionnaire is made to get the following information,

I. Demographic information about respondents
   a. Age sex, b. Education, c. Occupation, d. Income
II. Satisfaction/dissatisfaction regarding a. low compensation, b. loss of land, c. loss of job and d. change in income.

Whether there is enhancement in facilities (priority wise)

a. Transportation and communication, b. Health care, c. Education, d. Banking, e. Employment, f. Electrification, and g. Industrialization.

III. Problem for this project work (priority wise)
   a. Unemployment, b. Job insecurity, c. Social hazard, d. Marginalization of labour, e. Social insecurity and f. Pollution.

IV. Index of Satisfaction (IS) = Fs-Fd / N is calculated.

When,

FS= Number of satisfied respondents, FD= Number of dissatisfied respondents,

N= Total number of respondents.

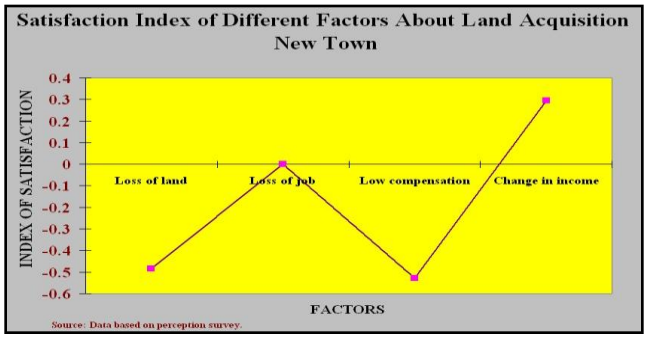

Figure 4: Satisfaction index of different factors about land acquisition

6. Change in occupational pattern:

Most of people who were engaged in cultivation now started to get engaged in different service sector i.e. business, daily labour, supplier and other activities (Figure: 5)

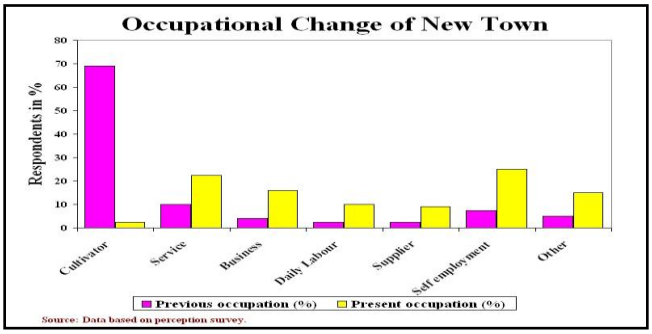

Figure 5: Occupational change

7. Income and satisfaction/ dissatisfaction level:

It is seen in the perception survey that the people who belong to low income group and low education level as well, they are highly dissatisfied. It may be cause due to they have no technical skill to get good job in urban activities. The higher income group mostly started good business in the newly developed market potential area. Daily workers are getting job in different offices or in commercial activity (Figure: 6).

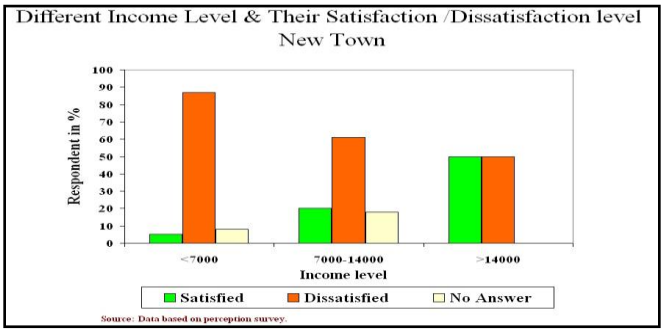

Figure 6: Income level and satisfaction/dissatisfaction

8. of facilities and problems:

Authors get a data base (priority wise) on perception regarding facilities and problems. In the first step, the score are weighted by their rank and then make it normalized for comparative status of different sectors (Figure: 8).

Normalized weighted score of facilities:

$$NWSF = \sum Pi\ ri / P1\ R$$

Where,

NWSF= Normalized weighted score of facilities

Pi (Priority) = 8 - i, i= 1……..7

ri= Number of respondents in the i th priority for the particular enhancement facility.

P1= Maximum priority number, R= Total number of respondents.

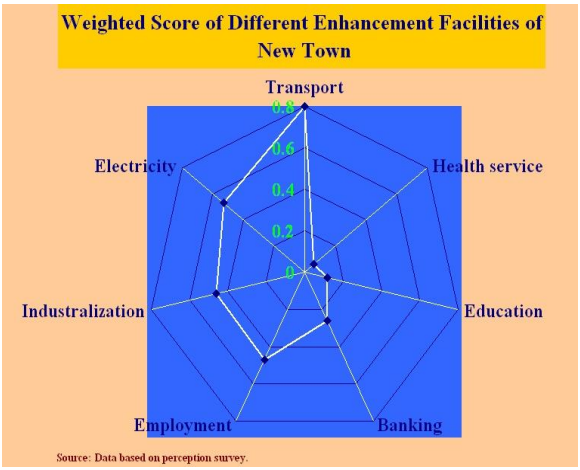

Figure 7: Weighted score of different facilities

Normalized weighted score of problems:

$$NWSP = \sum Pi\ ri / P1\ R$$

Where,
NWSP= Normalized weighted score of problems
Pi (Priority) = 7 - i, i= 1……..6
ri= Number of respondents in the i th priority for the particular problem.
P1= Maximum priority number, R= Total number of respondents.

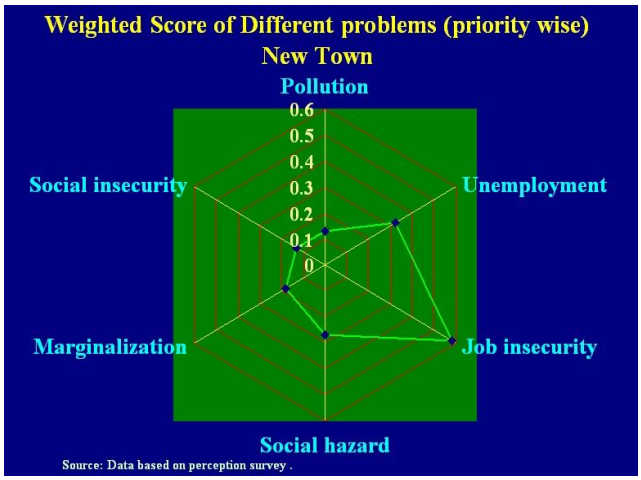

Figure 8: Weighted score of different problems

The star diagram revolves that people are satisfied regarding improvement in transport facilities, electrification, industrialization, employment opportunities.
On other hand people of existing rural settlement mostly feel job insecurity and unemployment problem (Figure: 7), because most of the people who were engaged in agricultural activities and they have poor knowledge of technology or employment in newly developed service sectors. At present they are mostly engaged as daily labour.

Suggestions:

People need different types of training according to their inclination in work and young population should get good vocational training which would make them fit for the present condition to improve their livelihood.

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Biographies

Jhantu Saradar received the B.A degree in Geography from the University of Calcutta in 2005, the M.A. in Geography from University of Calcutta in 2007. Qualify SET examination in the year 2007 and UGC NET with JRF in Geography in the year 2009. He has worked as lecturer in Geography at Vivekananda College, Madhyamgram under West Bengal State University. He is an UGC-SRF from 2011 at East Calcutta Girls' College under West Bengal State University. His research area includes remote sensing of resources especially land resource, environmental impact assessment of land use change etc. Sri Jhantu Saradar may be reached at jhantusaradar@gmail.com

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