

An Approach to Identify the Regional Imbalances of Socio-Economic Facilities: A Case Study of Narsingdi District

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Abstract

Socio-economic facilities play an important role in the development of regions and affect the maintenance and reinforcement of people's activity. Similar with the common scenario of most of the districts in Bangladesh, the distribution of socio-economic facilities in Narsingdi district is concentrated disproportionately rather than to an equitable and uniform manner. A detailed analysis and investigation has been carried out to determine the regional imbalances in distribution pattern of some socio-economic facilities among different Upazilas of the study area using different statistical methods and Geographic Information Tools. This study also examines the concentration pattern of socio-economic facilities and examined some possible factors liable behind the concentration of those facilities in some particular Upazilas. Based on the outcome of the study, finally some policies and strategies have been provided for upgrading the distribution pattern of socio-economic facilities.

Introduction

An equitable and uniform spatial distribution of socio-economic facilities provide basic services to people and forward to a pattern of ordered growth of activities, which ensures planned development of a particular region. But these activities are not equitably distributed over a particular region. As a result, it has now become a great concern for planners to forge novel ways to cope with problems associated with uneven distribution of socio-economic facilities. In this paper, several factors causing unequal distribution of socio-economic facilities are examined in order to help public officials make informed decisions on proper policy planning.

The analysis investigates the spatial distribution of socio-economic facilities in Narsingdi district and addresses several questions. Firstly, the researchers attempt to find out the regional imbalances in distribution pattern of socio-economic facilities of Narsingdi district with respect to population, area and density. The research determines the disparity and deficiency of socio-economic facilities in different Upazilas of Narsingdi district. Secondly, as the research is concerned with regional imbalances in terms of distribution of facilities, so the authors employ Location Quotient (LQ) method to examine the locational impacts of socio-economic facilities with respect to the central city of the study area. To carry out the study, however, the researchers provide a set of tentative solutions that are stated in the followings:

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1. The concentration of socioeconomic facilities is higher in Narsingdi Sadar Upazila
2. The regional imbalances are gradually increasing from the town center (i.e. Narsingdi Sadar Upazila) and that is to say "with respect to the increase in distance from town center to the lower concentration of facilities".

Methodology

The study area selected for the research is Narsingdi district. The area has been selected by the researcher due to proximity of Dhaka city, having a great potentiality for industrial development. If facilities are evenly distributed in a planned manner over Narsingdi district, pressure on Dhaka city will be relieved to some extent.

For identifying deficiency and the factors responsible for such deficiencies, four types of socio-economic facilities are taken into consideration. These facilities are the primary school, high school, college and Hats and Bazars, of which first three facilities are fallen in the category of education that is most important among the social facilities and Hats and Bazars is most important among the economic facilities. All the facilities taken into account for identifying deficiency for six Upazilas are suitable and give accurate result.

This study is primarily based on secondary data. That's why the research work mainly deals with the secondary sources of data. Socio-economic data related to educational institutions, hats and bazaars, roads etc. are collected from Banglapedia (Bangladesh Asiatic Society, May, 2004). Maps of Narsingdi district are collected from Local Government Engineering Department (LGED). After the result of the analysis being extracted, a field level survey has been conducted to examine the validity of the findings directing four Upazilas (i.e. Raipura, Palash, Belabo, Narsingdi Sadar) under sampling. After the collection of data from different sources, the following methods have been applied to conduct the research.

Location Quotient: The location quotient is most frequently used in location analysis. The location quotient (LQ) is an index for comparing an area's share of a particular activity with the area's share of some basic or aggregate phenomenon. The index of Location quotients (LQ) indicate the level of performance of an area compared to the performance of a higher unit of measurement. When $LQ < 1.00$, it is considered that the sector does not meet local demand; if $LQ = 1.00$, it suggests that the sector meets local demand; and when $LQ > 1.00$, this means that the sector exceeds local demand.

Four categories of socio-economic facilities are taken into account for the analysis of their concentration or dispersion in terms of Location Quotient (LQ) of six Upazila of Narsingdi district. LQ has been derived on the basis of population, area and density for each Upazila and finally Upazilas are categorized in terms of LQ values: $LQ > 1.5$ indicates highly served Upazilas in the district, compared to the area as a whole; $LQ = 1-1.5$ indicates the well served Upazilas having self sufficient facilities, compared to the area as a whole and $LQ < 1$ indicates the underserved Upazilas facing shortage of facilities, compared to the area as a whole.

Mean and Standard Deviation Technique: Deficiency of each type of socio-economic facility for the Upazilas of the study area is classified using mean and standard deviation technique. This classification is very important to understand the nature of same type of requirement to meet up the demand of deficiency of a particular type of facility. Formula

for classifying different Upazilas into groups: Mathematically mean and standard deviation are shown: $\bar{X} = \sum X / N$ and Standard Deviation, $\sigma = \sqrt{\sum(X - \bar{X})^2 / N}$ respectively.

Average Nearest Neighbor Analysis: Average nearest neighbor index is based on the average distance from each facility to its nearest neighboring facility and expressed as the ratio of the observed distance divided by the expected distance (hypothetical random distribution). Hence if the index is less than 1, the pattern exhibits clustering; if the index is greater than 1, the trend is toward dispersion/competition. That is to say, this attempts to measure the distributions according to whether they are clustered, random or regular.

Directional Distribution (Standard Deviation Ellipse): Directional Distribution Measures whether a distribution of a particular facility exhibits a directional trend (whether the components of the facility are farther from a specified point in one direction than in another direction).

Standard Distance (Mean+1SD): Standard distance measures the degree to which features are concentrated or dispersed around the points (or feature centroids) in an input feature class. The standard distance is a useful statistic as it provides a single summary measure of feature distribution around any given point (similar to the way a standard deviation measures the distribution of data values around the statistical mean). A mean center calculation is used to determine the geographic center(s) of the input feature class.

Analysis of Results

Primary School: In Narsingdi district, there are 755 primary schools, of which Narsingdi Sadar Upazila shares the highest. Attempted to measure the concentration or dispersion of facilities in terms of Location Quotient (LQ), the authors observed that Raipura and Palash Upazilas are in the underserved category on the basis of each criterion (i.e. population, area and density), whereas Narsingdi Sadar Upazila is ranked as “highly served”. The authors applied “Average Nearest Neighbor Analysis” to figure out the distribution of facilities regarding whether they are cluster, random or irregular in pattern and explored that distribution of primary school is concentrated more in some particular Upazilas i.e. Narsingdi Sadar, Manohardi and Shibpur (Figure 1).

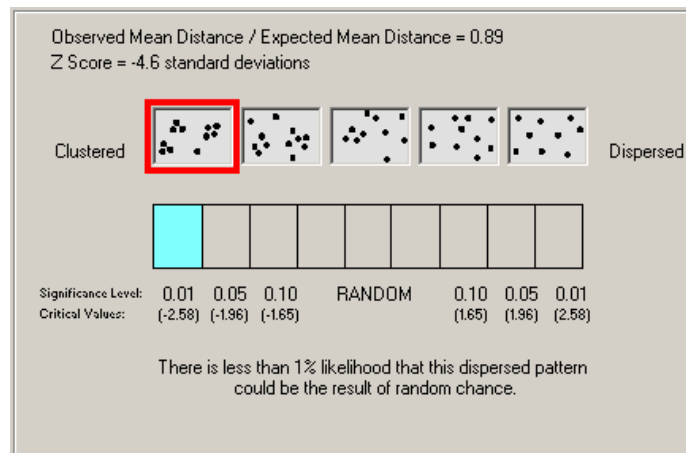


Fig. 1: Average Nearest Neighbor Analysis of Primary School

The output of Average Nearest Neighbor analysis of primary school is shown in Figure 1 where the index (Observed mean Distance / Expected Mean Distance) is less than 1 (0.89). Thus the pattern exhibits clustering as the index is less than 1. The Z score indicates how far and in what direction, primary school deviates from their distribution's mean, expressed in units of its distribution's standard deviation. The less the Z-score value of primary school, the more the concentration of primary school. The Z-score value -4.6 standard deviation indicates that most of the primary schools are clustered in some particular places.

High School: The concentration of high schools, in terms of LQ, gives an interesting scenario of study region that Narsingdi Sadar Upazila is fallen in the underserved category. But the result does not match with the general scenario of Bangladesh, as the trend follows to allocate better facilities in Sadar Upazilas. However, it is not just the quantitative analysis that can serve enough for identifying such concentration, but the qualitative analysis to find out the concentration of facilities is also important, which is not performed in this research. So, small numbers of high schools having good standard in terms of accommodating enough students may overcome the shortage of high schools in numbers.

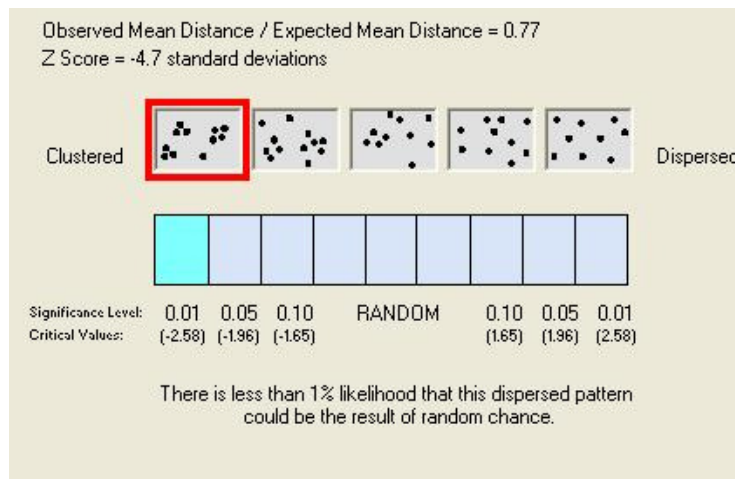


Fig. 2: Average Nearest Neighbor Analysis of High School

The index (0.77) is shown in Figure 2, which is less than 1. The pattern exhibits clustering that is to say, high schools are more concentrated in some Upazilas like Manohardi, Shibpur and Palash respectively. The Z Score value of -4.7 standard deviation points out that most of the high schools are clustered in the above mentioned Upazilas. The negative value of Z score signifies that the distance between the clustered high schools and mean is less than the average distance.

College: The Location Quotient (LQ) for college indicates that Shibpur and Raipura are fallen in the underserved category for all the criteria as they face shortage of colleges, compared to the area as a whole. However, Average Nearest Neighbor analysis for college signifies that distribution of college is almost equitable except Raipura Upazila. But this does not necessarily mean that the total number of college meets up the demand of the people of six Upazilas.

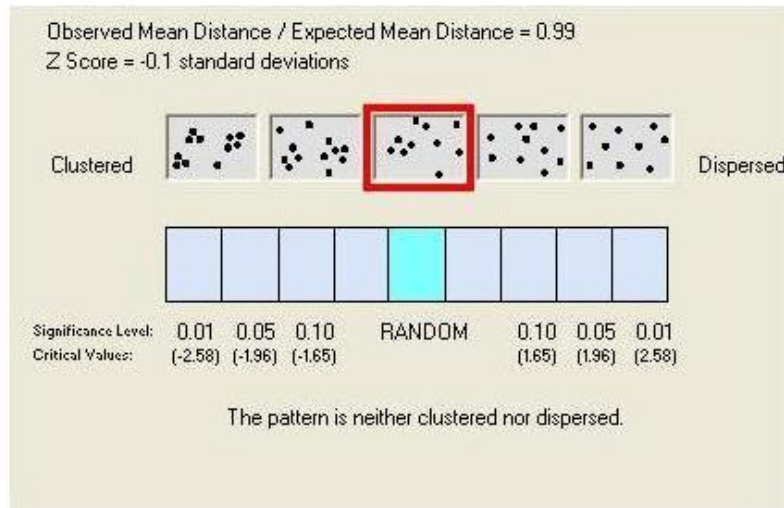


Fig. 3: Average Nearest Neighbor Analysis of College

Figure 3 shows the output of Average Nearest Neighbor analysis of college where the index is around 1. Hence the index is almost equal to 1, the pattern exhibits neither clustered nor dispersed compared to the district as a whole. The Z score value is -0.1 which is around 0, also indicates that the distance of all the colleges from their mean is near to the average distance.

Hats and Bazars: The value of Location Quotient (LQ) for Hats and Bazars shows that Narsingdi Sadar Upazila is ranked as underserved. But, in case of Sadar Upazila, the needs of Huts and Bazars are normally mitigated by grocery shops and local markets. Even to serve the luxurious needs, the shopping complexes having higher order of facilities are also installed generally in Sadar Upazilas. Hence, the small number of Huts and Bazars is not only the indicator to be designated Narsingdi Sadar Upazila as “underserved”.

Figure 4 shows the output of Average Nearest Neighbor analysis of Hats and Bazars where the index is 1.03 which is around 1 meaning that the pattern of distribution of Hats and Bazars exhibits neither clustered nor dispersed in six Upazilas, compared to the district as a whole. Distribution of Hats and Bazars is almost equitable in six Upazilas. The Z score value is positive and it is 0.3 which is tended to be equal to 0, also indicates that the distance of all the Hats and Bazars from their mean is slightly higher than the average distance. But this does not necessarily mean that the available Hats and Bazars in the study area, meets up the demand of the people of six Upazilas.

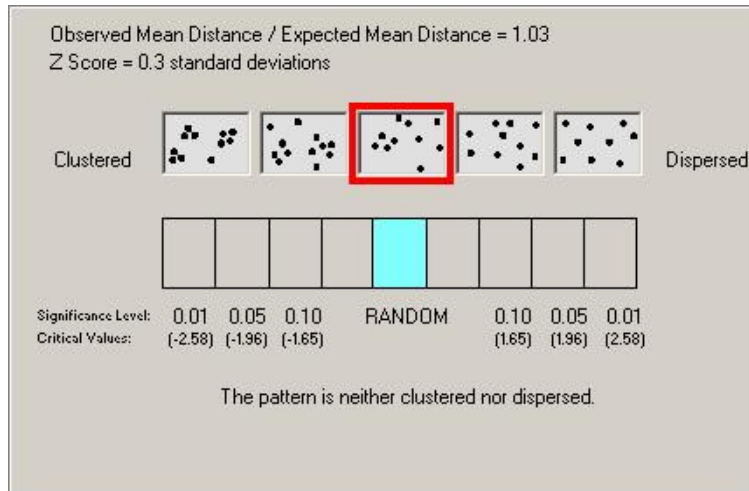


Fig. 4: Average Nearest Neighbor Analysis of Hats and Bazars

Directional trend of facilities: From the analysis, it has been observed that primary and Secondary schools have been distributed in clustered pattern (Figure 5). They are concentrated more in some Upazilas than others. Most of these two facilities are near to their respective mean and are taken place to the proximity of Dhaka-Sylhet highway and Narsingdi Town - Manohardi regional highway. In this case, it can be stated that improved transportation system behind establishing these facilities are responsible to a particular extent. But in case of Primary school, the contribution of improved transportation system is more than High school.

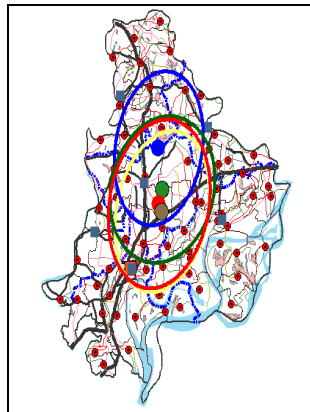


Fig. 5: Directional Distribution (Standard Deviational Ellipse) of facilities

Standard deviational ellipse for College has fallen to northern part of the study area and its direction is north to south through which Narsingdi town - Manohardi Upazila regional highway passes. In this case, it can be stated that other factors are more responsible than the geographical factors. Directional distribution trend for Huts and Bazars are centered to the central portion of Narsingdi district. But it is found that most of the Huts and Bazars are established in the places where the transportation system is

well (Figure 6). It is also found that establishment of the facilities depend on the accessibility. In case of most of the facilities, accessibility played a vital role behind their establishment. It is not necessarily meant that only the physical factors are responsible behind the establishment of the facilities. Both the physical and other factors are responsible in this respect.

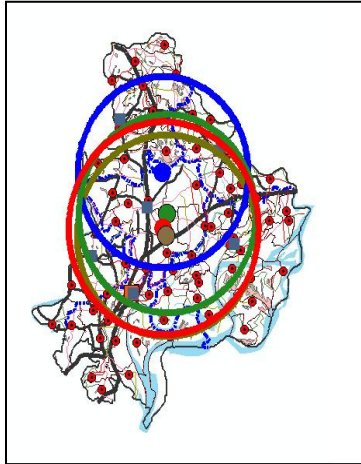


Fig. 6: Standard Distance (Mean + 1SD) of the selected facilities

Table 1: Socio-economic facilities falling within 1 standard deviation

Name of Facility	No. of Facility	Mean + 1 SD	Percentage (%)
Primary School	518	301	58.11
High School	121	73	60.33
College	16	10	62.50
Hats and Bazars	27	15	55.56

Source: Compilation of data of Local Government Engineering Department, 2007

Table 1 shows the percentage of facilities falling within the circles drawn with a radius of 1 standard deviation around the respective facility (Figure 6). From Table 1, it is evident that in case of college, 62.50% facilities are fallen within 1 standard deviation and it is observed that most of the colleges are situated in northern part of the study district. In case of Primary School, High School, and Huts and Bazars, the percentage of facilities are near to each other and their means are located almost at the center of the study district.

Proximity Analysis between the Growth Center and Other Facilities: In Proximity Analysis, buffer polygons are created to a specified distance around the Input Facilities. For doing so, 1 Km, 2 Km, and 3 Km buffered distances are taken for all the facilities with respect to the location of the growth center.

Table 2: Proximity analysis of the facilities with respect to the growth centre

Name of Facility	Percentage of Facility (%)		
	Within 1 Km.	Within 2 Km.	Within 3 Km.
Primary School	7.07	29.25	63.67
High School	14.18	32.09	53.73
College	21.21	33.33	45.45

Source: Compilation of data of Local Government Engineering Department, 2007

From Table 2, it is evident that all the facilities are fallen within 3 Km from the location of growth center. It is also evident that with the increase of distance from the location of the growth center, percentages of facilities distribution are increasing. Maximum percentages of college are fallen within 1 Km and 2 Km from the growth center. Within 3 Km, maximum numbers of primary school are located. From this analysis, it can be stated that the maximum influential zone of growth center with respect to the facilities is 3 Km.

Relation between Some Social Variables and Socio-economic Facilities: Finding out the social factors contributed to the regional imbalances, six types of social criteria are selected that would be responsible behind the concentration of the facilities. Then, the correlation coefficients are derived between the facilities and the selected social criteria to determine the relationship between those two properties which are shown in Table 3.

Table 3: Correlation among the different socio-economic facilities and different criteria

Criteria	Facilities			
	Primary School	High School	College	Hats and Bazars
Population	0.56347	-0.13444	0.34610	0.65825
Area (Sq. Km)	0.12736	0.32166	-0.1153	0.96712
Population Density (per Sq. Km)	0.59246	-0.66942	0.70053	-0.37718
Communication Facilities (in Km)	0.57690	0.68568	0.62097	0.15406
Average literacy	-0.30426	-0.21956	0.02194	-0.70068
Distance (Km) from Narsingdi Head Quarter	-0.64650	0.53002	-0.5767	0.16456

Source: Compilation of data from Asiatic Society of Bangladesh, 2004

From Table 3, it is evident that the correlation coefficient between primary school and the population density (per Sq. Km) is the highest, which indicates that population density is more responsible behind the concentration of the primary school. The correlation coefficient between the primary school and area and communication facilities, are also high which leads to the higher concentration of the concerned facilities. Area criterion is not significantly correlated than the above mentioned criteria. Average literacy rate and distance from the Narsingdi Headquarter are negatively correlated with the number of primary school. So in this respect, population density, communication facilities,

population and area are the factors contributing to the concentration of primary school in six Upazilas of the study area. In case of high school, communication facilities, area and distance from the Narsingdi Headquarter are correlated more with the concerned facility respectively whereas other criteria are negatively correlated. The above mentioned criteria that are positively correlated with high school are the factors behind concentration of the concerned facility. Population density, communication facilities and population have higher correlation respectively with the number of college which are the factors behind its concentration. The correlation coefficient between the average literacy rate and the number of college is positive but not significant. So, this is not the factor that contributes to the concentration of college. In case of Huts and Bazars, the correlation coefficient of the area, population, distance from the Narsingdi Headquarter and communication facilities with the concerned facility are respectively higher. In this respect, these are the social factors contributed to the concentration of the Huts and Bazars, compared to the area as a whole.

Recommendations

General Policy Guidelines: The study may be useful not only for the analysis of development level of an Upazila in terms of the available socio-economic facilities, but also for identification of regions for consideration of allocation of development resources. The study strongly recommends the followings:

Ranking in the Same Type of Facilities through Qualitative Analysis: Quantitative analysis is not the exact measures from which the decisions of providing the socio-economic facilities can be taken by the policy makers. In line with this analysis, qualitative analysis needs to be addressed from various perspectives.

Consideration of Factors in Facilitating Proper Planning and Development: Factors like natural resources, topography, river systems, cultural conditions, communication and industrial potential need to be considered to facilitate proper planning and development so that each region will become economically self-sufficient and prosperous.

Development of Standards: There should be a precise standard about the population coverage or amount of catchment area of specific socio-economic facility. The information system about different facilities existing in the country should be made strong and be able to make available the necessary data in important parameters on time.

Establishment of Collaboration between Different Agencies: Government and all other stakeholders should develop precise policy and establish coordination with a view to providing proper facilities as well as efficient management of them to the population of the country.

Accessibility to All: Socio-economic facilities should be available to all, irrespective of their ability to pay and it should look after especially the vulnerable and weaker section of the population to create and maintain a healthy environment.

Conclusion

To some extent, the study was complex for identifying the concentration of socio-economic facilities among the six Upazilas of the district under study. Different statistical methods have been used to know the regional imbalances and deficiencies in the distribution pattern of socio-economic facilities in different concerned Upazilas. Due to having some limitations of necessary primary data, time, resources and technical problems, the quantitative analysis rather than qualitative analysis is carried out. The study attempts to analyze from different possible aspects. That is why it is strongly believed and hoped that the recommended policies and strategies can surely upgrade the present situation of socio-economic facilities of the concerned district. In spite of some constraints, the outcome of the study may be found as a useful basis to describe a pattern of balanced future development of socio-economic facilities in all Upazilas of Bangladesh and introduce planning controls that will promote the desirable growth of the Upazilas.

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References

- Asiatic Society of Bangladesh, 2004. *Banglapedia*.
- Bahauddin, M. 1989. 'The Spatial Distribution of Physical Facilities in Bangladesh', an unpublished Master's Thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
- Bangladesh Bureau of Statistics (BSS), 2002. *Statistical Pocketbook of Bangladesh 2002*, Dhaka: Bangladesh Bureau of Statistics.
- Isard, W. 1960. *Methods of Regional Analysis: An Introduction to Regional Science*. London: The M.I.T Press.
- Mazumder, F. and Tamima, U. 2006. 'Spatial Distribution of Socio-economic Facilities in Rajshahi Metropolitan Area with reference to the Rajshahi Metropolitan Development Plan (2004-2024)', an unpublished Master's Thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
- Parveen, R. 1984. 'Location Analysis and Model for Union Family Welfare Centre in Rural Area of Bangladesh', an unpublished Master's Thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
- Pasha, K. 1991. 'Spatial Distribution of Socio-economic Facilities in Dhaka City', an unpublished Master's Thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.
- Toufique, M. and Zaman, S. 2005. 'Spatial Distribution of Health Facilities in Bangladesh', an unpublished master's thesis, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh.