

## A Spatial Analysis on the Distribution of Socio-economic Facilities in Chittagong

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**ABSTRACT :** Adequate and equal distribution of Socio-economic Facilities is one of the major tasks of planning. Major cities of Bangladesh are now facing rapid growth of urban population and such rapid urban growth results a lot of urban problems related to unplanned urbanization (e.g. housing, transport, environmental problems etc.) and creates pressure on existing service and facilities of the urban areas. One of the main reasons behind this growth is the availability and more concentration of Socio-economic Facilities in the city. This study analyses spatial distribution pattern of Socio-economic Facilities (e.g. school, college, hospital and market) in a part of Chittagong district which shows that the facilities are mainly concentrated in the city area. Here, the spatial variation, concentration and disparities in distribution of these facilities within different upazilas adjacent to city corporation and city corporation area of Chittagong district are identified by using the nearest neighborhood method, Location Quotient (LQ) method and Gini Co-efficient. The required number of these Socio-economic Facilities to serve the population of the district is also calculated here through comparing with population threshold standard for facilities. This study shows that all of the selected Socio-economic Facilities are mainly concentrated in the city corporation area and the upazilas remain underserved.

**KEYWORDS:** Chittagong, Gini Coefficient, Location Quotient, Nearest Neighborhood Analysis, Socio economic facilities, spatial analysis.

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### I. INTRODUCTION

Socio-economic facilities are the integral part for the residents of any city in the world which is the pre requisite for healthy and cheerful living environment in the city. It also affects the regional patterns of developments, environmental impacts and maintaining socially acceptable level of quality of life. [1.] For this reason, adequate and equal distribution of socio-economic facilities is one of the major tasks of planning and it is more concerning issue for the developing countries. [2.] As a developing country of asia, major cities of bangladesh are now facing rapid growth of urban population. [3.] Chittagong is not different from these cities and it is also experiencing a lot of urban problems related to unplanned urbanization as a result of rapid urban growth. [4.] One of the main reasons behind this growth is the availability of public services and facilities in urban area which acts as a pull factor of rural urban migration. [5.] Besides the increasing urban population creates pressure on existing socio-economic facilities of the urban areas and government becomes unable to meet the increasing demand of socio-economic facilities. [6.] Inadequacy and inequality in distribution of socio-economic facilities in chittagong city is the result of increasing pressure on these facilities through rapid urbanization. [7.] Reducing disparity in the distribution of socio-economic facilities in the whole district can reduce rural urban migration along with maintaining socially acceptable levels of quality of life.

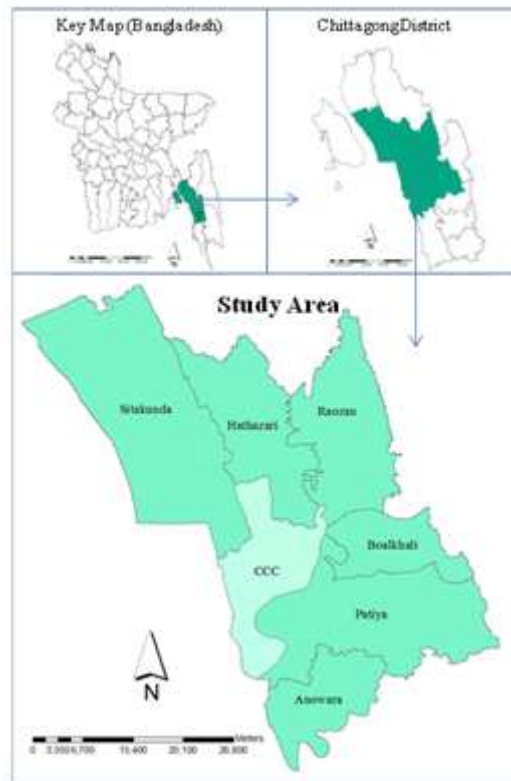
This study attempts to analyze spatial distribution of existing Socio-economic Facilities of Chittagong District. This study focuses on educational, health and market facilities due to lack of availability of data. The aim of the study is to analyze the distribution of Socio-economic Facilities within different upazilas of Chittagong and the city corporation. Following objectives are needed to be achieved for this study:

- i. To analyze the spatial distribution of Socio-economic Facilities (educational institutions, health services and markets) within Chittagong City Corporation (CCC) and adjacent upazilas to the City Corporation.

- ii. To calculate the existing deficiencies of facilities for different upazilas.

**II. STUDY AREA**

Among 14 upazilas of Chittagong district, 6 upazilas were taken for comparing the distribution of selected Socio-economic Facilities with the city area. The selected upazilas are Anwara, Boalkhali, Hathazari, Patiya, Raozan and Sitakunda. These upazilas are situated adjacent to the Chittagong City Corporation (CCC). The study areas are shown by Figure 1.



(Data Source: LGED, 2010)

**Figure 1. Study Area Map**

**III. RESEARCH METHODS**

This research is based on secondary data collected from Local Government Engineering Department (LGED) and Bangladesh Bureau of Statistics (BBS). Collected data is spatially analyzed by using Nearest Neighborhood method (to identify distribution pattern), Location Quotient (to measure spatial concentration), Gini Index (to measure disparity) for fulfilling of the first objective. To achieve the second objective, Population threshold standard was determined for selected facilities.

Distribution pattern of selected Socio-economic Facilities are analyzed by using nearest neighborhood analysis (NNA) in Arc GIS 9.3. NNA indicates clustered pattern if the value of r (observed mean distance/expected mean distance) is less than 0.5, more cluster than random if r = 0.5 to 1 and random distribution pattern if r > 1. Random pattern indicates less dispersion and cluster pattern indicates more dispersion in the distribution of facilities. Point data on the location of the socio-economic facilities were used for NNA.

Spatial concentration of facilities was measured by calculating LQ values. Equation (i) was used to calculate the values of LQ for a particular facility in a particular sub-district (City Corporation and Upazilas) of Chittagong district.

$$LQ = \frac{\frac{x_i}{n_i}}{\frac{x}{n}} \dots \dots \dots (i)$$

Where,

$x_i$  = number of facility  $i$  in a selected *sub – district*

$n_i$  = population of the concerned *sub – district*

$x$  = Number of facility  $i$  in the Chittagong district

$n$  = Total population of the Chittagong district

A LQ that is less than 1 means that the concentration of a particular facility in a *sub-district* is less than that of the District as a whole, The value of LQ is 1 or close to 1 indicates self-sufficiency means a particular facility in a *sub-district* is exactly sufficient to meet the local demand and if the value of the quotient for a particular facility in a particular *sub-district* exceeds 1 (one), over concentration is indicated since the per capita availability of that facility in that *sub-district* exceeds that of the city as a whole. [8.]

Spatial disparity is measured here by using Gini Coefficient (G). Gini Co-efficient is a measure of inequalities which is defined as the mean of absolute differences between all pairs of individuals for some measure. The minimum value is 0 when all measurements are equal indicating no equality and the theoretical maximum is 1 which is the ultimate inequality. [9.]

In this study, Gini Index has been calculated by using equation (ii)

$$G=2 \frac{\sum_{i=1}^n i (x_i - \bar{x})}{n^2 \bar{x}} \dots\dots\dots(ii)$$

Where,

$x$  = observed value (Number of facilities per population)

$n$  = number of values observed (Number of subdistricts)

$\bar{x}$  = mean value of  $x$

For the calculation,  $x$  values are placed in an ascending order and only positive non-zero values of  $(x_i - \bar{x})$  is used. [10.]

To determine the deficiencies of facilities in the selected upazilas, population threshold standard (Primary school- 595, secondary school- 1190, college 52600, hospital or clinic 54300, market-29200) is used. For primary and secondary school, threshold student number (5-9 years for primary and 10 -14 years people for secondary school) was used. Deficiencies of other facilities were calculated based on threshold population for a particular service. Based on the population threshold standard, required number of facilities was calculated by dividing total population by the threshold standard. [11.]

**IV. DISTRIBUTION OF SOCIO ECONOMIC FACILITIES**

The distribution of Socio-economic Facilities within CCC and adjacent upazilas are shown in the table 1. Wide variation is observed in the availability of facilities between upazilas and the city area. 20% of total primary schools of the district are situated in the city. In case of other facilities, more than 50% of total facilities of the district are concentrated within the city area.

**Table 1: Distribution of Socio-economic Facilities in CCC and adjacent upazilas**

Name of the Sub districts	Primary School		Secondary School		College		Health care Facilities		Markets/ Growth centers	
	No.	%	No.	%	No.	%	No.	%	No.	%
Chittagong City Corporation	283	20	307	53	277	85	169	55	103	59
Anowara Upazila	58	4	18	3	2	1	1	0	5	3
Boalkhali Upazila	5	0	8	1	3	1	9	3	4	2
Hathazari Upazila	133	9	34	6	5	2	0	0	5	3
Patiya Upazila	160	11	34	6	6	2	8	3	6	3
Raozan Upazila	112	8	41	7	6	2	13	4	5	3
Sitakunda Upazila	66	5	21	4	4	1	3	1	6	3

Source: LGED, 2010

Among all of the facilities college has the highest percentage. CCC has 85% of total colleges in the Chittagong district. The table indicates that, the upazilas have very low concentration of facilities (less than 10%). Within the selected upazilas, Patiya and Raozan have comparatively more proportion of facilities than other upazilas but the proportion is very low while comparing with the city. The table indicates greater disparity in the distribution of educational, health and market facilities. Such disparity in Socio-economic Facilities distribution contributes as a pull factor in the migration to the city area. Among the all facilities, college indicates highest level of disparity. Therefore more attention should be given to the distribution of colleges for future planning of the Chittagong district.

**V. SPATIAL DISTRIBUTION PATTERN OF FACILITIES**

The findings of nearest neighborhood analysis on the distribution pattern of Socio-economic Facilities in Chittagong district are given in the table 2.

**Table 2: Pattern Analysis of Socio-economic Facilities Using Nearest Neighbor Analysis**

Name of the Facilities	'r' value (observed/expected mean distance)	Pattern
School	0.55	Clustered
College	0.61	Clustered
Health Care Facilities	0.46	Perfectly Clustered
Markets/ GC	0.64	Clustered

Data Source: LGED, 2010

The table indicates that the distribution of all of the selected facilities is following a clustered pattern as the value of  $r$  is less than 1. Each of these facilities has only 1% likelihood of being random at 99% confidence level. Among the selected four facilities, health care facilities are distributed in perfectly clustered pattern than other facilities and indicate greater disparity in distribution.

## VI. SPATIAL CONCENTRATION OF FACILITIES

This distribution pattern of facilities shows whether the facilities are concentrated in some particular area or evenly distributed. This pattern actually cannot actually define the disparity in full context. This is because where there is a concentration of facility; there can be concentration of population too. So, to understand the disparity more clearly, population distribution should be considered along with facility distribution. That's why LQ method is used in this section which considers the number of facility and population for the selected *upazilas* and CCC area.

Table 3 represents the spatial concentration of primary school, secondary school, college, hospital/clinic and markets within the CCC and selected *upazilas* of the Chittagong district. From this table, it is seen that, except primary school, the CCC has the over concentration of every facilities.

**Table 3: Location Quotient (LQ) values of different Socio-economic Facilities**

Name of the sub-districts	LQ Values of Different Socio-economic Facilities				
	Primary school	Secondary school	College	Hospital/clinic	Markets
CCC	0.59	1.54	1.96	1.63	1.73
Raozan	1.86	1.66	0.96	1.01	0.67
Hathazari	1.65	1.03	0.60	0.00	0.50
Patiya	1.62	0.84	0.59	0.38	0.49
Anowara	1.20	0.91	0.40	0.10	0.84
Boalkhali	0.12	0.47	0.70	1.01	0.78
Sitakunda	0.91	0.71	0.53	0.19	0.67

Data source: LGED, 2010 and BBS 2011

In case of educational facilities, except Boalkhali, all of the *upazilas* have adequate primary and secondary schools. But in case of the distribution of college, only Raozan is self-sufficient (0.96), Boalkhali, Patiya and Hathazari have comparatively higher concentration and Anwara has the lowest concentration of colleges (0.4) with respect to its population.

The distribution of health facilities indicates more concentration in the city area (1.63). Among the selected *upazilas*, Boalkhali and Raozan have sufficient facilities (LQ =1.01) with respect to their population but other *upazilas* have very low concentration of health facilities. The most concerning issue is the zero concentration of health facilities in Hathazari *upazilas* and very low concentration in Anwara (0.1) and Sitakunda *upazilas* (0.19).

Like concentration of college, concentration of market is high in Chittagong City Corporation Area, All other *Upazilas* are underserved with market facilities in response to district's average concentration. The concentration can be regarded as satisfactory of Anwara *Upazila* with compared to other selected *upazilas*.

## VII. SPATIAL DISPARITY IN THE DISTRIBUTION OF FACILITIES

Relative positions of different sub-districts with respect to particular facility have been gained from the LQ analysis. This analysis indicates that the concentration of different facilities varies significantly across sub-districts and thus we can assume that considerable disparity exists among the different sub-districts in terms of the selected facilities. To get idea about the level of disparity with respect to various Socio-economic Facilities, an index of inequality known as Gini Index has been calculated for each socio economic facility.

The table 4 depicts the Gini Co-efficient of the facilities of Chittagong District. The tables represents that, the spatial inequality in distribution of Health facilities is acute in Chittagong District. The gini co-efficient 0.76 illustrates there is a very high disparity. The disparity in the distribution of schools and markets is not very much significant. The disparity in the distribution of market is low within all *upazilas* but the level of disparity is very high between CCC and other *upazilas* which is shown in the table 4 through LQ values. Besides, the

disparity in the distribution of Colleges is also significant. Therefore, it is essential to reduce the disparity in the distribution of college and health care facilities.

**Table 4: Level of Spatial Disparity of Socio-economic Facilities in Chittagong District**

Socio-economic Facilities	Gini Coefficient
Primary School	0.39
Secondary School	0.30
College	0.44
Health Facilities	0.76
Market	0.32

Data source: LGED, 2010 and BBS 2011

### VIII. EXISTING DEFICIENCIES OF THE FACILITIES

The previous sections provide the evidence that the distribution of educational, health care facilities and markets is not even throughout the whole district. Wide differences are found in the number of facilities in city corporation area and other *upazilas*. To reduce the gap of facilities distribution, the required number of new facilities in the *upazilas* or under- served areas has been determined. The requirement of facilities has been calculated for only the selected *upazilas* as the LQ values indicate over concentration of facilities in the Chittagong city corporation (CCC). Calculated amount of the required facilities for the selected *upazilas* are shown in the table 5.

**Table 5: Existing Socio-economic Facilities and total requirement by upazilas**

Name of the Sub districts	Primary School		Secondary School		College		Health care Facilities		Markets/ Growth centers	
	Existing	Required	Existing	Required	Existing	Required	Existing	Required	Existing	Required
Anowara	58	62	18	30	2	5	1	5	5	9
Boalkhali	5	43	8	23	3	4	9	4	4	8
Hathazari	133	84	34	46	5	8	0	8	5	15
Patiya	160	107	34	56	6	10	8	10	6	18
Raozan	112	61	41	33	6	6	13	6	5	11
Sitakunda	66	70	21	37	4	7	3	7	6	13

Data Source: LGED 2010 and BBS 2011

The results of table 5 indicate more deficiency of college, health care facilities and markets in the selected *upazilas*. On the other hand, comparatively less deficiency is observed in the distribution of schools and some *upazilas* (Hathazari, patiya and Raozan) have more primary schools than the requirement. It indicates the mushroom growth of the kindergarten within these *upazilas*.

### IX. SCORING THE FACILITIES

By constructing scores of the facilities exists and required, the ratio of this two will help to understand the gap between the actual and required number of facilities in the *upazilas*. Score was given based on the demand of the facilities. From the study is seen that the concentration of primary school is higher and so its demand in much lower than the other facilities. So primary school is given point 1. In this way, secondary school is given point 2 and college, hospital/clinic and market/ Growth center is given point 5. Multiplying the points of each facility by the number of that facility available and required for that *upazila*, total points scored by an *upazila* and total points required by each *upazilas* in that facility were obtained. Table 6 shows the points scored and required for different facilities within different *upazilas*. Finally, ratio of points scored by an *upazila* on the basis of existing facilities to the points required by it to serve its population was calculated to have an idea about the gap between the actual and required number of facilities in the *upazila*. The ratio has been shown in the table 7.

Table 6: Points scored for each facility in different upazilas

Name of the Upazilas	Primary School		Secondary School		College		Health care Facilities		Markets/ Growth centers	
	Existing	Required	Existing	Required	Existing	Required	Existing	Required	Existing	Required
Anowara	58	62	36	60	10	25	5	25	25	45
Boalkhali	5	43	16	46	15	20	45	20	20	40
Hathazari	133	84	68	92	25	40	0	40	25	75
Patiya	160	107	68	112	30	50	40	50	30	90
Raozan	112	61	82	66	30	30	65	30	25	55
Sitakunda	66	70	42	74	20	35	15	35	30	65

Data Source: LGED 2010 and BBS 2011

The table indicates large gaps in the requirement of college, health care and market facilities within the adjacent upazilas of Chittagong City Corporation. Except, Boalkhali upazilas, the gap in the distribution of primary school is comparatively less than other facilities.

Table 7: Ratio of points scored to points required by upazilas

Upazilas	Primary School	Secondary School	College	Health care Facilities	Markets/ Growth centers
Anowara	0.94	0.60	0.40	0.20	0.56
Boalkhali	0.12	0.35	0.75	2.25	0.50
Hathazari	1.58	0.74	0.63	0.00	0.33
Patiya	1.50	0.61	0.60	0.80	0.33
Raozan	1.84	1.24	1.00	2.17	0.45
Sitakunda	0.94	0.57	0.57	0.43	0.46

Data Source: LGED 2010 and BBS 2011

To understand the gap in a better way, the ratio is helpful. The ratio less than one indicate deficiency and greater than one represents self-sufficiency. Highest deficiency is found in the distribution of market facilities in the selected upazilas. Deficiency of college is also significant within the selected upazilas. Except Raozan, all of the selected upazilas have deficiency of colleges. In terms of health care facilities, Boalkhali and Raozan are showing self-sufficiency but other upazilas are indicating more deficiency. The distribution of schools is showing less disparity but in some upazilas, these facilities are indicating more deficiency. Finally it can be concluded from the table that only Raozan Upazila is comparatively more self-sufficient in terms of selected Socio-economic Facilities among the selected upazilas of Chittagong district.

## X. CONCLUSION

The analysis of the distribution of the socioeconomic facilities shows a lead-lag relationship among various sub districts of Chittagong. City corporation area is more developed in terms of the most of the facilities while upazilas lag far behind the mean level of development in terms of those facilities. Maximum level of disparity has been found in the distribution of health care facilities throughout the district. Rural-urban disparity has been observed in the distribution of colleges and markets. The analysis on the gap or requirement of existing facilities indicates that comparatively Raozan is more self-sufficient than any other selected upazilas. Spatial variation in the distribution of the selected facilities indicates that existing planning efforts are not sufficient to reduce disparity within the Chittagong district. Usually, Socio-economic Facilities are mainly provided by the government of the country and therefore a careful investigation of their availability and deficiency is needed for proper planning. Since the population of urban areas is increasing alarmingly and one of the reasons behind is migration to the city for better living standard, distribution of Socio-economic Facilities should be planned carefully to reduce rural urban disparity and migration to the city.

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