# Does Distribution of Schools Matter in Human Development?

# - A Case Study of Bangladesh

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## Abstract

This paper investigates relationship between the distribution patterns of the schools and the human development index value of the respective study areas. In this study 50 upazilas have been selected out of 460 upazilas in Bangladesh. The distribution patterns of the primary and high school in each selected upazila have been analyzed through the "Nearest Neighbor Analysis" method. Then the value of Human Development Index (HDI) for each upazila has been determined. Finally a positive correlation between those two indices has been determined. This research can assist the policy makers to take proper decisions while selecting locations for schools keeping the broad view in mind which is development of that particular area.

**Keywords:** Distribution of School, Spatial Pattern of Utilities, Human Development Index (HDI), Urban Planning, Regional Planning, Bangladesh

# 1. Introduction

The Human Development Index (HDI) is a composite statistic of life expectancy, education, and income indices to rank any countrys/region/area into four tiers of human development. The breakthrough for the HDI was the creation of a single statistic which was to serve as a frame of reference for both social and economic development. Spatial distribution pattern of the community facilities (i.e. education, healthcare, commercial) is signified behind the advancement (in terms of socio-economic well-being) of any particular area in the academic regime of Urban and Regional Planning. But no standard research findings have been found on the favor of this proposition. This study thus initiates for the very first time this particular kind of research considering the research question in mind 'Whether there is any kind of correlation between the HDI value of any particular area and the distribution pattern of the community facilities?' In this study in case of investigating pattern of community facilities distribution only educational facilities (primary and secondary schools) has been considered and in case of HDI index, two indices has been considered (Education, GDP) out of three. This kind of research is very crucial and can be helpful for the policy makers to decide the locational choices of the new community facilities in view to develop the standard of living of any particular area or an increase in HDI value of that particular area in other words.

# 2. Brief on the Key Terms

**2.1 Nearest Neighbor Analysis:** Nearest neighbor analysis is a common procedure for determining the spatial arrangement of a pattern of points (in this study the location of the primary and high school) within a study area (McGrew & Monroe, 2000). For each of the points, the nearest neighbor (NN) is determined as the point closest in straight-line (Euclidean) distance. The distance (NND) is then calculated from the scale of the map. From the set of the nearest neighbor distances, the average nearest neighbor distance $\overline{\text{NND}}$ is determined using the basic formula for the mean:

$$\overline{\text{NND}} \;\; = \;\; \frac{\sum \text{NND}}{n} \;\; ; \;\; \text{where n = number of points}$$
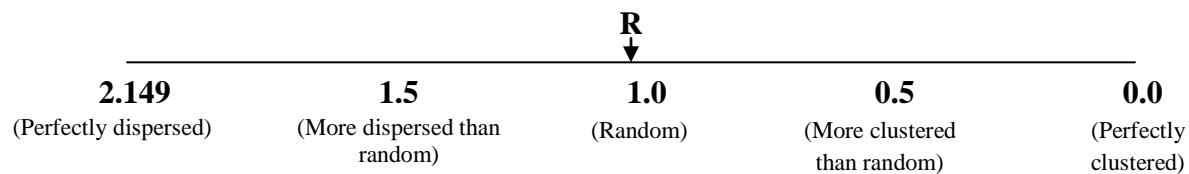
This index value is than compared with another index value of perfectly normal frequency distribution, $\overline{\text{NND}_R} = \dfrac{1}{2\sqrt{\text{Density}}}$.

Where $\overline{\text{NND}_R}$ = average nearest neighbor distance in a random pattern;

Density = number of points (n) / area

Standardized Nearest Neighbor Index, $\mathbf{R} = \overline{\text{NND}} / \overline{\text{NND}_R}$ ;

Continuum of R Values in Nearest Neighbor Analysis:

| **R** | | | | |
|---|---|---|---|---|
| **2.149** | **1.5** | **1.0** | **0.5** | **0.0** |
| (Perfectly dispersed) | (More dispersed than random) | (Random) | (More clustered than random) | (Perfectly clustered) |

**2.2. Human Development Index:** The Human Development Index (HDI) is a composite statistic used to rank countries or regions by level of "human development" and separate developed (high development), developing (middle development), and underdeveloped (low development) countries or regions (UNDP, 1998, p107).

The HDI combines three dimensions:
- Life expectancy at birth, as an index of population health and longevity.
- Knowledge and education, as measured by the adult literacy rate (with two-thirds weighting) and the combined primary (5-10 year), secondary (10-15 year), and tertiary (15-24 year) gross enrollment ratio (with one-third weighting).
- Standard of living, as indicated by the real GDP per capita.

For the construction of the index, fixed minimum and maximum values have been established for each of these dimensions:
- Life expectancy at birth: 25 years and 85 years
- Adult literacy: 0% and 100%
- Combined gross enrollment ratio: 0% and 100%
- Real GDP per capita (in US dollar): ₴ 100 and ₴ 40,000

For any component of HDI, individual indices can be computed according to the general formula:

$$\textbf{Index} = \frac{\textbf{Actual Value} - \textbf{Minimum Value}}{\textbf{Maximum Value} - \textbf{Minimum Value}}$$

After computing the three individual indices (Life expectancy index, Educational attainment index and GDP per capita index) their average is considered as the HDI value. In this study two indices (Educational attainment and GDP per capita) is used to determine the HDI value.

## 3. Methodology

**3.1 Study Area Selection:** In this study 50 upazilas have been selected out of 460 upazilas in five divisions (out of six) of Bangladesh (Figure 1).
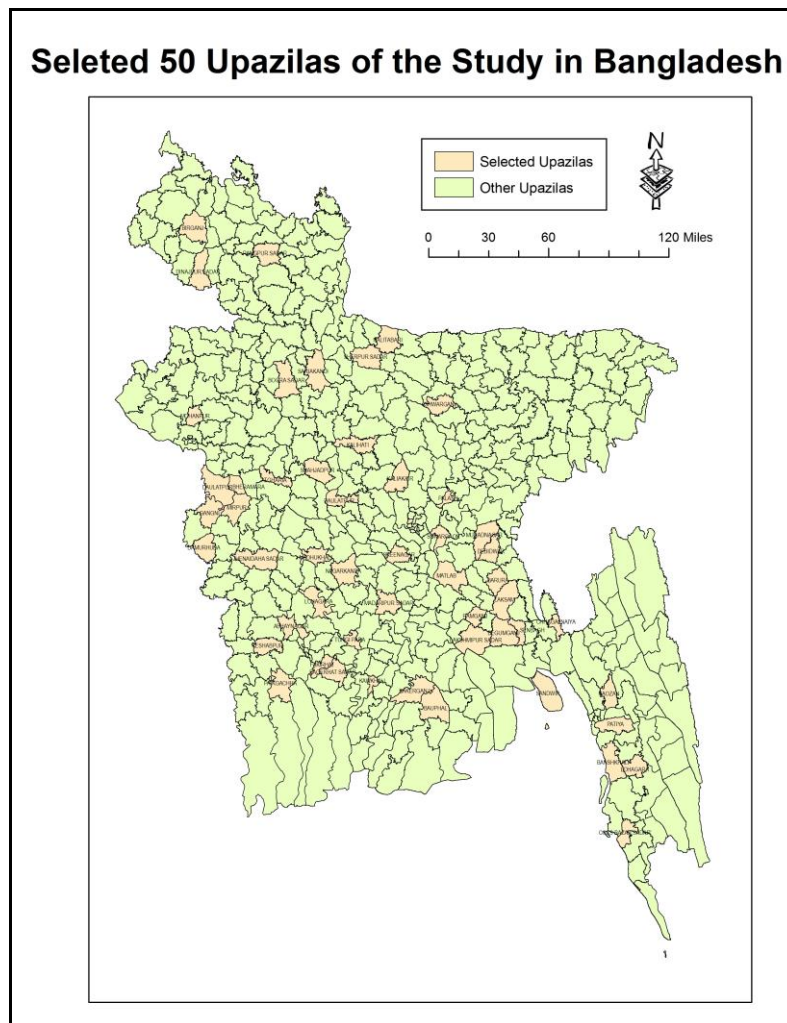


**Figure-1: Selected Study Upazilas**

**3.2 Method of the Study:** The nearest neighbor data for the previously selected upazila of five divisions have been calculated to compute the Standardized Nearest Neighbor Index (SNNI= R) for Primary and Secondary school from the upazila map (LGED, 2010). Finally they are combined for further analysis. From the Upazilla wise data it has been tried to have an idea about the distribution of Primary and Secondary school within each division.

HDI values of the selected upazilas have been calculated by the respective students. In this regard Educational Attainment Index and Adjusted Real GDP Per Capita Index has been developed using appropriate Minimum and Maximum values and formulas, for each upazila. Literacy rate according to age group (BBS, 2001, Table-P08) has been used for the development of Educational Attainment Index. During this process the adult literacy rate has been provided two-thirds weighting and the combined primary, secondary, and tertiary gross enrollment ratio has been given one-third weighting. Upazila wise Real GDP per capita (BBS, 2002) has been applied to compute the Adjusted Real GDP Per Capita Index. In this case world average income has taken as the threshold level and any income above this level is discounted using the Atkinson's formula for the utility of income (UNDP, 1998). After that these two indices has been averaged to find out the final HDI value for each upazila. Finally HDI values for the selected upazilas have been compiled for additional investigation.

In conclusion pattern of correlation between the overall division wise "Standardized Nearest Neighbor Index" (SSNI) value of primary and high school and the "Human Development Index Value" of the divisions is determined.

## 4. Results and Discussion

### 4.1 Distribution Pattern of Primary and Secondary Schools

**4.1.1 Dhaka Division:** Under Dhaka division there are 17 districts and 124 Upazillas. Among them for 13 Upazillas R values are collected for analyzing the distribution of Primary and Secondary schools. Among the Upazillas of Dhaka division the greater R value for primary schools is observed for Tongibari Upazilla of Munshiganj district which is 2.84. This value represents that the distribution of primary schools in Tongibari Upazilla is perfectly dispersed or the distribution is locationally equitable within the region. The minimum R value for primary

school is calculated for Polash upazilla of Narshing district which is .83. This value represents random distribution, since it is between random and more cluster than random. The average R value of the 13 upazillas of Dhaka division is 1.147 primary schools. It refers to a distribution pattern which is more dispersed than random; it means the distribution of Primary schools within Dhaka division is almost random but not totally random, slightly dispersed.

For Secondary school the highest R value is observed for Madaripur Sadar of Madaripur District which is 1.66. This value represents a distribution which is more dispersed than random. The lowest value is of Nagarkanda which is 0.041 and this value represents a perfectly clustered distribution. The average R value for Secondary school in Dhaka division is .981 which refers to a random distribution with no dominant trend toward either clustering or dispersion.

**4.1.2 Chittagong Division:** In Chittagong division there are 39 Upazillas among which data was collected for 15 upazillas. Among them for primary school Begumganj upazilla has the highest value of R 2.05 representing a perfectly dispersed distribution. And Sandwip has the lowest value of .43 which represents a distribution more clustered than random. The average R value of the 15 upazillas of Chittagong division is 1.041 for primary schools refereeing to a random distribution.

For secondary school Ramganj has the highest value 1.47 representing a more dispersed than random distribution and Chhagalnaiya has the lowest value 0 representing a perfectly clustered pattern. The average value of R for primary schools in Chittagong Division is 1.068 which refers to a random distribution.

**4.1.3 Rajshahi Division:** For Rajshahi division data of 8 Upazillas are collected among 66 upazillas. The average R value of the 8 upazillas of Rajshahi division is 1.136 for primary schools which refers to a random distribution.
The average value of R for primary schools in Rajshahi Division is .819 which is between random and more clustered than random pattern. So the distribution of secondary schools of Rajshahi division is almost random.

**4.1.4 Barisal Division:** Barisal Division is consists of 39 Upazillas among which data of 3 upazillas have collected. The average R value for primary schools of these 3 upazillas of Barisal district is 1.248 which means the distribution of primary schools of Barisal division is not

perfectly random, a little dispersed. For secondary schools the average R value of these 3 upazillas is 1.222 which is also between random and more dispersed than random. So In Barisal district the distribution of primary schools and secondary schools is almost same.

**4.1.4 Khulna Division:** In Khulna the average value of R for primary schools of selected 10 Upazillas is 1.239 which refers to a random distribution with slightly clustered characteristics. The average R value for secondary school for Khulna division is 1.454 which means that the distribution of secondary schools of Khulna division is more dispersed than random.

**4.1.5 Division Wise Comparison of Distribution Pattern of Primary and Secondary School**: Among the Upazillas of corresponding five divisions data have been collected for a few selected upazillas of each division. The average R values of these few upazillas will not represent the perfect scenario for the divisions but to some extent it will give an idea about the distribution pattern.

For the five divisions the corresponding R value for primary school is as like: Dhaka 1.147, Chittagong 1.041, Rajshahi 1.136, Khulna 1.239, and Barisal 1.247. Among them the maximum value is generated by Barisal which is 1.247 representing a value between random and more dispersed than random. Chittagong has the minimum value of 1.041 referring a random pattern. It could be easily identified that the distribution of Primary schools for every five division follows almost a random pattern with no dominant trend toward either clustering or dispersion.For Secondary school the corresponding R value for five divisions is as like: Dhaka .981, Chittagong 1.068, Rajshahi 0.819, Khulna 1.454, and Barisal 1.222. The highest value is 1.454 for Khulna division representing a more dispersed than random distribution. The lowest value is .981 for Chittagong representing a random pattern. If the values of all the divisions are observed than it could be said that the distribution of Secondary schools through the five divisions is almost random.
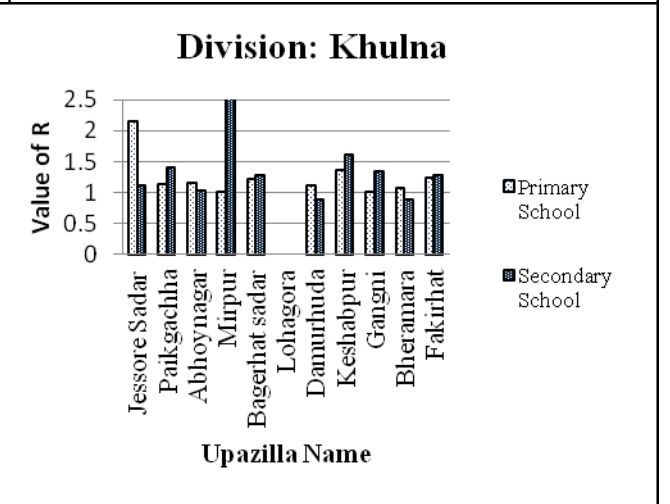
**Division: Dhaka**

**Division: Rajshahi**

**Division : Barisal**

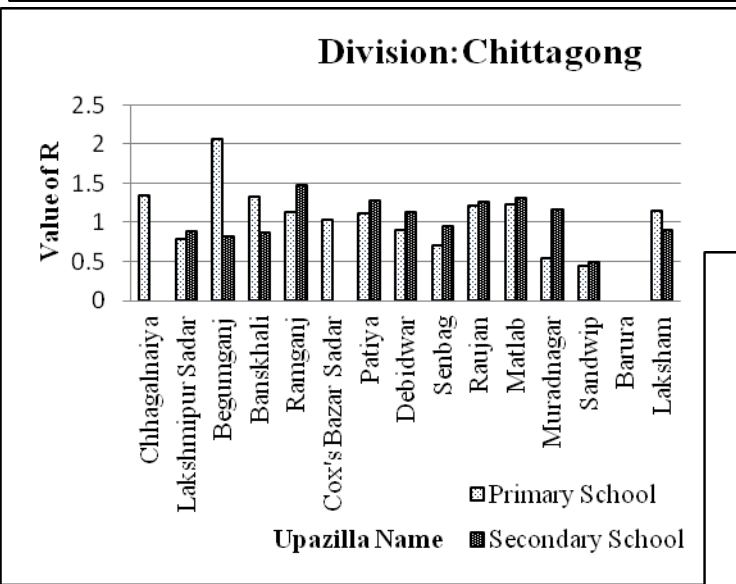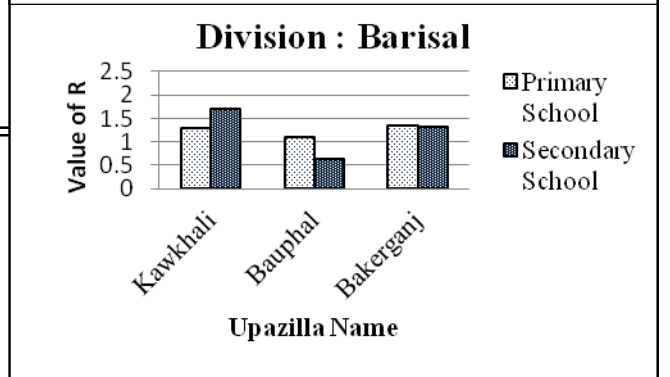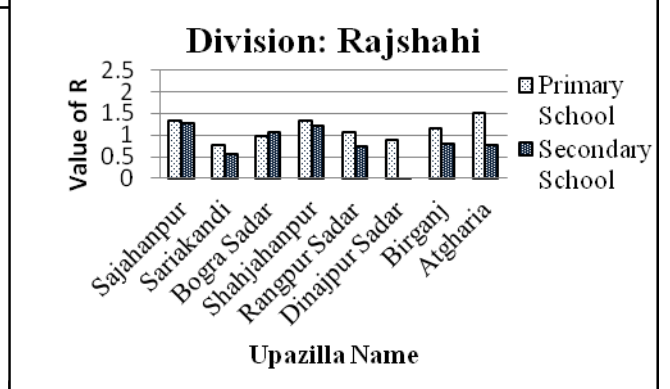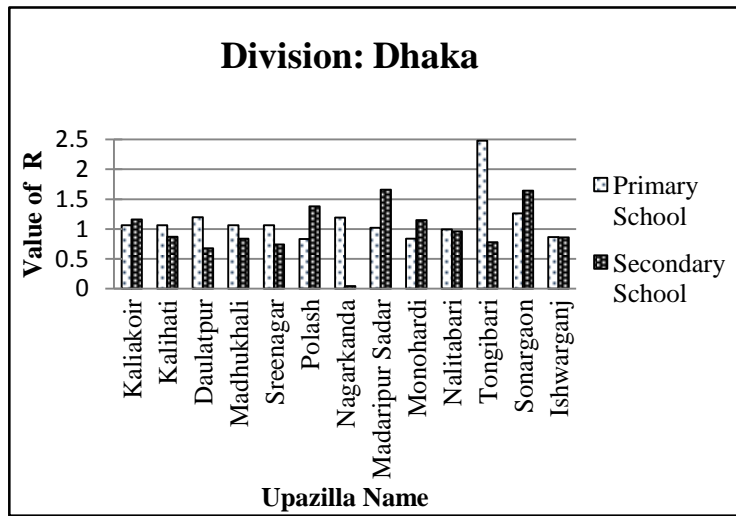**Division:Chittagong**

**Division: Khulna**

**Figure-2: Upazilla Wise Comparison of Distribution Pattern of Primary & Secondary School According to Respective Divisions.**
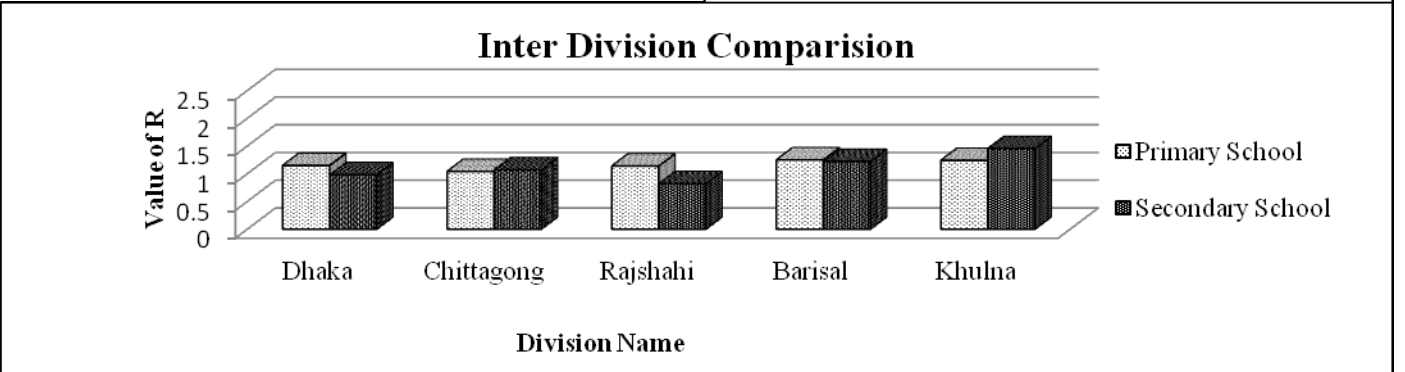


**Inter Division Comparision**

**Figure-3: Division Wise Comparison of Distribution Pattern of Primary and Secondary School**

## 4.2 Comparison of Human Development Index

**4.2.1 Dhaka Division:** In Dhaka division, the highest value of HDI comes from Sreenagar upzilla and the value is 0.333. The lowest value is 0.167 and Nalitabari upzilla is the holder of this value. By taking 13 upzillas in account, the average HDI value of Dhaka division is measured which is 0.223038.

**4.2.2 Chittagong Division**: The port city has got 0.243354 as the average HDI value. Within the division, Ramgonj has the highest value (0.344) which is in fact the highest one among all the study areas in this report. The lowest value in Chittagong Division is from Laksham which is 0.169.

**4.2.3 Rajshahi Division**: Having Rangpur Sadar as the highest HDI holder and Sariakandi as the lowest, Rajshahi division has the average HDI value of 0.248477.

**Barisal Division:** The calculated HDI of Barisal does not actually represent the actual situation of this division which covers the southern portion of the country. Only 3 upzillas are taken in account while calculating the HDI. Thus it has the highest HDI value in this study and that is 0.300467.

**4.2.4 Khulna Division:** Within this division, the Jesssore Thana Sadar has got the highest HDI value (0.28) and Gangni has got the lowest one (0.17). The average HDI of the Khulna division is 0.221898.

**4.2.5 Division wise Comparison of HDI:** This study shows that Barisal division has greater HDI then any other divisions within the country which is very likely to be untrue as it is the south part of the country and practically very small amount of development activities are taken place in that place compare to Dhaka division. However, the graphical representation of the comparison of the HDI values among the divisions is given below.

Currently, the world's highest HDI value is 0.968 which is possessed by Iceland and Norway. Compared to that it is easily understandable that people of Bangladesh do not at all have a standard condition of living.
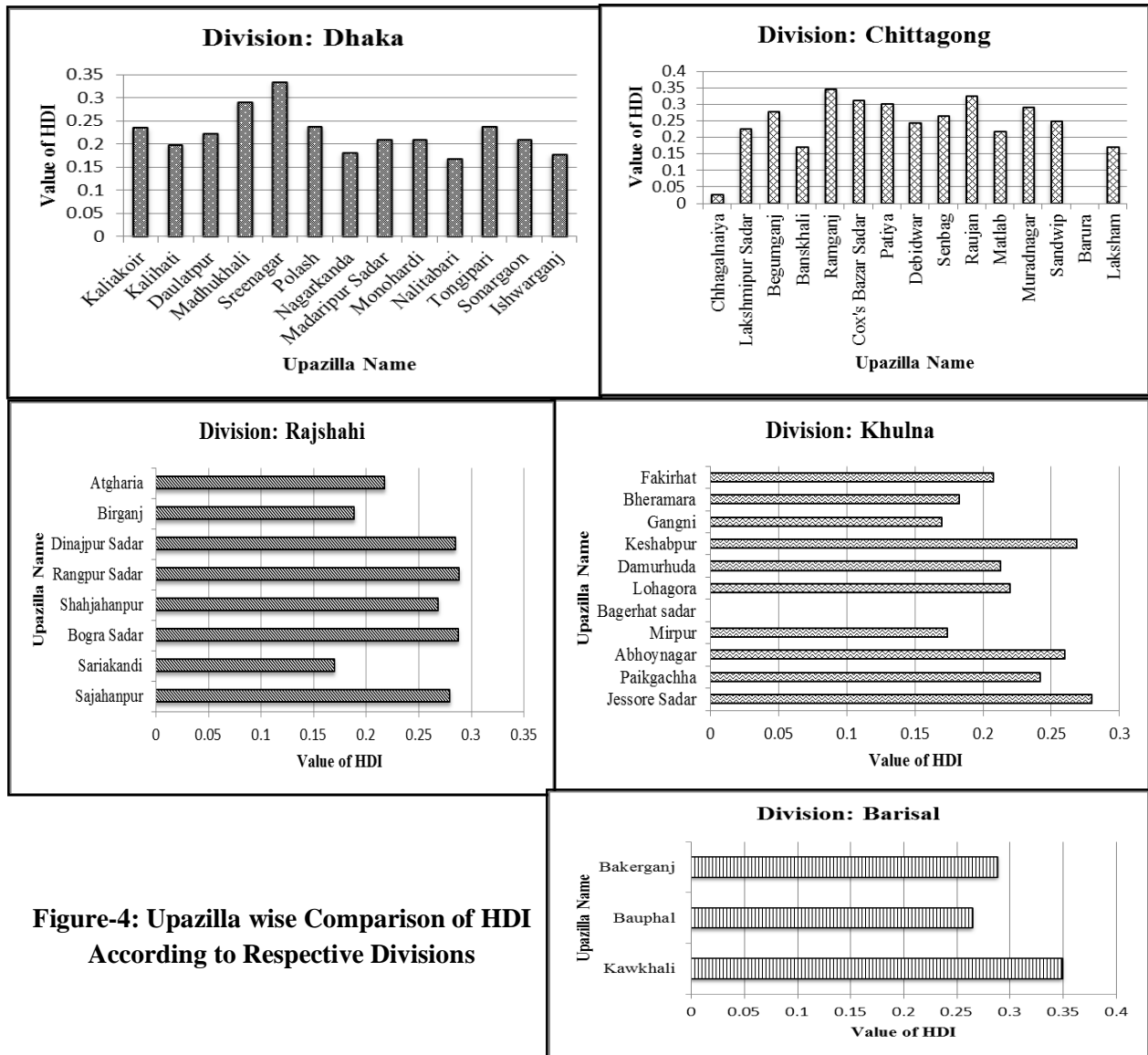
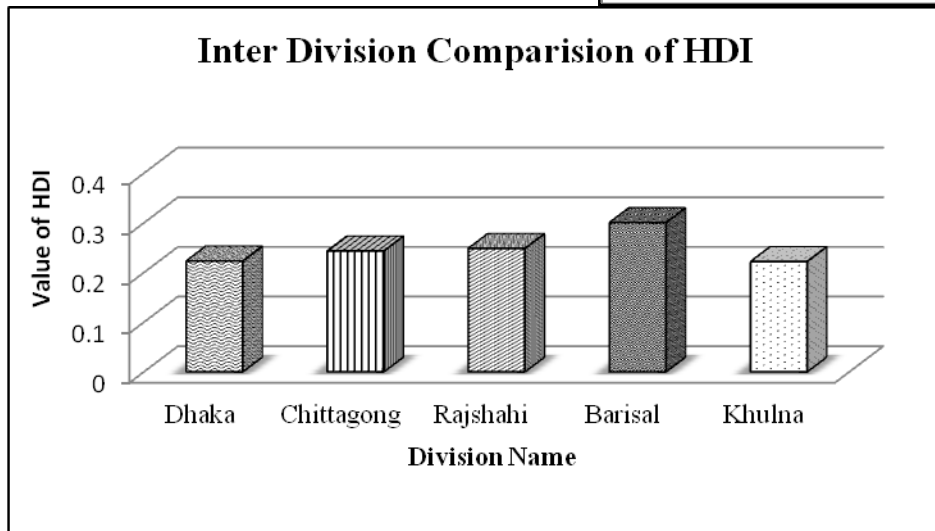**Figure-4: Upazilla wise Comparison of HDI According to Respective Divisions**



**Figure-5: Division wise Comparison of HDI**

**4.3 Correlation of HDI with Distribution Patterns of the Schools:** In this segment the pattern of correlation between the overall division wise "Standardized Nearest Neighbor Index" (SNNI) value of primary and high school and the "Human Development Index Value" of the divisions is determined. The following table represents the division wise values for the 3 types of variables stated above.

**Table-1: Division wise SSNI_PrimarySchool, SSNI_Secondary School, HDI**

| Division | SSNI_PrimarySchool | SSNI_Secondary School | HDI |
|---|---|---|---|
| Dhaka | 1.1474 | .9807 | .2230 |
| Chittagong | 1.0412 | 1.0682 | .2434 |
| Rajshahi | 1.1364 | .8194 | .2485 |
| Barisal | 1.2475 | 1.2223 | .3005 |
| Khulna | 1.2394 | 1.4538 | .2219 |

The following output table is achieved from the SPSS (Statistical Package for Social Science) software while determining the correlation value among the above stated variables. As correlation coefficient "Pearson's Coefficient" and for test of significance "Two Tailed Test" is being used.

**Table-2: Correlation Output**

| Correlations | | | | |
|---|---|---|---|---|
| | | SSNI_PrimarySchool | SSNI_SecondarySchool | **HDI** |
| **SSNI_PrimarySchool** | Pearson Correlation | 1 | 0.617 | **0.312** |
| | Sig. (2-tailed) | | 0.267 | 0.609 |
| | N | 5 | 5 | 5 |
| **SSNI_SecondarySchool** | Pearson Correlation | 0.617 | 1 | **0.007** |
| | Sig. (2-tailed) | 0.267 | | 0.992 |
| | N | 5 | 5 | 5 |
| HDI | Pearson Correlation | 0.312 | 0.007 | 1 |
| | Sig. (2-tailed) | 0.609 | 0.992 | |
| | N | 5 | 5 | 5 |

**4.4 Result:** According to Pearson's Correlation Coefficient Scale, from the above table it can be stated that the strength of association between the variables HDI and "SSNI_Primary School" is 0.312; this value indicates weak but positive correlation between these two variables. Also, it can be said that 9.7% ($0.312^2$) of the variation in HDI is explained by SSNI_PrimarySchool. Finally

the finding is, the Human Development Index of the studied divisions is weakly but positively dependent on the distribution patterns of the primary schools in that division.

Again, the strength of association between the variables HDI and "SSNI_Secondary School" is 0.007; this value indicates very weak positive correlation between these two variables. Also, it can be said that only 0.0049% ($0.007^2$) of the variation in HDI is explained by SSNI_SecondarySchool. Finally the finding is, the Human Development Index of the studied divisions is weakly but positively dependent on the distribution patterns of the secondary schools in that division.

## 5. Conclusions

The prime limitation of this study is the availability of only 50 upazilas out of 481 from the whole country. From this limited database, at the end of this study, it can be generally concluded that the distribution patterns of the schools (both primary and secondary) in those selected upazilas is random. So it can be said that the development pattern in those study areas is not concentrated at any certain point rather scattered all over the area. Finally, there is a correlation between the distribution patterns of the "Primary Schools" and the Human Development Index of any specific study area but this correlation is almost absent in case of secondary school. Because a large number of children attain the primary education level but after a certain time (at high school level) a major portion of them drop out because of poverty. For the presence "Primary Level Enrollment" in "Educational Attainment Index" in the calculation of HDI, the value of HDI is dependent on the distribution pattern of "Primary School" but this value is not dependent on the distribution pattern of "Secondary School" for "Low Secondary Level Enrollment" caused by poverty, which is major problem in our country.

This study can guide the policy makers while choosing locations for new primary and secondary schools. If the correlation results as moderately positive for any of the educational facilities stated above then government should take initiative to facilitate more schools within walking distance of the households in the view to making the distribution pattern more concentrated, resulting increased attainment in the schools and finally an increased value of HDI for the respective upazilas which indicates by a positive correlation during this study.

This study has the further scope to carry out for all the upazilas in Bangladesh and determine the distribution pattern of the Primary and Secondary Schools and their correlation with the HDI values of the respective upazilas.

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