



An analysis of interregional disparity from Lorenz curve to Gini Co-efficient: A study based on district wise facility distribution in Bangladesh

Md. Shakil Ar Salan, Abdullah Al Kafy*, Mahmud Arafat

Graduate, Department of Urban & Regional Plannin, Rajshahi University of Engineering & Technology, Bangladesh

Abstract

Inequality in social, physical, economic aspects beside with infrastructure provision has become a widespread attribute between the districts in Bangladesh. Unequal distribution of facilities causes disparity among the regions. This happens due to many social, political and geographical matters. By calculating the amount of disparity it becomes helpful for the policy and decision makers to take the right action to develop the under privileged regions. The main objectives of this study are to analyze and find out inter regional disparities in the distribution of facilities and to compare the regional distribution of facilities with respect to national. In this study, interregional inequalities have been determined by using Lorenz curve and Gini index. The study investigates, existing inequality level based on facilities (Utility, Educational, Social welfare, Transport and Health facilities) in 64 districts of Bangladesh using 2011 Bangladesh Bureau of Statistics (BBS) data. With the help of these methods as well as analysis the actual scenario of disparity will be found out which in turn assist for the development of the deprived regions. The study results that there exist regional disparity in the sense of facility distribution and some leading factors tend to accelerate these inequalities.

Keywords: lorenz curve, gini index, regional inequality

1. Introduction

Bangladesh is a compactly populated country of the world which is experiencing speedy urbanization but the rate of urbanization is not so persuasive for all the regions or districts of the country. There has been a growing interest in regional economics and geography on the long-term convergence in per capita income between sub-national regions and countries (Huang and Leung, 2009) [4]. There are many reasons which may lead to the divergent views on the trends of spatial inequality in Bangladesh, such as the use of different spatial scales, economic indicators, quantitative measures, and time periods. Inequality in social, physical, economic aspects beside with infrastructure provision has become a widespread attribute between the districts since its independence. Due to this uneven urbanization, inequity exists in all of the districts of Bangladesh in respect of investment, infrastructure, resource and other facilities. Bangladesh has been facing countless problems for providing its entire Citizen various facilities like water supply, electricity connection, sanitary condition, education, number of hospital bed, health center, growth center, Transportation facilities through road network etc. Generally facilities are not equally distributed all over the country. This phenomenon causes disparity among different regions. Regional disparity can be based on various criteria and can vary from time to time. There are many techniques to measure regional disparity. Lorenz curve and Gini index are two of these tools that measure disparity among regions. These methods help to see the actual scenario of disparity and can assist for the development of the deprived regions. Regional disparity refers to the differences among regions with respect to specified variables such as income, employment etc. (Pearson, 2005) [7]. People as well as

infrastructure, resource, social, economic and public facilities are heavily concentrated in few large cities which in turn effect on rapid and uneven urbanization. Due to this uneven urbanization, inequity exists in all of the districts of Bangladesh in respect of investment, infrastructure, resource and other facilities. The existence of inequality in allocation of resources is a universal fact for the third world country like Bangladesh. Bangladesh has been facing countless problems for providing its entire citizen fundamental utility services like sanitation, water supply and electricity connection facilities. Regions which are under privileged suffer slow economic intensification due to lack of fundamental utility facilities and the region which have adequate facilities experience speedy economic growth. So, it is urgent for our government and policy makers to find out those districts which are lack of basic services and have slow economic growth for equilibrium progress of Bangladesh. It is also helpful for achieving Millennium Development Goals (MDGs) and gaining the title of middle income country (Islam, Safayet & Meghna, 2013) [5].

2. Review of the Literature

Regional disparity refers to the differences among regions with respect to specified variables such as income, employment etc. (Pearson, 2005) [7].

In Bangladesh a number of facilities in the different field of transport, health, agriculture, education, power and industry are available. These facilities are closely related with the growth of economy and wellbeing of the society (Bahauddin, 1989). A number of variables of the available facilities deal with major concern of wellbeing and the economic growth of the country. These variables are under regional measures of

disparity in providing basic services to the people of concern region. There are some variables which served as indices for analyzing the socio-economic and development status of each region. These variables are:

- No. of Primary School
- No. of High School
- No. of College
- No. of Madrasha
- No. of Bazar/Hat
- No. of Bank
- No. of Growth Center
- No. of Railway Station
- No. of Family Welfare Center
- No. of Health Center
- No. of Hospital Bed
- No. of Hand Tubewell
- Length of Metalled Road
- Length of Semi-Metalled Road
- Electricity Connection
- Land Area under Irrigation

2.1 Methods for the Analysis of Regional Inequality

A number of indexes are available for the analysis of regional inequality.

2.1.1 Gini Coefficient

The Gini coefficient has been the most popular method for operationalizing the inequality in facility distribution (Maio, 2007). Represents the facility distribution of a nation's people, and is the most commonly used in measuring inequality. In particular, it measures the ratio of the area between the Lorenz Curve and the equal distribution line to the area of maximum concentration. The Gini coefficient is usually defined mathematically based on the Lorenz curve, which plots the proportion of the total facilities of the population (y axis) that is cumulatively earned by the bottom x% of the population (see diagram). The line at 45 degrees thus represents perfect equality of facilities. The Gini coefficient can then be thought of as the ratio of the area that lies between the line of equality and the Lorenz curve (marked A in the diagram) over the total area under the line of equality (marked A and B in the diagram).

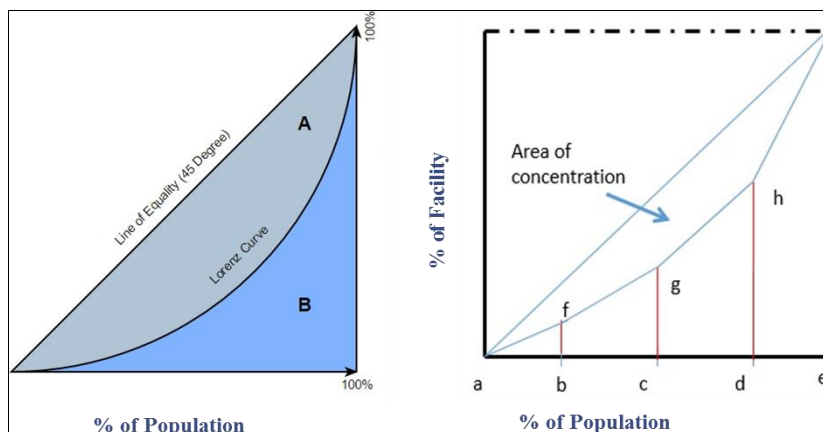


Fig 1: Determination of Gini Coefficient with the Help of Lorenz Curve.

The Gini Coefficient, $G = \frac{A}{A+B}$

Where

A= Area of Concentration

A+B = Maximum Area of Concentration (.5).

Area of concentration = 0.5 – (Area of triangle abf + area of trapeziums bcfg, cdhg, deih).

It is also equal to 2A and to 1 - 2B due to the fact that A + B =

0.5 (since the axes scale from 0 to 1). Value of Gini coefficient varies between 0 and 1. If the value of index equals to zero, that means there is no disparity in the resource distribution among the different areas and the distribution is even in all the areas fulfilling the demand of the population. On the other hand if the value of Gini Index equals to 1, it means that the resource is perfectly unequally distributed among limited number of the population.

Table 1: Expected value range category of Gini Coefficient

Value of Gini Coefficient	Meaning
0.1-0.2	Though considerably equal, there is an anxiety to obstruct the effort to the improvement.
0.2-0.3	Usual distribution type that exists in general in society.
0.3-0.4	Though there are some differences, there is also a desirable respect in the improvement through competition.
0.4-0.5	The difference is serious.
>0.5	The improvement is required except under special circumstances.

Source: Bahauddin, 1989

3. Objectives and Methodology of the Study

A number of research works are available regarding regional inequality assessment. But in case of Rajshahi City Corporation (RCC), no research has yet been conducted focusing the regional inequality with respect to nation condition. The main objectives of this study are to analyze and find out inter regional disparities in the distribution of facilities and to compare the regional distribution of facilities with respect to national. In this study, interregional inequalities have been determined by using Lorenz Curve and Gini index. Secondary data regarding Utility facilities, Educational, Social welfare, Transport and Health facilities in 64 districts of Bangladesh has been collected from Bangladesh Bureau of Statistics (BBS, 2011) to conduct this study. At last, some major findings from the analysis have been identified.

4. Study Area Profile

Bangladesh emerged as an independent and sovereign country in 1971 following a nine month war of liberation. It is one of the largest deltas of the world with a total area of 147,570 sq. km. With a unique communal harmony, Bangladesh has a population of about 152.51 million, making it one of the densely populated countries of the world. The majority (over 88%) of the people are Muslim. Over 98% of the people speak in Bangla. English, however, is widely spoken. The country is covered with a network of rivers and canals forming a maze of interconnecting channels. Being an active partner, Bangladesh plays vital role in the international and regional forum, particularly in the UN, Commonwealth and South Asian Association of Regional Cooperation (SAARC) (BBS, 2015). Generally facilities are not equally distributed all over the country in Bangladesh. This phenomenon causes disparity among different regions in Bangladesh. Regional disparity can be based on various criteria and can vary from time to time including a targeted focus on good governance and gender equality. (Understanding Urban Inequalities in Bangladesh, UNICEF, 2010). Bangladesh is the most densely populated country in the world (excluding some city-states), with an average of 1,050 people per square kilometer in 2005 (in contrast, the Netherlands has almost 400 people per square kilometer, and Brazil, 20). Bangladesh has made impressive progressing human development in the last decade. Identified as a rising star in the 2013 Human Development Report, Bangladesh has either attained—or is on track to attain—the vast majority of Millennium Development Goal (MDG) targets. Bangladesh's 2013 Report on the Post-2015 Sustainable Development Agenda reaffixed the country's commitments to achieving proper, inclusive and sustainable growth (UNDP Bangladesh Annual Report 2014). The relationship between inequality, growth and poverty in developing countries like Bangladesh have been discuss at some level While the theoretical arguments for explaining the links between growth, inequality and poverty have been refined over time in Bangladesh. There has been a significant reduction of regional disparity in Bangladesh through the years. Different Government steps are the main factor behind this progress. Development is like the economic cake sliced up more within the regions, which depends on development of infrastructure, internal situations, resources, policies and

decisions on local government (Islam, Safayet & Meghna, 2013) [5].



Fig 2: The Entire 64 Districts of Bangladesh

5. Analysis and Discussion

5.1 Analysis of interregional disparity

5.1.1 Electricity Connection

The number of connected electricity compared to all household is highest at Dhaka district. About 97% household are electricity connected in Dhaka district. The number of connected electricity is lowest at Lalmonirhat district. In Lalmonirhat district about 20.1% household are connected with electricity compared to total household. The moderate connected electricity are in Kishoreganj, Maulavibazar, Noakhali about 49.6%, 50.8%, 51.10% connected compared to total household respectively.

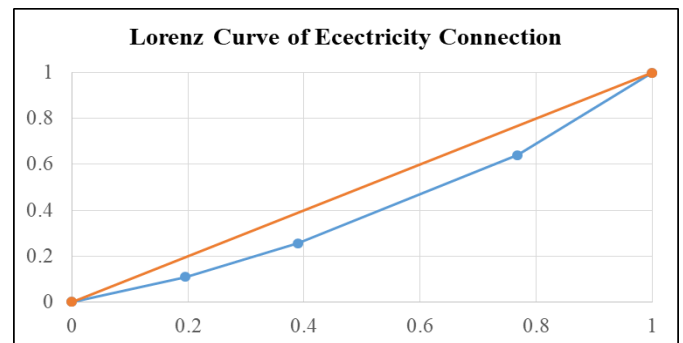


Fig 3: Lorenz Curve of Electricity Connection.

The Gini Co-efficient for electricity connection is: 0.19. Which means that the electricity connection distribution is

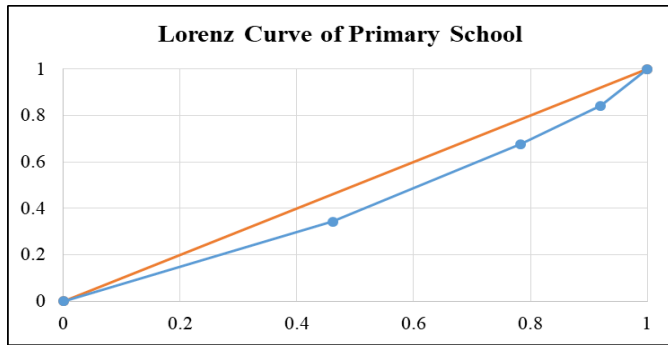
considerably equal, there is an anxiety to obstruct the effort to the improvement.

5.1.2 Educational Institution

In the analysis, disparity of educational facilities distribution based on some variables; like: Primary School, High School, College, Madrasha distribution.

5.1.2.1 Primary School

The number of primary school distribution is highest at Narayangaj compared to total household. The number of primary school distribution is lowest at Rangamati compared to total household. The moderate districts are Pirojpur, Madaripur & Dinajpur.



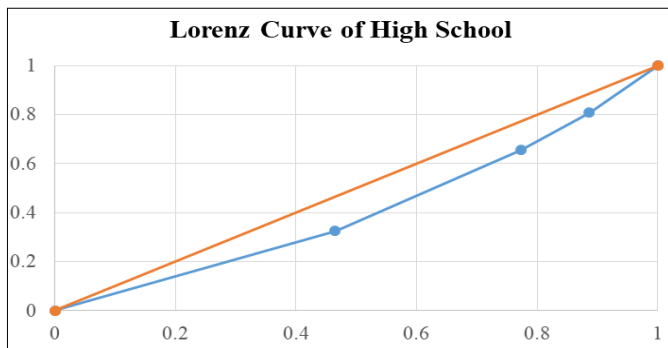
Source: Prepared by the Researcher.

Fig 4: Lorenz Curve of Primary School.

The Gini co-efficient of primary school is 0.16 which means that the primary school distribution is considerably equal, there is an anxiety to obstruct the effort to the improvement.

5.1.2.2 High School

The number of high school is distributed highest at Jhalokati compared to total household unit. The number of high school is distributed lowest at Dhaka district compared to total household unit resides. In Jhalokati district the total household is about 158139 & total number of high school is 195 (BBS,2011). On the other hand, In Dhaka district the total number of household & high school is 2786133 & 485 respectively.



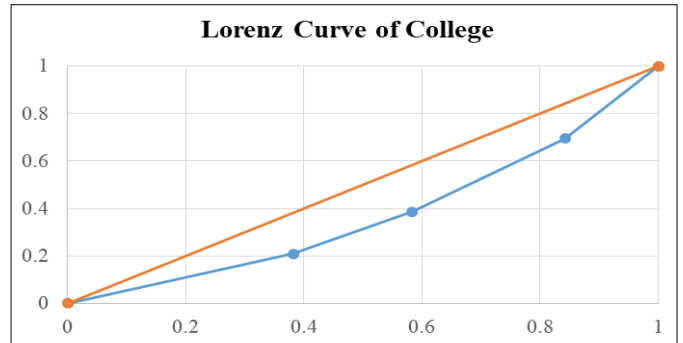
Source: Prepared by the Researcher

Fig 5: Lorenz Curve of High School.

The Gini co-efficient of high school is 0.18 which means that the high school distribution is considerably equal, there is an anxiety to obstruct the effort to the improvement.

5.1.2.3 College

The number of college is distributed highest at Sylhet district compared to total household. The number of college distribution is lowest at Cox’s Bazar district compared to total household unit resides. In Sylhet the total number of household unit & college is 596081 & 341 respectively. In Cox’s Bazar the total number of household unit & college is 415954 & 21 respectively. The districts having moderate distribution of college are Bhola, Panchagar, Comilla.



Source: Prepared by the Researcher.

Fig 6: Lorenz Curve of College.

The Gini co-efficient of college is 0.30 which means that usual distribution type that exists in general in society.

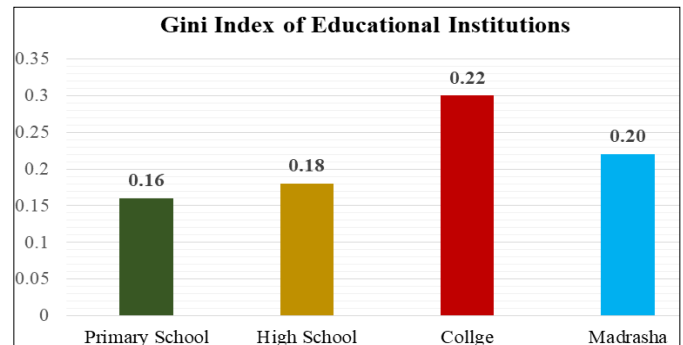
5.1.2.4 Madrasha

The number of madrasha is distributed highest at Barguna district compared to total household. The number of madrasha is distributed lowest at Dhaka district compared to total household. In Barguna the total number of household unit & madrasha is 215842 & 404 respectively.

The Gini co-efficient of college is 0.22 which means that usual distribution type that exists in general in society.

5.1.2.5 Gini Index of Educational Institution

The educational institutions based on four variables. Here, the highest value of Gini index at primary school means considerably equal distribution of primary school through all districts. The highest value of college represents that the distribution of college is distributed more evenly. To ensure equal distribution of educational facility first attempt should reduce the dispersion of college distribution over Bangladesh.



Source: Prepared by the Researcher.

Fig 7: Gini Index Disparity of Educational Institution

The combined index for educational institution is

$$\text{Combined Index} = \frac{\text{Summation of variables index}}{\text{Number of variables}}$$

Here, The combined index for educational institution is

$$= \frac{0.16 + 0.18 + 0.3 + 0.22}{4} = 0.215$$

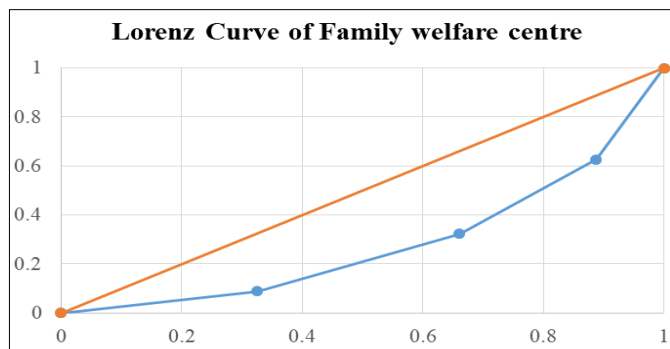
The value of Gini co-efficient 0.215 means that usual distribution of educational facilities that exists in general in society.

5.1.3 Health Care Facilities

The analysis, disparity of health care facilities distribution based on some variables; like: Family welfare centre, Health care centre, Hospital bed.

5.1.3.1 Family Welfare Centre

The number of family welfare centre is distributed highest at Khulna district. The number of family welfare centre is distributed lowest at Brahmanbaria district compared to total household. In the Khulna district the total number of total household & family welfare centre is 547347 & 97. In the Brahmanbaria district total number of household unit & family welfare centre is 538937 & 1 respectively. The moderate districts are Shariatpur, Rajbari, Bogra compared to total household unit. The Gini co-efficient of family welfare centre is 0.43 which means that the facility distributed difference is serious.



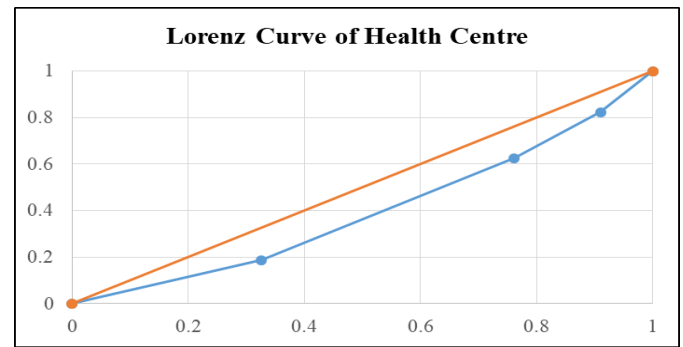
Source: Prepared by the Researcher.

Fig 8: Lorenz Curve of Family Welfare Centre

5.1.3.2 Health Centre

The number of health care centre highest at Khulna district about 191 provided to its population about 547347. In the Dhaka district the number of health centre compared to its population is lowest. The statistic shows that in Dhaka district the number of health centre is 61 provided to its huge amount of population about 2786133. The moderate districts are Tangail, Naogaon, Comilla having 113, 86, 140 health centre respectively. The Gini co-efficient of health centre is 0.21

which means that usual distribution of Health centre that exists in general in society.



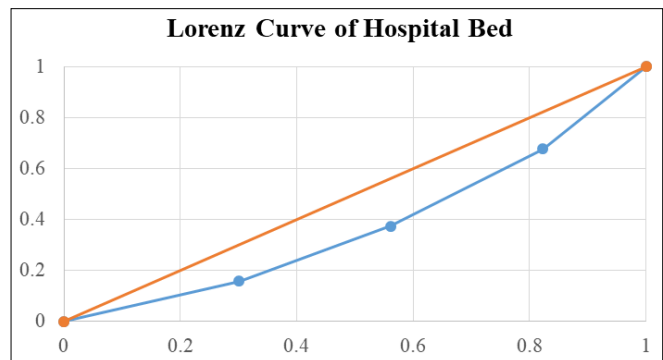
Source: Prepared by the Researcher.

Fig 9: Lorenz Curve of Health Centre

5.1.3.3 Hospital Bed

For calculating the regional disparity of hospital bed, the number of hospital bed provided for how amount of population is counted. The number of hospital bed distributed highest at Sylhet district about 4431 serving for 596081 population. The number of hospital bed provided lowest at Thakurgaon district about 204 respecting to its total population 320786. The districts having moderate amount of hospital bed are Narayanganj, Meherpur, Chuadanga having 1343, 343 & 584 respectively.

The value of Gini co-efficient of hospital bed is 0.24 which means that usual distribution of Hospital bed that exists in general in society.

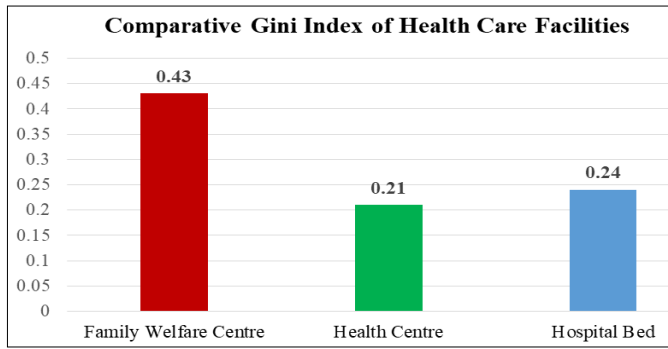


Source: Prepared by the Researcher.

Fig 10: Lorenz Curve of Hospital Bed

5.1.3.4 Gini Index of Health Care Facilities

The analysis of health care facility based on three variables Family welfare centre, Health care centre, Hospital bed. Here, the highest value of family welfare centre 0.43 means that the disparity is serious. The lowest value 0.21 & 0.24 means the usual distribution type that exists in general in society. To ensure equal distribution of Health care facility first attempt Should reduce the dispersion of family welfare centre distribution.



Source: Prepared by the Researcher.

Fig 11: Gini Disparity of Health Care Facilities.

The Combined Index for Health Care Facilities is

$$\text{Combined Index} = \frac{\text{Summation of variables index}}{\text{Number of variables}}$$

Here, The combined index of health care facilities

$$= \frac{0.43 + 0.21 + 0.24}{3} = 0.293$$

The value of Gini co-efficient **0.293** which means the usual distribution type that exists in general in society. Ultimate situation of category two.

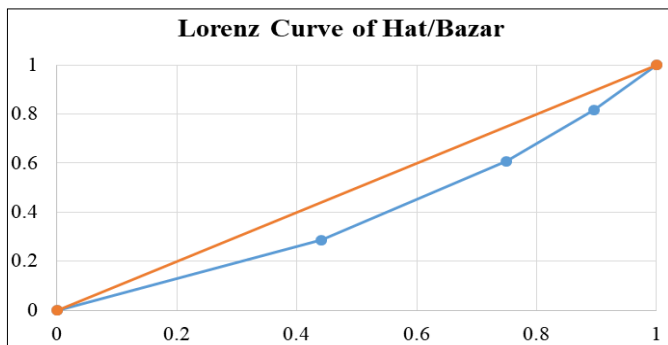
5.1.4 Social Welfare Services

The analysis, disparity of social welfare services distribution based on two variables; like: Hat/Bazaar & Growth Centre.

5.1.4.1 Hat/Bazaar

The number of hat/bazaar distributed highest at Madaripur district & lowest at Meherpur district respecting to total household unit. The number of hat/bazaar distributed at Madaripur district is 179 respecting to its total household unit 252149. The number of hat/bazaar distributed at Meherpur district is 9 respecting to total household unit 166312. The districts having moderate number of hat/bazaar distributed are Habiganj, Manikganj, Netrokona having 115, 95, and 141 respectively.

The value of Gini co-efficient for hat/bazaar is 0.20 which means that the distribution of hat/bazaar is considerably equal, there is an anxiety to obstruct the effort to the improvement.

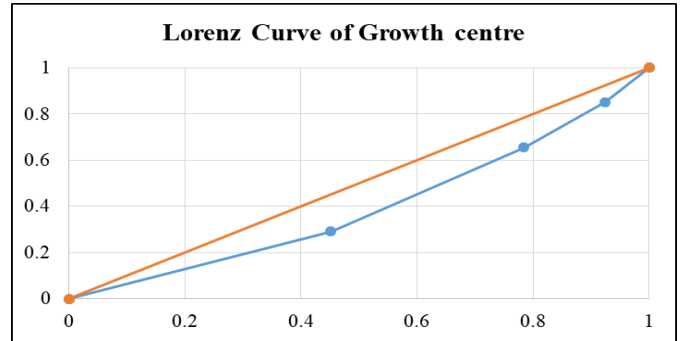


Source: Prepared by the Researcher.

Fig 12: Lorenz Curve of Hospital Bed

5.1.4.2 Growth Centre

The number of growth centre distributed highest at Rangamati district about 39 respecting to its total amount of household unit about 128496. The number of growth centre distribute lowest at Dhaka district about 42 respecting its total amount household about 2786133. The districts having moderate amount of growth centre are Khulna, Magura & Satkhira districts having 45, 17 & 39 repecting 547347, 205902 & 469890 household unit respectively.



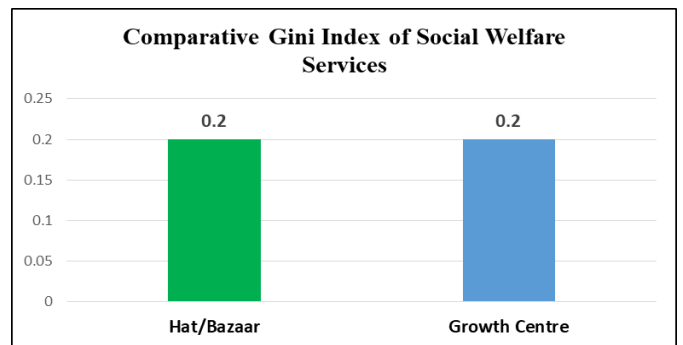
Source: Prepared by the Researcher.

Fig 13: Lorenz Curve of Growth Centre

The value of Gini co-efficient for growth centre is 0.20 which means that the distribution of growth centre is considerably equal, there is an anxiety to obstruct the effort to the improvement.

5.1.4.3 Gini Index of Social Welfare Service

The analysis of social welfare centre based on Hat/bazaar & Growth Centre. The value of Gini co-efficient is same for the two variables. So, the combined Gini co-efficient will also be 0.20 which means the usual distribution type that exists in general in society. The dispersion of distribution of two variables are same.



Source: Prepared by the Researcher.

Fig 14: Gini Index of Health Social Welfare Services.

The Combined Index for Health Care Facilities is

$$\text{Combined Index} = \frac{\text{Summation of variables index}}{\text{Number of variables}}$$

Here, The combined index of health care facilities = $\frac{0.20 + 0.20}{2} = 0.20$

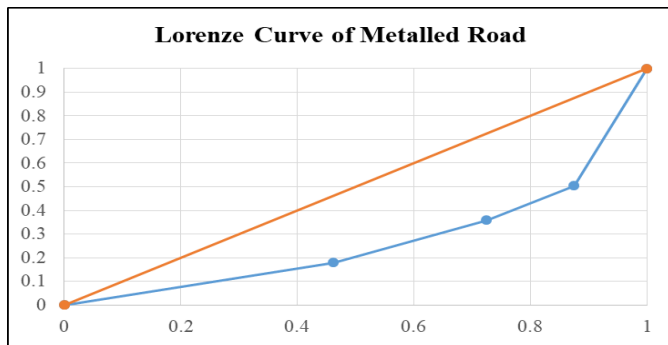
The value of Gini co-efficient 0.20 which means the usual distribution type that exists in general.

5.1.5 Transportation Facility

The analysis disparity of transportation facility distribution based on two variables; like: Metaled Road and Semi-metalead Road.

5.1.5.1 Metaled Road

The amount of metaled road respecting to household unit resides is highest at Bhola district. The amount of metaled road is 16557.14 km respecting to 372723 household units. The amount of semi-metalead road is lowest at Shariatpur district about 73.71 km respecting to 247880 household units. The districts having moderate amount of metaled road is Jhalokati, Pirojpur & Kishoreganj district having 350.82, 569.61 & 1409 km metaled road respecting 158139, 256002 & 627322 household units.



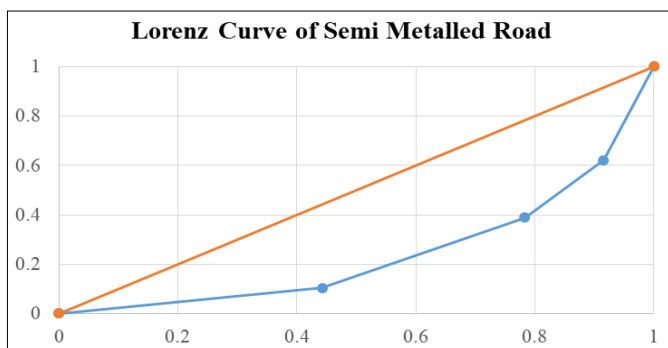
Source: Prepared by the Researcher.

Fig 15: Lorenz Curve of Metaled Road

The value of Gini co-efficient of metaled road is 0.46 which means that the disparity of metaled road distribution is serious.

5.1.5.2 Semi-metalead Road

The amount of semi-metalead road highest respecting to total household resides is at Bhola district about 3025.21 km respecting to 372723 household units. The amount of semi-metalead road lowest at Panchagor district about 1 km respecting to total household unit resides is 228581. The district having moderate amount of semi-metalead road is at Natore, Capai Nawabganj & Gazipur district about 188.21, 164.63 & 391 respecting to 423875, 357982 & 826458 household unit respectively.



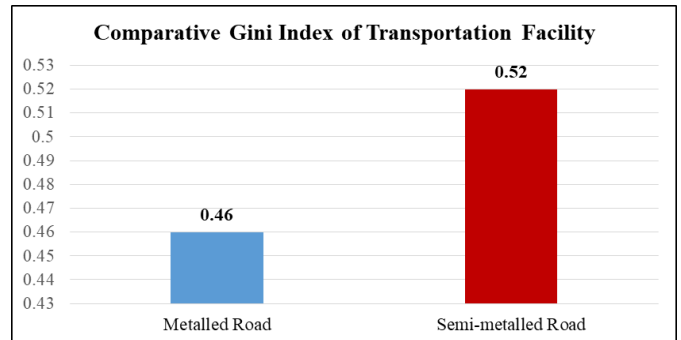
Source: Prepared by the Researcher.

Fig 16: Lorenz Curve of Semi Metaled Road.

The value of Gini co-efficient of semi-metalead road is 0.52 which means the improvement is required except under special circumstances.

5.1.5.3 Gini Index of Transportation Facility

The analysis disparity of transportation facility distribution based on two variables; like: Metaled Road and Semi-metalead Road. The highest value of Gini Co-efficient is 0.52 for semi-metalead road which means the improvement is required except under special circumstances. The lower value of metaled road 0.46 means that the difference is serious. The disparity of two variables for transportation facility distribution is at risk.



Source: Prepared by the Researcher.

Fig 17: Gini Index of Transportation Facility.

The Combined Index for Transportation Facilities is

$$\text{Combined Index} = \frac{\text{Summation of variables index}}{\text{Number of variables}}$$

Here, The combined index of transportation facilities

$$= \frac{0.46 + 0.52}{2} = 0.49$$

The value of Gini co-efficient of transportation facility is 0.49 which means the difference is serious in an ultimate situation.

6. Major Findings and Conclusion

6.1 Factors Leading to Inequality

GDP per capita is used to measure the level of development associated with various service facilities like Education, Utility, Transport, Health and social welfare etc. If the per capita income is increase the overall condition for all the facilities are in increasing rate. There are some other importance factors that are associated with the Gini Index and Lorenz curve those influence the regional inequality. These are:

1. Higher Migration Rate
2. Higher Number of Households as well as Population.
3. Locational Factor (hilly areas, inaccessible areas and areas containing rural characteristics).
4. Distance from the Capital
5. Poor Regional Connectivity-national highway and railway services.
6. Neighboring Regions-whether prosperous or lagging.
7. Insufficient Supply of Resources.

8. Lower Economic Growth and Infrastructure Development.

6.2 Major Findings

- From the above analysis, it is clear that, Dhaka and its surrounding regions are the most improved sections in Bangladesh. But this scenario is worst day by day due to its increasing population growth rate.
- Electricity condition is improving day by day due to some initiatives by our government.
- The condition of educational institution, social welfare services, health care services are good in majority of the districts.
- Almost half of the total districts have the low transport facility and the condition is more deteriorating in case of Rajshahi and Rangpur division.
- Almost half of the total districts have the low transport facility and the condition is more deteriorating in case of Dhaka division as a means of lack of total cropped areas.
- Bandarban, Rangamati are the most deprived areas in respect of utility facilities. So, it is needed to provide suitable facilities for those areas.

6.3 Conclusion

There has been a significant reduction of regional disparity in Bangladesh through the years. Different Government steps are the main factor behind this progress. Policies are needed to improve the conditions in existing less developed regions and develop at the disbursement of lagging regions. So, it is necessary to provide more infrastructures and public facilities in all of the regions for ensuring a balanced regional equity according to the demand of people. To some extent, the study was complex for identifying the concentration of socioeconomic facilities among all division and 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 district and division of Bangladesh and introduce planning controls that will promote the desirable growth of the Upazilas.

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