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Spatial Inequality Assessment: Netrokona District, Bangladesh

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Article info	Abstract
Received: 24 February 2023 Accepted: 25 March 2023 Published: 25 March 2023 Available in online: 30 March 2023 *Corresponding author: hasanmdiqbal1@gmail.com	Inequality is defined as the uneven and unfair allocation of resources. Economic, social, and geographical elements that intersect with inequality develop when resources in a community are unequally distributed. This study was undertaken to identify and to assess the existing spatial inequality in Netrokona district based on the 2011 census. Here, this study used some specific datasets as well as conversion, processing, and analyzing tools in ArcGIS software to determine the existing spatial inequality in Netrokona district via upazila-wise sectoral analysis (economic, social, Infrastructure, Health, and Sanitation). Datasets were weighted overlaid using ArcGIS through modeling. The study demonstrates that Netrokona sadar is in 'very good' condition, whereas Khaliajuri upazia is in 'very poor' condition based on all sector variables. This spatial variation may raise the possibility of unplanned growth and worse social conditions in the study area. These findings could help the government and policymakers implement essential policies and measures to combat inequality. Keywords: Spatial Inequality, Netrokona District, Variable, ArcGIS, and Model.

Introduction

Disparities in economic and social well-being indexes between geographical regions within a nation are known as "Spatial Inequality". Policymakers are concerned about two issues. First, regional inequality is a component of the overall national inequality of persons. National inequality is raising disparity in tandem with regional disparities. Second, regional inequality within a country may be problematic in and of itself, particularly if the regions are separated along political, ethnic, or religious lines. According to Islam *et al.* (2016), inequality varies from country to country depending on its history, culture, economic condition, climate. and so on.

The study of spatial inequality in Bangladesh is intriguing for at least two reasons. First, between 2000 and 2010, significant decreases in poverty were realized across the country. From 2000 and 2010, the poverty rate fell from 48.9% to 31.5% (World Bank, 2013). According to Direct Estimate (HIES, 2016), all upazilas of Netrokona were in between a high and very high level of poverty, which was the major aspect of selecting this study area. There have been few studies focusing on the topic of regional disparities. All studies were conducted on a national scale. On the other, macro-level study is inadequate. Therefore, it is necessary to perform extensive analyses at the micro level in Bangladesh to ensure the country's balanced development. This study is one such attempt.

According to the overview of UNU-WIDER Project by Kanbur and Venables (2005), spatial inequality is a dimension of overall inequality, but it has added significance when spatial and regional divisions align with political and ethnic tensions to undermine social and political stability. As well as most other developing and transitioning economies, there is a sense that spatial and regional disparities in economic activity, incomes, and social indicators, are on the increase.

Bangladesh has an inspiring story of reducing poverty and advancing development. Since 2000, the country has reducing poverty, it lifted more than 25 million out of poverty. The country's higher economic growth in the last decade has not led to faster poverty reduction. Spatially, poverty has stagnated and even increased in the Western divisions while the eastern divisions fared better (World Bank, 2016).

Looked into the factors behind the recent decline of the regional inequality known as the east-west divide. That study tried to capture the persistent regional disparity and the trend of it, and the if there is a decline (Mahzab, 2015). Yet, this assessment revealed that the Netrokona has a traditional division.

Spatial inequality is significantly lower in rural areas and has only slightly decreased during these years (from 0.22 to 0.20). Inequality has recently become a major source of concern around the world, and it is increasing at an alarming rate. According to the new Oxfam analysis, 82% of the money created last year went to

the world's richest 1%, while the 3.7% billion people who make up the world's poorest half had no growth in wealth; in other words, they received nothing. In this study a basic model is developed for tracking regional inequalities and analyzed to see how different causes contribute to spatial disparity. Hence the present study was undertaken to find out the spatial variation in different sectors(economic, social, Infrastructure, health and sanitation of Netrokona district. Spatial Variations in geospatial analysis have been examined for these sectors using data from the 2011 population census.

Methodology of the Study

In GIS, the weighted overlay technique is used to do an integrated analysis of many distinct variables by applying a single standard measurement scale of values to multiple inputs. Also, the variables may have equal influence on their relevant sector. Each raster cell is grouped into a similar measuring scale and multiple by weight to calculate its relative contribution. Furthermore, spatial variations in the study have been examined using datasets based on factors such as literacy rate, female literacy rate, number of high schools, number of primary schools, and number of technical and vocational

Table 1. Weighted Index table

Sector	Variables (Data Sources)	Scale values (Scale: 1 to 5)	Weight Influence* (%)	Sectorial Weight Influence* (%)
	Bank Branches (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
U	Govt.Employee (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	25
conomi	Govt.Offices (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	25
ы	Growth Centers (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Small Scale Industries (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Govt. Doctors (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
tation	Diagnostic Centers (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
& Sanit	Tube well facilities (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	25
Health	Private Doctors (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Toilet facilities (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Literacy Rate (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Female Literacy Rate (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	25
Social	Primary School (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	25
•	High School (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Technical & Vocation Institutions (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Metalled Road (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
ē	Sami-Metalled Road (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	95
tructur	Culvert (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	25
Infras	Bridges (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	
	Pucca House (BBS 2011)	1 to 5 (Very Poor to Very Good)	20	

Source: Data is prepared based on the Population Census 2011.



Note: Model is made by the author with the help of the population census data from 2011(BBS).

Figure 1. Flowchart model

government employees, small scale industries, growth centers, and government offices (in the Economic sector) Tubewell facilities, toilet facilities, private doctors, government doctors, and diagnostic centers (in the Health and Sanitation sector) number of bridges, culverts, metalled roads, sami- metalled roads, and pucca houses (under Infrastructure sector). Data from secondary sources such as the Bangladesh Bureau of Statistics' Population Census (2011). has been used. The district is located between 24°34" and 25°12" north latitudes and between 90°00" and 91°07" east longitudes.

The relative weight influence must add up to 100. The sectors were considered as variables to perform in a single map overlay in a weighted manner in order to depict the overall spatial inequality in one map. Table 1 shows a weighted indexing table used in the study to assess spatial inequality. The flowchart model for analyzing spatial inequality in the Netrokona district is presented in Figure 1.

Results and Discussions Overall Economic Inequality

The unequal distribution on income, wealth, and opportunity among distinct groups is called economic inequality. Poverty is an issue in almost every country, and people are trapped in poverty with little prospect to climb the social ladder. While the study focuses on work, especially the economic imbalance between the wealthy and poor of Netrokona districts.

Table 2	Economic	Condition
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Economic Condition	Number of Upazila	Percentage
Very poor	1	10
Poor	5	50
Moderate	3	30
Very good	1	10
Total	10	100

Note: Data is adapted based on population census 2011

Out of ten upazilas, five are in 'poor' condition, while only one is in 'very good' condition.





Figure 2. Overall economic inequality of Netrokona Districts

According to the study finding, the overall economic situation in Netrokona district is not satisfactory regarding economic sectors such as growth centre, government office, small scale industry, bank branches, govt. employees and so on. Most Upazilas are in 'poor' condition except Natrokona sadar. On the other hand, Kendua, Purbadhala, Durgapur are in 'moderate' condition. The remaining Upazilas are in disrepair. Khaliajuri upazila is in 'very poor' condition. Total 60% is in 'poor' to 'very poor' condition where only 10% is in 'very good' condition.

Overall Social Inequality

Social sector refers to partially nonprofit sector and partially nongovernmental sector. The main aim of the social sector is to achieve social development. It refers to providing basic needs to the people.

Table 3: Social Condition

Social Condition	Number of Upazila	Percentage
Very poor	2	20
Poor	3	30
Moderate	4	40
Very good	1	10
Total	10	100

Note: Data is adapted based on population census 2011

Most of the percentage under 'moderate' condition is 40%, while only 10% is in 'very good' condition. The northwestern part of the district is better than northeastern part.



Source: Population Census 2011(Map prepared by author)

Figure 3. Overall Social Inequality of Netrokona District

The overall condition of social sector of the Netrokona district (according to female literacy rate, Literacy rate, number of govt. primary school, number of govt. secondary school, technical and vocational institutions) is 'very good' in Netrokona sadar upazila. On the other hand, Kendua, Mohanganj, Durgapur, Purbadhala Upazilas are in 'moderate' condition. Atpara, Barhatta and Kalmakanda are in 'very poor' condition based on the variable of social sectors. While 5 upazilas were found in the 'poor' to 'very poor' category and 3 upazilas were found in the 'good' to 'very good' category. On the other hand, 5 upazilas were found in the 'moderate' category (Table 3).

Overall Health & Sanitation inequality

Inequalities in health and sanitation exist in our society due to lack of adequate related facilities. These inequalities mostly impact people and groups who face multiple human rights violations. Counted on for health and sanitation amenities the viewpoint number of government doctors, the number of private doctors, access to safe drinking water, Toilet facilities and the number of diagnostic Centre. Based on the population census in 2011, the Netrokona district has inequalities in the sector of health and sanitation.

Table 4: Health and Sanitation Condition

Health & Sanitation Condition	Number of Upazila	Percentage
Very poor	7	70
Poor	2	20
Very good	1	10
Total	10	100

Note: Data is adapted based on population census 2011

The overall scenario of the health and sanitation sector shows that the Upazilas of the northeastern and southern parts of the district are very poor in that sector. As only 1 upazila is identified in the 'very good' category of the health & sanitation sector, it can be said that there is a centralized characteristic in the health sector where people depend on the sadar for getting better health services.



Source: Population Census 2011(Map prepared by author)

Figure 4: Overall health and sanitation inequality of Netrokona district.

The map mentioned above showed that Netrokona sadar upazila is in very good condition from the perspective of health and sanitation sector variables however, the remaining upazilas are in 'poor' to 'extremely poor' conditions. So, the overall status of health and sanitation is miserable.

Overall Infrastructure Inequality

Infrastructure is the fundamental facilities and system that serve a country, city, or other location, including the services and facilities. Roads, trains, bridges, tunnels, water supply, telecommunications, and sewage are examples of public and private physical improvements. In general, it has also been defined as the physical components of interconnected system delivering goods and services required to enable, sustain or enhance social living circumstances.

Table 5: Infrastructure condition

Infrastructure Condition	Number of Upazila	Percentage
Very poor	3	30
Poor	4	40
Moderate	3	30
Total	10	100

Note: Data is adapted based on population census 2011

It is found that there needs to be a satisfactory condition of infrastructure in the Netrokona district. While three upalizels were found in the 'moderate' condition, including the economic hub of that region. The rest of the area is in 'poor' to 'very poor' condition.



Source: Population Census 2011(Map prepared by author)

Figure 5. Overall Infrastructure Inequality of Netrokona District

The overall infrastructure status of Netrokona district could be better. While 70% of the area is in 'poor' condition in terms of infrastructure sectors. 'Moderate' conditions are found in a few upazilas, such as Netrokona sadar, Kendua and Purbadhala upazila. On the other hand, Madan, Khaliajuri, Mohanganj and Durgapur upazilas have 'poor' conditions. Atpara, Barhatta, and Kalmakanda are in 'very poor' shape in the context of infrastructure.

Overall Inequality of Netrokona District

In the Netrokona district, inequality is caused by unequal distribution of resources and opportunities among upazilas. Inequality has diverse but overlapping economic, social, Infrastructure, health & sanitation aspects. It aims to determine the overall disparity situation in the study area. As a result, a model is made for determining and analyzing entire inequality of the Netrokona district.

The integration of all sectors' thematic layers through weighted overlay results in 50% of the upazila being in 'poor' condition, which means half of the area is dominated by 'poor' status, while 30% of the upazila is in 'moderate' condition, and only 10% is in both 'very good' and 'very poor' condition.

Table 6: Overall	condition of Netrokona	District
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Condition of Netrokona	Number of Upazila	Percentage
Very poor	1	10
Poor	5	50
Moderate	3	30
Very good	1	10
Total	10	100

Note: Data is adapted based on population census 2011



Source: Population Census 2011(Map prepared by author)

Figure 6: Spatial Inequality of Netrokona District

The map above demonstrates that Netrokona Sadar upazila is in 'very good' condition. Durgapur, Kendua, and Purbadhala upazilas are in 'good' shape regarding all sector and variable data obtained from BBS 2011. During this study and after analyzing the dataset, it was found that Netrokona sadar, Durgapur, Kendua, and Purbadhala Upazilas are slightly well-served in all sectors, including economic, social, infrastructure, health, and sanitation. On the other side, the remaining upazilas are in 'poor' and 'very poor'. It might also be stated that the remaining upazilas have trailed behind. Those Upazilas have not been provided with development facilities. Therefore, the overall sectoral condition of the upazilas is 'poor'.

The medical facilities in this area are insufficient to service the inhabitants. There are fewer doctors. Compared to the population, the number of government and private doctors in the upazila health complex needs to be increased to provide individuals with adequate medical care. Significant pay and income discrimination exists in laggard areas that lack a development center. Those areas are in 'poor' shape since the infrastructure is inadequate. Those areas lag far behind in terms of current technical capabilities.

Conclusion

In the final spatial inequality map created by combining all sectors maps, Netrokona sadar was only located in the comparatively 'very good area' indicating district centralization. Because the northeastern part of the area has more opportunities than other parts, it may be expanded towards the northwestern side. The analysis shows that Khaliajuri Upazila was in 'very poor' condition. The majority of the improvised upazilas were found in the northeast and southeast regions of the Netrokona district. As a result, eastwest division is found in the results. In which the west division is considered more developed than east division. Through minimizing spatial inequality, to achieve long-term growth in Bangladesh, it is critical to ensure that no one in left behind.

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