Khulna University Studies Volume 15 (1 & 2): 133-148 : 2018

SOCIAL SCIENCE

URBAN INEQUALITY: AN ASSESSMENT ON THE DISTRIBUTION OF INFRASTRUCTURE AND SERVICES IN KHULNA CITY CORPORATION, BANGLADESH

Md. Hasan Howlader*, Md. Ashikuzzaman, Md. Zobayer Hossain and Md. Arman Khan

Development Studies Discipline, Khulna University, Khulna 9208, Bangladesh

KUS: 18/01:010318

Manuscript received: March 01, 2018 Accepted: September 30, 2018

Abstract: The objective of the study is to analyze the nature of inequality in the distribution of infrastructure and services in Khulna City Corporation. Results of Gini coefficient show that public toilet, market (both commercial and essential commodity), bank, park, factory and culvert are unequally distributed across the city whereas distribution of tube-well, primary school, hospital and dustbin show more equal distribution within the city. Findings reveal that first principal component (termed as Urban Conveniences) has positive association with public toilet, market (both commercial and essential commodity), culvert, primary school and bank whereas the second principal component (termed as Commercial Infrastructure) has positive relation with commercial market and bank. The third component (termed as Health and Urban Hygiene) has positive relation with hospital and dustbin and lastly, the fourth principal component (termed as Industrial Enterprises) has positive association with factory. The agglomerative hierarchical clustering method exhibits that only one Ward (Ward # 21), out of 31, is the most privileged area in terms of agglomeration of infrastructure and services. This study calls for greater attention on the part of the government to address the uneven distribution of infrastructure and services to foster socio-economic development in areas that are lagging behind.

Keywords: Urban inequality, infrastructure and services, Gini coefficient and Lorenz curve, Khulna City Corporation.

Introduction

Inequality means different things to different people; whether this will be understood as differences in income or should include anything else is of much debate (Litchfield, 1999). This can be understood as achieving equality of opportunity or inequality of outcomes or both (Atkinson, 2015). Inequality of opportunities includes situations such as unequal access to employment or education whereas inequality of outcomes incorporates various material dimensions of human well-being such as the level of income, educational attainment, health status and so on. Together, they constitute economic inequality i.e. how economic variables are distributed among individuals in a group, among groups in a population, or among countries (United Nations Development Programme, 2013). On the effect of inequality on

*Corresponding author:<hasan07ku@yahoo.com>

growth in market economies, the standard argument is that inequality is necessarily good for incentives and therefore good for growth (Aghion & Williamson, 1998; Aghion, Caroli, & Garcia-Penalosa, 1999; United Nations, 2013). On the other hand, there are arguments that redistributive pressures, insecure property rights and social conflict that stem from significant inequality may well discourage investment and hinder growth (Benhabib, 2003). If there prevails immense inequality, an expanding economy may fail or can do little to change the situation of the poor (Royce, 2009). So, it is evident that the concept of inequality has manifolds and it has been conceptualized in different ways over the years. This paper focuses on inequality in the distribution of infrastructure and services. Government provision of public goods such as infrastructure is an important mechanism through which wealth can be redistributed across society (Bajar & Rajeev, 2015; Chatterjee & Turnovosky, 2012). Physical infrastructure such as public utilities (water supply, sanitation and sewerage, solid waste collection and disposal, public works, railways, ports and waterways, etc.) can be seen as the "wheels" of economic activities as these link underdeveloped and peripheral regions with areas of core economic activity (World Bank, 1994). Thus, adequate infrastructure is an important input for economic and social development (Ayub, 2013; Seneviratne & Sun, 2013). Infrastructure has a key role to play in human development as well (Leipziger, Fay, Wodon, & Yepes, 2003). Studies (Calderon & Chong, 2004; Calderon & Serven, 2008, 2010, 2014; Cockburn, Dissou, Duclos, & Tiberti, 2013; Estache, 2003; Gibson & Rioja, 2014; Hooper, Peters, & Pintus, 2017; Mendoza, 2017;Seethepalli, Bramati, & Veredas, 2008) suggest that infrastructure development can play pivotal role in reducing poverty by fostering economic growth and equity through redistribution of income. But the linkage between infrastructure and economic growth is multiple and complex. Besides affecting production and consumption directly, it creates many direct and indirect externalities that involve large flows of expenditure, which results in additional employment opportunities (Ghosh & De, 2005 as cited in Raychaudhuri & De, 2010). In rural areas, infrastructural investments can foster farm and nonfarm productivity, employment and income opportunities with increased availability of wage goods and skilled manpower. Thus, rural infrastructure can reduce poverty by raising mean income and consumption (Ali & Pernia, 2003). Lack of adequate infrastructure, on the other hand, is usually perceived as an obstruction that can harm prospects for investment and therefore, growth. Productive public investment can alleviate inequality even if spending is uniformly distributed (Lopez, 2003). Infrastructure is one of such geographic capital that its deficiency can be seen as one of the main causes behind poverty (Majumdar, 2012). Variation in Geographical location and infrastructural development stand for the disparities in economic growth within a country (Demurger, 2001). Thus, spatial inequality comes into play. Spatial inequality refers to the situation where different spatial or geographical units are at different levels in terms of specific variables (Lall & Chakravorty, 2004). This, in turn, results in regional disparity- a situation when any state fails to distribute the developmental fruits equitably to all corners of the region (Paul, 2012). Spatial inequality matters for a number of reasons. Market failures may occur in such a situation. Moreover, positive and negative externalities associated with clustering and congestion means that outcomes are likely to be inefficient (Kanbur & Venables, 2005; Kim, 2008). To lead a decent life, one has to have the access to certain facilities such as market, housing, water supply, electricity and adequate transportation. These facilities are however, unequally distributed within any urban region (Adefila, 2012; Aderamo & Aina, 2011; Obu, Obienusi, Ozoemene, & Iwu, 2015). Khulna, a divisional city of Bangladesh, is not an exception.

In Khulna city, there are acute shortage of parks and playgrounds, schools and health service facilities (Rahaman & Salauddin, 2009). Disparity prevails among the distribution of these infrastructure and services in different areas of Khulna City. But no systematic inquiry has been conducted regarding the nature and extent of the disparity in the distribution of those infrastructure and services, which are crucial for growth, development and livelihood. This study is an attempt to analyze the nature of inequality in the distribution of infrastructure and servicesin Khulna city. The guiding question for this paper is what is the nature of inequality in the distribution of infrastructure and services in Khulna City Corporation? Inequality in the distribution of infrastructure and services refers to the unequal distribution or physical absence of infrastructure and services in different geographical locations within Khulna city.

Materials and Methods

Study Area: Khulna City Corporation is the third largest city in Bangladesh- the city that stands on the banks of the river Rupsa and Bhairab in the southwest of Bangladesh. It lies at 22"49' north latitude and 89"34' east longitude (Fig. 1). It is a port city and an industrial hub of the southern region of the country. Khulna City Corporation, as an urban administrative unit, was established in 1990 which started its functioning in 1992. The city covers an area of 64.78 sq. km with a population of 751.23 (in thousands) and a density of 16268 per sq. km (Ahmed, 2011; Bangladesh Bureau of Statistics, 2015; Murtaza, 2001; Roy, Datta, Adhikari, Chowdhury, & Roy, 2005).

Data collection: Selected infrastructure and services have been taken as variables. Information about number and location of infrastructure and services were collected form Khulna Development Authority and Khulna City Corporation. A total eleven infrastructure and services namely primary school (115), hospital (147), commercial market (104), essential commodity (22), factory (420), culvert (431), park (7), bank (32), dustbin (171), public toilet (34), and tube-well (6460) were taken into account after checking accuracy as the working variables.

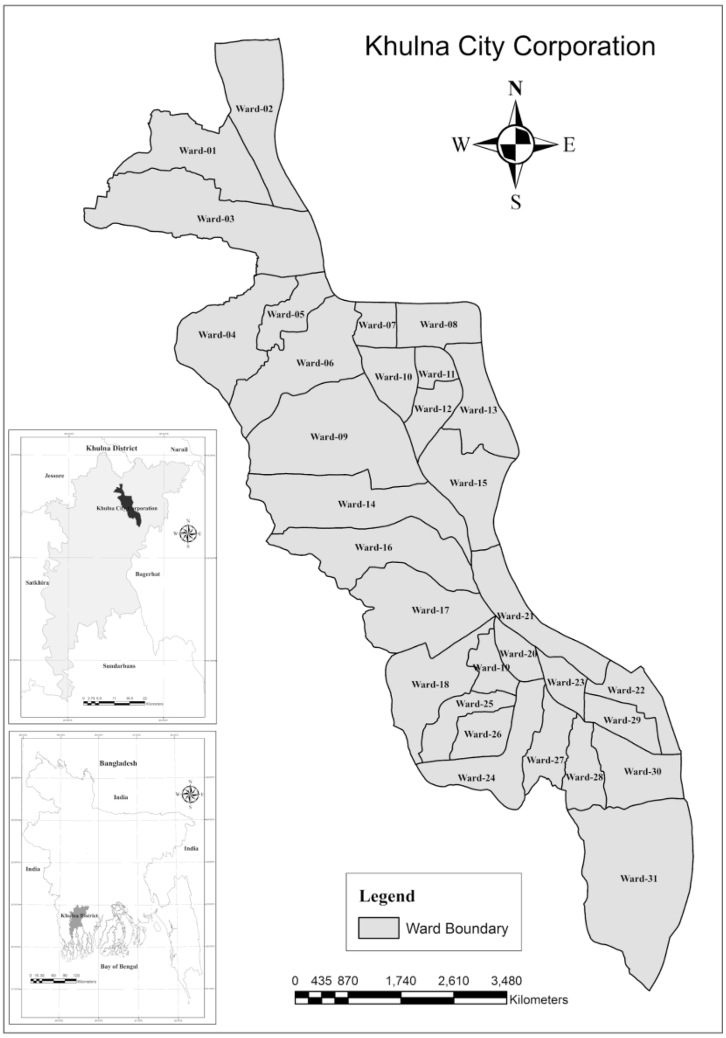

Fig. 1: Map of Khulna City Corporation (KCC), Bangladesh

Data Analysis: The Gini coefficient is a measure of inequality of distribution. It is described as a ratio with values between 0 and 1. For this study, variable-wise Gini coefficient is calculated by measuring the area between the line of perfect equality and Lorenz curve. Lorenz curve is a curve with a concave slope. The more bowed out a Lorenz curve from the line of perfect equality; the higher is the inequality in the distribution of an infrastructure. The area under the Lorenz curve is calculated by measuring the value of variables for each ward. These individual values are added up to calculate area between line of perfect equality and Lorenz curve. Gini coefficient is found by dividing this value with total area (0.5).

Agglomeration of infrastructure and services raise two further questions: (i) To what extent are the variables (infrastructure and services) correlated to one another? (ii) What are the major components that mostly can describe the variability among the variables? Gini coefficient describes the state of distribution for each variable (i.e. hospital, park, public toilet, etc.). Neither can it show whether there prevails any correlation among these variables nor can it tell about the major factors causing the variability within the variables. To find out the variables that contribute mostly in the unequal distribution of infrastructure and services, principal component analysis (PCA) of the variables was put into effect. Guttman-Kaiser criterion is used in this study as the stopping criterion in PCA. Therefore, any principal component connected with an eigen value whose magnitude is greater than 1 is retained (Cangelosi and Goriely, 2007; Jackson, 2004).

The first clustering of wards is driven from the contribution of wards for each factor in PCA. A cut off line is determined for the influential wards. As it was assumed that the contribution of the variables were uniform; the expected value would be 1/31(total number of wards). Hence, the cut off line for this study is 3.23%. For more accurate clustering of the wards, variable's value based agglomerative hierarchical clustering (AHC) method was used as well.

Results and Discussion

Inequality of infrastructure and services: Table 1 shows the level of inequality in the distribution of infrastructure and services. Out of 11 variables only 4 (tube-well, primary school, hospital and dustbin) have a Gini value less than 0.50 which stipulates comparatively low level of inequality in the distribution of the infrastructure and services within the city.

Table 1: Summary Statistics of the Variables with Gini coefficient

Sl. No.	Variables	Mean	Median	Mode	Standard Deviation	Gini coefficient
1	Tube-well	208.39	181	-	132.87	0.33
2	Primary School	3.71	4	3	2.28	0.34
3	Hospital	4.74	3	3	3.85	0.39
4	Dustbin	5.52	5	9	4.11	0.41
5	Culvert	13.90	10	0	14.58	0.54
6	Market (Commercial)	3.35	2	0	4.42	0.54
7	Factory	13.55	8	7	14.27	0.55
8	Public Toilet	1.10	1	0	1.42	0.62
9	Market (Essential Commodities)	0.71	0	0	0.86	0.62
10	Bank	1.03	0	0	1.94	0.75
11	Park	0.23	0	0	0.43	0.77

The Gini values of bank and park demonstrate the top two values indicating that these are highly unequally distributed across the city. Even the distribution of public toilet has a Gini value of 0.62 showing vast inequality. On the contrary, Gini values for tube-well (0.33) and primary school (0.34) denote a comparatively equal distribution within the wards of the city followed by hospital (0.39) and dustbin (0.41). Markets of a city act as the business hubs and center of all economic activities. It is observed markets are unequally distributed within wards. For commercial market, Gini value is 0.54 whereas for essential commodity market, Gini value is 0.62. These values illustrate the fact that market accessibility is narrower for a significant portion of the population. Factory has a Gini value of 0.55 meaning unequal distribution across Khulna city. The gaps in distribution of infrastructure and services across Khulna city are more visible through Lorenz curves. Fig. 2 shows that the distance of Lorenz curves from line of equality for different infrastructure and services. Fig. 2 also depicts the fact that bank, park, public toilet, culvert, market (both commercial and essential commodity), factory are highly unequally distributed whereas primary school, tube-well, hospital and dustbin are comparatively less unequally distributed across Khulna city.

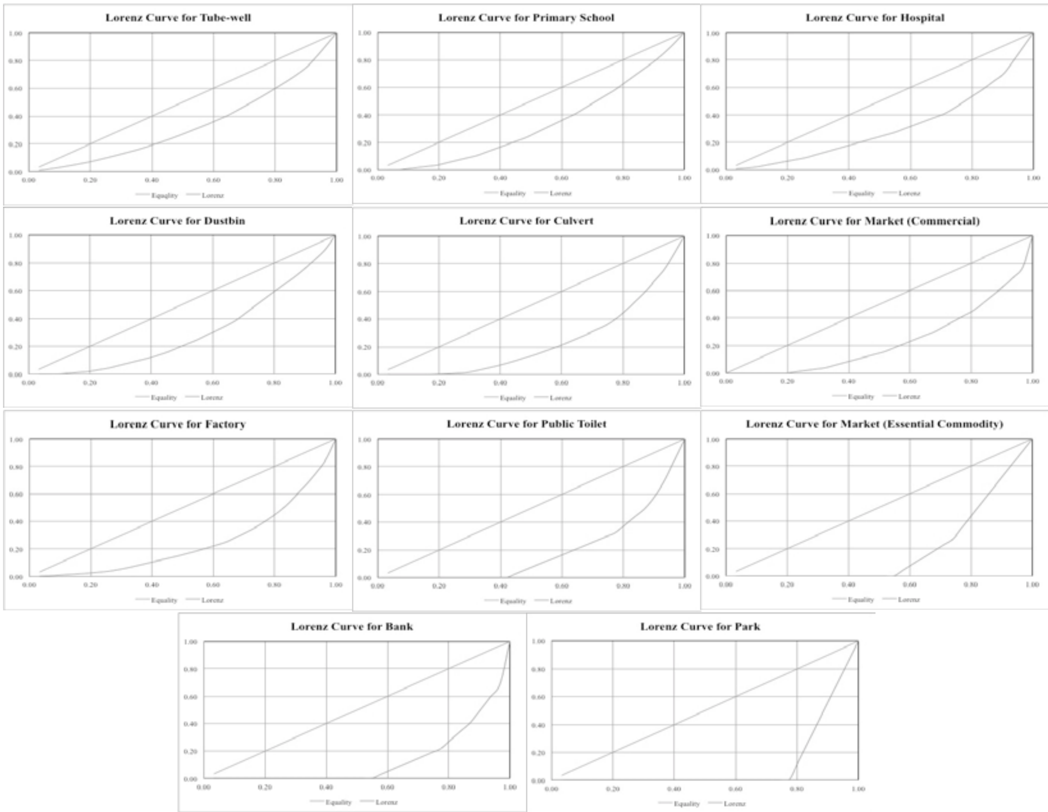

Fig. 2: Lorenz curves for infrastructure and services

Factors behind inequality: The study categorizes the factors that contribute mostly to this inequality through principal component analysis (PCA). Hence, a Pearson correlation matrix has been produced to show in which way and to what extent the variables i.e. infrastructure and services are correlated to one another (Table 2). Major findings are discussed in the following sections.

Table 2: Correlation matrix (Pearson)

	Variables	1	2	3	4	5	6	7	8	9	10	11
1	Market (Commercial)	1										
2	Bank	0.773	1									
3	Factory	-0.034	-0.020	1								
4	Market (Essential Commodity)	0.299	0.105	-0.041	1							
5	Primary school	0.073	-0.028	0.040	0.429	1						
6	Hospital	0.106	0.090	-0.161	0.077	0.105	1					
7	Park	0.418	0.153	-0.043	0.185	0.001	0.098	1				
8	Public Toilet	0.541	0.446	0.291	0.322	0.153	0.242	0.128	1			
9	Dustbin	0.034	-0.186	-0.028	-0.078	0.215	0.066	-0.069	0.094	1		
10	Tube-well	-0.103	-0.194	0.040	0.369	0.433	-0.069	-0.129	0.046	0.000	1	
11	Culvert	0.084	-0.126	0.183	0.268	0.420	0.389	-0.007	0.470	0.317	0.393	1

Values in bold are different from 0 with a significance level alpha=0.05

The matrix shows that correlation between commercial market and bank is significant (0.773) along with the relationship between commercial market and public toilet (0.541) in Khulna city. Usually commercial areas attract more people and businesses than other areas. Precisely, that's why location of banks has a high and positive correlation with commercial markets. Availability of public toilets in commercial markets can be explained by the same token.

The other set of variables which are significantly correlated includes culvert, primary school, essential commodity market, tube-well and hospital. Culverts are necessary for drainage and connectivity in urban areas. Correlation between culvert and primary school (0.420) illustrates the fact that they are in close proximity. According to the correlation matrix the relation between hospital and culvert (0.389) is also significant. Primary school also has a significant relation with essential commodity market (0.429) and tube-well (0.433). In Bangladesh, in most of the cases, a primary school is facilitated with tube well. Moreover, primary schools are established in places where majority of the population can reach on foot. Essential commodity markets also take hold on those places. These variables, thus, are significantly correlated.

Principal component analysis helps to find out those major variables, which explain most of the variations in a data set. With a principal component comes an eigenvalue. The higher the eigenvalue of a principal component, the higher the component can explain the variation in the data set and vice versa. Principal components with eigenvalues larger than average are taken into account. In the case of eigenvalues, the average is 1. Therefore, any principal component with an eigenvalue greater than 1 is retained. In this analysis, the first four principal components have the magnitude over 1 as well as these components cover 67.63 percent of variability (Fig. 3). Hence, the first four components are retained for this study.

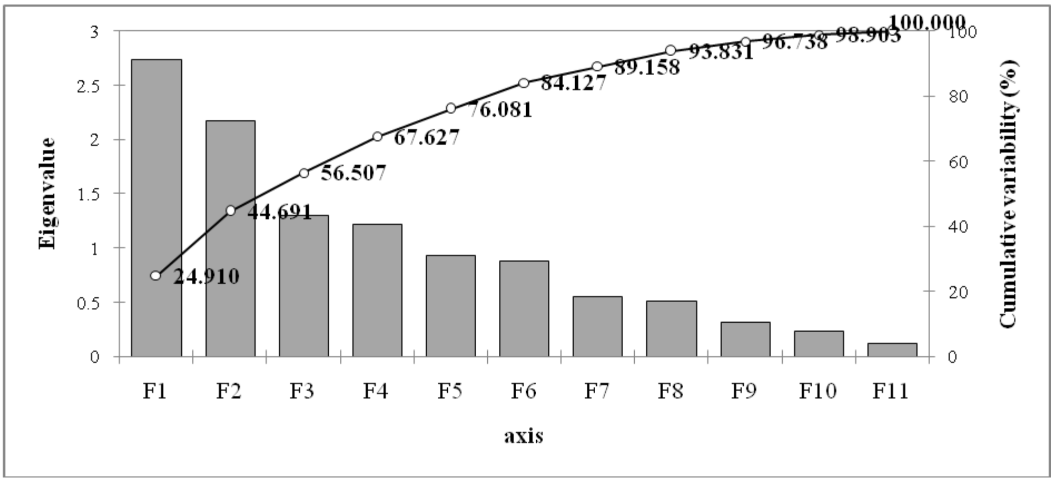

Fig. 3: Scree plot

Table 3 provides the correlation between variables and principal components. Here, coefficients depicting strong and positive correlations have been taken into account.

Table 3: Correlation between variables and factors

Variables	Principal Components				Communalities
	F1	F2	F3	F4	
Market (Commercial)	0.706	0.583	-0.050	-0.025	0.842
Bank	0.498	0.700	-0.074	0.094	0.753
Factory	0.135	-0.114	0.119	0.869	0.801
Market (Essential Commodity)	0.617	-0.193	-0.518	-0.147	0.708
Primary school	0.505	-0.538	-0.217	-0.119	0.606
Hospital	0.373	-0.042	0.496	-0.469	0.607

Variables	Principal Components				Communalities
	F1	F2	F3	F4	
Parks	0.325	0.378	-0.128	-0.280	0.343
Public Toilet	0.785	0.141	0.229	0.326	0.795
Dustbin	0.148	-0.339	0.572	-0.121	0.479
Tube-well	0.282	-0.647	-0.455	0.043	0.708
Culvert	0.614	-0.554	0.336	0.033	0.798

Table 3 shows that the first principal component has positive association with public toilet, market (both commercial and essential commodity), culvert, primary school and bank. It can be interpreted as the component that incorporates infrastructure and services to support urban livelihood. Hence, the first principal component has been termed as Urban Conveniences. The second component, termed as Commercial Infrastructure, has positive relation with commercial market and bank. This component shows the extent of economic activities in a ward. The third component, termed as Health and Urban Hygiene, has positive relation with hospital and dustbin. The fourth principal component has positive association with factory, which measures the productive activities of a ward. This component, therefore, has been termed as Industrial Enterprises. In the following figure (Fig. 4), a factor loading plot has been given to show the results for the first two components visually. The portion of the common variance that is shared by a variable is called communality (Field, 2009). Table 3 also shows the communalities for each variable. A relatively lower communality for parks denotes that it does not have significant load on factors.

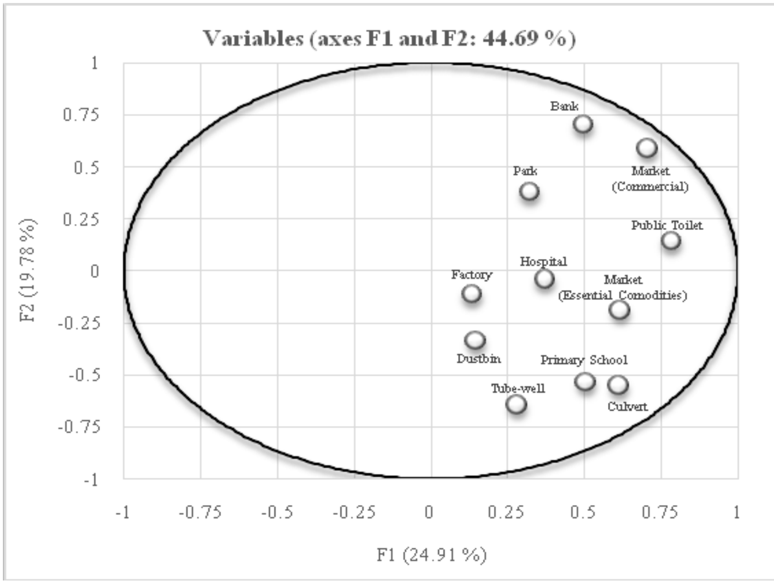

Fig. 4: Factor loading plot (First two factors)

Clustering of wards based on factors behind inequality: Using PCA and retained components, wards are clustered based on their contribution in terms of percentage to all four factors. If the contribution of the variables were uniform, the expected value would be 3.23% (1 divided by number of wards that is 31). Therefore, the cut off line for this study is 3.23%. Table 4 shows the wards that contribute more than 3.23% for each principal component.

Table 4: Factor-wise major contribution of the observation

Factor	Wards	Percentage of Contribution
F1 (Urban Conveniences)	21	33.044
	17	13.526
	07	6.702
	09	6.586
	02	5.300
	08	4.643
	14	3.426
F2 (Commercial Infrastructure)	21	41.344
	16	8.904
	14	6.321
	03	5.674
	31	4.729
	23	4.623
	01	3.932
	06	3.842
	20	3.532
F3 (Health and Urban Hygiene)	09	12.278
	03	11.826
	28	11.346
	22	11.006
	31	9.084
	06	5.861
	08	5.627
	17	4.284
	23	4.233
	01	3.276
F4 (Industrial Enterprises)	30	24.401
	22	17.742
	09	10.492
	24	9.485
	05	6.820
	28	5.769
	11	3.887

Summarized form PCA's Contribution of the observations

Table 4 elaborates that in terms of urban conveniences and commercial infrastructure Ward # 21 contributes the most. Ward # 9 contributes the most to health and urban hygiene whereas for industrial enterprises, it is Ward # 30.

Using agglomerative hierarchical clustering method, the wards have been divided into three clusters where cluster 1 represents the most privileged and cluster 3 is the least privileged areas in terms of the distribution of infrastructure and services (Table 5).

Table 5: Clustering of Wards

Cluster	Ward Number	Total Number of Wards in Cluster	Percentage
1	21	1	3.23
2	01, 02, 03,06, 09, 14, 16, 17, 22 and 31	10	32.26
3	04, 05, 07, 08, 10, 11, 12, 13, 15, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29 and 30	20	64.52

In Table 5, Ward # 21, itself, constitutes a single cluster and is completely different from other wards of Khulna city which is reaffirmation of the finding that Ward# 21 is the most privileged and is contributing mostly to principal factor 1 and 2. Cluster 2 includes Ward # 01, 02, 03, 06, 09, 14, 16, 17, 22 and 31 mainly, having those infrastructure and services that are contributing to factor two and three. Wards in cluster 3 have less significant influence onall four principal factors. These findings both determine and uphold the existence and causes of inequality in Khulna City Corporation.

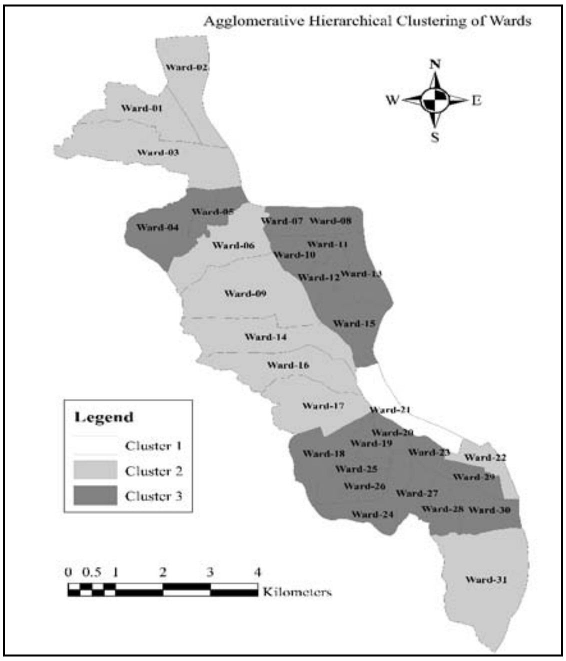

Fig. 5: Value based agglomerative clustering of wards of Khulna city

Conclusion

Inequality in the distribution of infrastructure and services hinder the process of development. Its implications are manifolds. First, it creates a sense of deprivation among the citizens living in areas that are lagging behind in terms of government services and public utilities. Second, areas with insufficient infrastructure fail to attract investment and to grasp the fruit of development. Third, most importantly, lower investment opportunities might lead to faded attention from the government which might further result in inadequate provision of services and utilities and the cycle continues. This study reveals that public toilet, market (both commercial and essential commodity), bank, park, factory and culvert are unequally distributed across the city whereas tube-well, primary school, hospital and dustbin are more equally distributed. Findings also reveal that first principal component - urban conveniences - has positive association with public toilet, market (both commercial and essential commodity), culvert, primary school and bank whereas the second component - commercial infrastructure - has positive relation with commercial market and bank. This study also depicts that only one ward (ward number 21), out of 31, constitutes a single cluster in terms of agglomeration of infrastructure and services within Khulna city. Concentration of economic activities in some selected areas can be politically driven (Sridharan, 2011) and it deepens spatial inequality (Shefer & Antonio, 2013). Targeted public spending can decrease infrastructure inequality (Simon & Natarajan, 2017). Therefore, this study recommends that the government take necessary initiatives to address the prevailing unequal distribution of infrastructures and public utilities in Khulna city. This is a very limited scale research conducted in Khulna city with some selected variables. Further research can be conducted with a broader geographic location and a wide range of variables so that more clear picture of infrastructural inequality can be portrayed and compared with other regions.

References

Adefila, J. O. (2012). Regional inequalities in socio-economic development in Nassarawa state of Nigeria: A spatial analysis for planning. *Asian Social Science*, *9*(1), 60–67. doi: <https://doi.org/10.5539/ass.v9n1p60>

Aderamo, A. J., & Aina, O. A. (2011). Spatial inequalities in accessibility to social amenities in developing countries: A case from Nigeria. *Australian Journal of Basic and Applied Sciences*, *5*(6), 316–322.

Aghion, P., & Williamson, J. G. (1998). *Growth, inequality, and globalization: Theory, history, and policy*. Cambridge, UK: Cambridge University Press.

Aghion, P., Caroli, E., & Garcia-Penalosa, C. (1999). Inequality and economic growth: The perspective of the new growth theories. *Journal of Economic Literature, 37*(4), 1615-1660. doi:<10.1257/jel.37.4.1615>

Ahmed, B. (2011). Modelling spatio-temporal urban land cover growth dynamics using remote sensing and GIS techniques : A case study of Khulna city. *Journal of Bangladesh Institute of Planners, 4*, 15–32.

Ali, I., & Pernia, E. M. (2003). *Infrastructure and poverty reduction — What is the connection?* (ERD Policy Brief No. 13). Manila: Asian Development Bank.

Atkinson, A. (2015). *Inequality: What can be done?* Cambridge, MA: Harvard University Press.

Ayub, M. (2013). Poverty and inequality. *Global Journal of Emerging Market Economies, 5*(3), 329-346. doi: https://doi.<org/10.1177/0974910113505796>

Bajar, S., & Rajeev, M. (2015). *The impact of infrastructure provisioning on inequality: Evidence from India* (Global Labor University Working Paper No. 35). Retrieved from<http://www.global-labour-university.org/fileadmin/GLU_Working_Papers/GLU_WP_No.35.pdf>

Bangladesh Bureau of Statistics. (2015). *Bangladesh population and housing census 2011, Zila Report: Khulna*. Retrieved from<http://203.112.218.65:8008/WebTestApplication/userfiles/Image/PopCenZilz2011/Zila-Khulna.pdf>

Benhabib, J. (2003). The tradeoff between inequality and growth. *Annals of Economics and Finance*, *4*(2), 491–507.

Calderon, C., & Chong, A. (2004). Volume and quality of infrastructure and the distribution of income: An empirical investigation. *The Review of Income and Wealth*, *50*(1), 87-106. doi: 10.1111/j.0034-6586.2004.00113.x

Calderón, C., & Servén, L. (2008). *Infrastructure and economic development in Sub-Saharan Africa* (World Bank Policy Research Working Paper No. 4712). Retrieved from<https://openknowledge.worldbank.org/bitstream/handle/10986/6988/WPS4712.pdf?sequence=1&isAllowed=y>

Calderón, C., & Servén, L. (2010). *Infrastructure in Latin America* (World Bank Policy Research Working Paper No. 5317). Retrieved from<https://openknowledge.worldbank.org/bitstream/handle/10986/3801/WPS5317.pdf>

Calderón, C., & Servén, L. (2014). *Infrastructure, growth and inequality: An Overview* (World Bank Policy Research Working Paper No. 7034). Retrieved from<https://openknowledge.worldbank.org/bitstream/handle/10986/20365/WPS7034.pdf?sequence=1&isAllowed=y>

Cangelosi, R., & Goriely, A. (2007). Component retention in principal component analysis with application to cDNA microarray data. *Biology Direct*, *2*(2). doi:<10.1186/1745-6150-2-2>

Chatterjee, S., & Turnovsky, S. J. (2012). Infrastructure and inequality. *European Economic Review, 56*(8), 1730-1745. doi: <https://doi.org/10.1016/j.euroecorev.2012.08.003>

Cockburn, J., Dissou, Y., Duclos, J.-Y., & Tiberti, L. (Eds.) (2013). *Infrastructure and economic growth in Asia*. Cham, Switzerland: Springer.

Démurger, S. (2001). Infrastructure development and economic growth: An explanation for regional disparities in China? *Journal of Comparative Economics, 29*(1), 95–117. doi: <https://doi.org/10.1006/jcec.2000.1693>

Estache, A. (2003). On Latin America's infrastructure privatization and its distributional effects. *SSRN Electronic Journal.* Retrieved from<https://doi.org/10.2139/ssrn.411942>

Field, A. (2009). *Discovering Statistics Using SPSS* (3rd ed.). London, UK: Sage.

Gibson, J., & Rioja, F. (2014). *A bridge to equality: How investing in infrastructure affects the distribution of wealth* [PDF File]. Retrieved from<https://www.frbatlanta.org/-/media/documents/news/conferences/2014/SIDE-workshop/papers/Gibson-Rioja.pdf>

Hooper, E., Peters, S., & Pintus, P. (2017). *To what extent can long-term investment in infrastructure reduce inequality?* (Banque de France Working Paper No. 624). Retrieved from <https://ssrn.com/abstract=2952365>

Jackson, J. E. (2004). *A user's guide to principal components*. Hoboken, NJ: John Wiley & Sons.

Kanbur, R., & Venables, A. J. (Eds.) (2005). *Spatial inequality and development.* Oxford, UK: Oxford University Press.

Kim, S. (2008). *Spatial inequality and economic development : Theories, facts, and policies* (Commission on Growth and Development Working Paper No. 16). Retrieved from<http://www.kantakji.com/media/4643/c367.pdf>

Lall, S. V., & Chakravorty, S. (2004). Industrial location and spatial inequality: Theory and evidence from India. *Review of Development Economics, 9*(1), 47-68. doi: 10.1111/j.1467-9361.2005.00263.x

Leipziger, D., Fay, M., Wodon, Q., & Yepes, T. (2003). *Achieving the millennium development goals: The role of infrastructure* (Policy Research Working Paper No. 3163). Retrieved from<https://openknowledge.worldbank.org/handle/10986/17901>

Litchfield, J. (1999). *Inequality: Methods and tools* [PDF File].Retrieved from<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.201.1911&rep=rep1&type=pdf>

Lopez, H. (2003). *Macroeconomics and inequality* (World Bank Working Paper No. 37572). Retrieved from<http://documents.worldbank.org/curated/en/292721468319775386/Macroeconomics-and-inequality>

Majumder, R. (2012). *Removing poverty and inequality in India: The role of infrastructure* (MPRA Paper No. 40941). Retrieved from<https://mpra.ub.uni-muenchen.de/40941/1/rm24.pdf>

Mendoza, O. M. V. (2017). *Infrastructure development, income inequality and urban sustainability in the People's Republic of China* (ADBI Working Paper No. 713). Retrieved from<https://www.adb.org/sites/default/files/publication/239186/adbi-wp713.pdf>

Murtaza, G. (2001). Environmental problems in Khulna city, Bangladesh: A spatio-household level study. *Global Built Environment Review*, *1*(2), 32–37.

Obu, J. I., Obienusi, E. A., Ozoemene, M. L., & Iwu, E. O. (2015). Spatial inequality in development: A case study of Anambra state, Nigeria. *International Journal of Physical and Human Geography, 3*(4), 1–26.

Paul, S. (2012). Factors and dimensions of inter-ward disparities in urban facility-utility services in Burdwan city, India. *Applied Science Research, 4*(3), 1376–1388.

Rahman, K. R., & Salauddin, M. (2009). A spatial analysis on the provision of urban public services and their deficiencies: A study of some selected blocks in Khulna city, Bangladesh. *Theoretical and Empirical Researches in Urban Management*, *4*(1), 120-132. Retrieved from<http://um.ase.ro/no1S/10.pdf>

Raychaudhury, A., & De, P. (2010). *Trade, infrastructure and income inequality in selected Asian countries: An empirical analysis* (ARTNeT Working Paper Series No. 82). Retrieved from<http://www.unescap.org/sites/default/files/ AWP%20No.%2082.pdf>

Roy, M. K., Datta, D. K., Adhikari, D. K., Chowdhury, B. K., & Roy, P. J. (2005). Geology of the Khulna City Corporation. *Life Earth Science, 1*(1), 57–63.

Royce, E. (2009). *Poverty and power: A structural perspective on American inequality.* Lanham, MA: Rowman & Littlefield.

Seethepalli, K., Bramati, M. C., & Veredas, D. (2008). *How relevant is infrastructure to growth in East Asia?* (World Bank Policy Research Working Paper No. 4597). Retrieved from<http://documents.worldbank.org/curated/en/845081468234277536 /pdf/wps4597.pdf>

Seneviratne, D., & Sun, Y. (2013). *Infrastructure and income distribution in ASEAN-5: What are the links?* (IMF Working Paper No. WP/13/41). Retrieved from<https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Infrastructure-and-Income-Distribution-in-ASEAN-5-What-are-the-Links-40316>

Shefer, D., & Antonio, M. (2013). Spatial inequality between and within urban areas: The case of Israeli cities. *European Planning Studies*, *21*(3), 373-387. doi:<10.1080/09654313.2012.718198>

Simon, N. S., & Natarajan, P. (2017). Nonlinearity between infrastructure inequality and growth: Evidence from India. *Review of Market Integration*, *9*(1-2), 66–82. doi:<10.1177/0974929217721764>

Sridharan, N. (2011). Spatial inequality and the politics of urban expansion. *Environment and Urbanization ASIA*, *2*(2), 187-204. doi:<10.1177/097542531100200204>

United Nations. (2013). *Inequality matters: Report of the world social situation 2013*. New York, NY: UN. Retrieved from<http://www.un.org/esa/socdev/ documents/reports /InequalityMatters.pdf>

United Nations Development Programme. (2013). *Humanity divided: Confronting inequality in developing countries*. New York, NY: UNDP. Retrieved from<http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/Inclusive%20development/Humanity%20Divided/HumanityDivided_Full-Report.pdf>

World Bank. (1994). *World development report 1994: Infrastructure for development*. Oxford, UK: Oxford University Press.