

Measuring socio-economic inequality: From dwellers' perspective within Bangalore urban agglomeration

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Planners and researchers have realized that larger regional framework of urban areas are significant in assessing various inequality aspects in a developing country like India. The framework consists of heterogeneity in spatial and demographic aspects and in quality of socio-economic development levels as well. Against this background, the present paper has proposed a methodological framework to assess socio-economic inequality within Bangalore Urban Agglomeration (BUA) as governed by the composite set of Human Development Index (HDI) based indicators. Assessments are based on local data of dwellers' preferences on the indicators. On the whole, this paper has tried to establish the significance of application of HDI based indicators in an assessment of socio-economic inequality within BUA. Consequently, the paper has arrived at the need for improvement of comprehensive HDI governed basic public services, amenities, and advanced facilities, across all trans-urban-area levels to ensure a holistic development within BUA.

Keywords: *agglomeration, inequality, HDI indicators, urban governance*

1. INTRODUCTION

The recent urban development has explored substantial changes in the framework of urban agglomeration and this framework cannot be explained by the existing empirical model (Cladera et al., 2009). Urban planners and policy makers have realized that a more appropriate scale for assessing socio-economic inequality within an urban agglomeration in a developing country is its larger regional framework (Burges & Jenks, 2000; Wall Street Journal Report, 2005). The framework exhibits two aspects viz. first heterogeneity in spatial and demographic characteristics and secondly consequential inequality in quality of socio-economic development levels. United Nations Development Program (UNDP) has emphasized a need to assess socio-economic inequality considering the aforesaid two aspects. Across the world each region has a specific environment and cultural heritage based on which wide range of indicators has been developed that employ differing methodologies to measure human development (Gallardo, 2009). Till date the selection of indicators for assessing spatial inequality of a large area is based on mathematical and statistical derivations, avoiding normative aspects of human life. Based on this need the first objective of the present paper is to develop a set of parameters based on Human Development Index (HDI) which are embraced by the dwellers of Bangalore Urban Agglomeration (BUA) and reflects their aspirations towards an enriched life.

The second objective is to propose a methodological framework to assess socio-economic inequality within BUA. The assessment is governed by HDI based indicators viz., education, economy, and health. Finally, based on the assessment this paper tries to establish an improved governance of basic services and amenities, suggested by dwellers within BUA.

2. LITERATURE

Research in urban agglomerations established a long analytical tradition in socio-economic studies (Phelps, 2004). The two aspects (quantitative and qualitative) of socio-economic inequality within urban agglomeration differ from standpoint of a developed and a developing economy (Birdsall et al., 2011; Kundu, 1992; Sivaramakrishnan et al., 2005). In case of a developing country urban geographers, physical planners and social policy makers are more interested to focus on distribution of settlements and extended metropolitan forms of East Asia, instead of a single and compact urban form (Burges & Jenks, 2000; Dick & Rimmer, 1998; Wall Street Journal Report, 2005). The larger regional framework of an urban agglomeration exhibits a significant extent of heterogeneity and consequential socio-economic inequality across the agglomeration having varying development levels within it (Atkinson, 1992; Shukla & Bauer, 2009). These levels are indicated by a variety of factors ranging from general income based socio-economic parameters to multi-dimensional

parameters representing other normative frontiers of development (Bartsch, 2011; Bhaumik & Chakraborty, 2006; Panda & Agarwal, 2005). It is evident from recent researches that the objective of India's national development should not be just to abolish income based inequalities in development but minimize inequalities in its multiple aspects (Aluwahlia, 2010). In this respect, recent research has emphasized three principal indicators of development a) *economic* development based on growth and employment, b) social development based on *education* to endow people with human capital, and c) *health* facilities based on availability of basic medical services. Incidentally, the three aforesaid principal indicators, i.e., economic development, level of education, and availability of health facilities, all collectively constituting socio-economic development, are synonymous with three principle indicators of HDI (Human Development Reports, 1990). As India is a widely diverse country, socio-economic inequality levels in India vary within states or regions and between rural and urban areas within a state (Desai et al., 2010; Vanneman & Dubey, 2010). According to the Human Development Report (Human Development Reports, 2013) of the United Nations Development Program (UNDP), India ranks 136, which implies medium human development with HDI value of 0.554. Planning Commission Government of India (2002) has felt the need of the balanced development policies in minimizing the multiple aspects of inequality in different levels of spatial as well as socio-economic sectors within India (Aluwahlia, 2010).

Researchers have also pointed out the importance of a relationship between the levels of indicator of HDI and the role of different forms of local governance within an urban agglomeration (Charlesworth & Cochrane, 1994; Kanbur et al., 2006; Ke & He 2009; Kim, 2008). According to empirical assumption the urban societal preference significantly effects on the spatial arrangement of urban agglomeration, which can be defined as a spatial correlation of human activities (Anderson et

al., 1996; Schretzenmayr et al., 2009). Based on the same, an assessment of dwellers' perception and their preferences on future governance establishes the bases of the research of this paper. Existing studies have shown that need of assessing socio-economic inequality based on a) the present and future levels of indicators of HDI and b) its impact on metropolitan governance as perceived by the dwellers is significant (Feenstra & Hanson, 1996; Pinelopi & Pavcnik, 2007). Till date, minimizing socio-economic inequality within an urban agglomeration in light of dwellers' preference remains as unexplored area of assessment. As societies are dynamic with time, selection of indicators based on dwellers' preferences is a challenging work (Tai-Kei & Coates, 2002; Gallardo, 2009). This paper selects a range of parameters under each of three HDI based indicators that reflect the best possible options of dwellers within BUA. Also the paper put an effort to establish a methodological framework to assess the extent of socio-economic inequality within BUA based on dwellers' perspective.

3. METHODOLOGY

The study entirely based on primary data collected from household survey within BUA in the year 2013. According to Bruhat Bangalore Mahanagara Palike (BBMP), BUA is divided into eight zones (refer Fig. 1, Directorate of Census Operations of Karnataka, 2013). Primary data is collected from east zone of BBMP, to represent BUA. Based on the population density the entire zone is subdivided into five sub-zones. These are Sub zone North (SzN), Sub zone East (SzE), Sub zone Central (SzC), Sub zone South (SzS), Sub zone West (SzW). In the present research total numbers of household surveys have been divided within east zone. Based on ward population density contribution of each of the sub-zone to total (refer Table 1) sample size is calculated. Ascending weightings are given as:

$$\mu = 0.359 \times 5 + 0.298 \times 4 + 0.174 \times 3 + 0.096 \times 2 + 0.073 \times 1 = 3.8.$$

$$\text{So, } O_2 = 0.359 (5-3.8)^2 + 0.298 (4-3.8)^2 + 0.174 (3-3.8)^2 + 0.096 (2-3.8)^2 + 0.073 (1-3.8)^2 = 1.8$$

$$\text{For 95\% confidence and density tolerance limit as 1 (e); } n = 3.84 O_2 / e^2 = 6.912$$

$$\text{For 95\% confidence and density tolerance 0.75}$$

$$n = 12.28 \text{ which is } < 13 \text{ or the targeted sampling size per ward.}$$

Table 1: Logic of sample size and number of collected sample

All sub-zones	SZ-North	SZ-Central	SZ-West	SZ-East	SZ-South
Ward based contribution by population density (%)	35.9	29.8	17.4	9.6	7.3
Total no. of wards in each sub-zones	10	8	7	6	5
Sample size according to density (as min. =13)	130	104	91	78	65

Table 2: Deduction of parameters from indicators

Indicators	Parameters
Education	<ol style="list-style-type: none"> 1. Total no. of family members attending/attended education 2. Nature of attending educational institute 3. Expenditure on education for last year (/month in Rs) 4. Loan for education 5. Perception of current state of education services
Economy	<ol style="list-style-type: none"> 1. Total number of earning members in the family 2. Nature of employment 3. Family expenditure 4. Family income 5. Family savings/investments 6. Perception of current state of employment opportunities
Health	<ol style="list-style-type: none"> 1. Total number of family members availing medical services 2. Nature of medical institutions being attended 3. Aggregate expenditure on health for last year (/month in Rs) 4. Health insurance 5. Perception of current state

Sampling size shows that 13 household surveys under each of the ward from five sub-zones are the minimum requirement. This led to a total of 468 surveys which matches to the aggregate minimum. The households are selected randomly from ward level of each of the sub-zones. The list of the wards is gathered from Bangalore Urban District at a Glance: 2009 – 2010. Personal interview method is the only way of collecting primary data from the respondents. At the door of each house a coin is tossed to decide whether interview will be taken of that household or not. In each selected household, only present adult who is willing to participate in the survey, is recruited. The sample accounts for about 25% of all the households in visited wards.

Based on human development indicators, all three indicators are divided into several parameters. These are presented in Table 2.

Dwellers' perception on present situation of HDI based indicators is calculated based on nine point scale for each parameter say, *amount of educational loan*. Additionally, for calculating their future preferences they have been asked to rank the parameters in terms of their importance as 'least important', 'less important', and 'equally important', 'more important', and 'most important'. The ranks are converted to weightings based on five point scale viz. 0.20, 0.33, 1.0, 3.0, and 5.0 respectively. Choice of this relative weight is typically based on trial and error method that suits the research objective most. In the present paper dwellers' weighted preferences for present situation are termed as '*scaled value*'. To get an illustrated view of dwellers' present situation and preferences, detailed analyses have been done based on scaled values of parameters under each of the indicator.

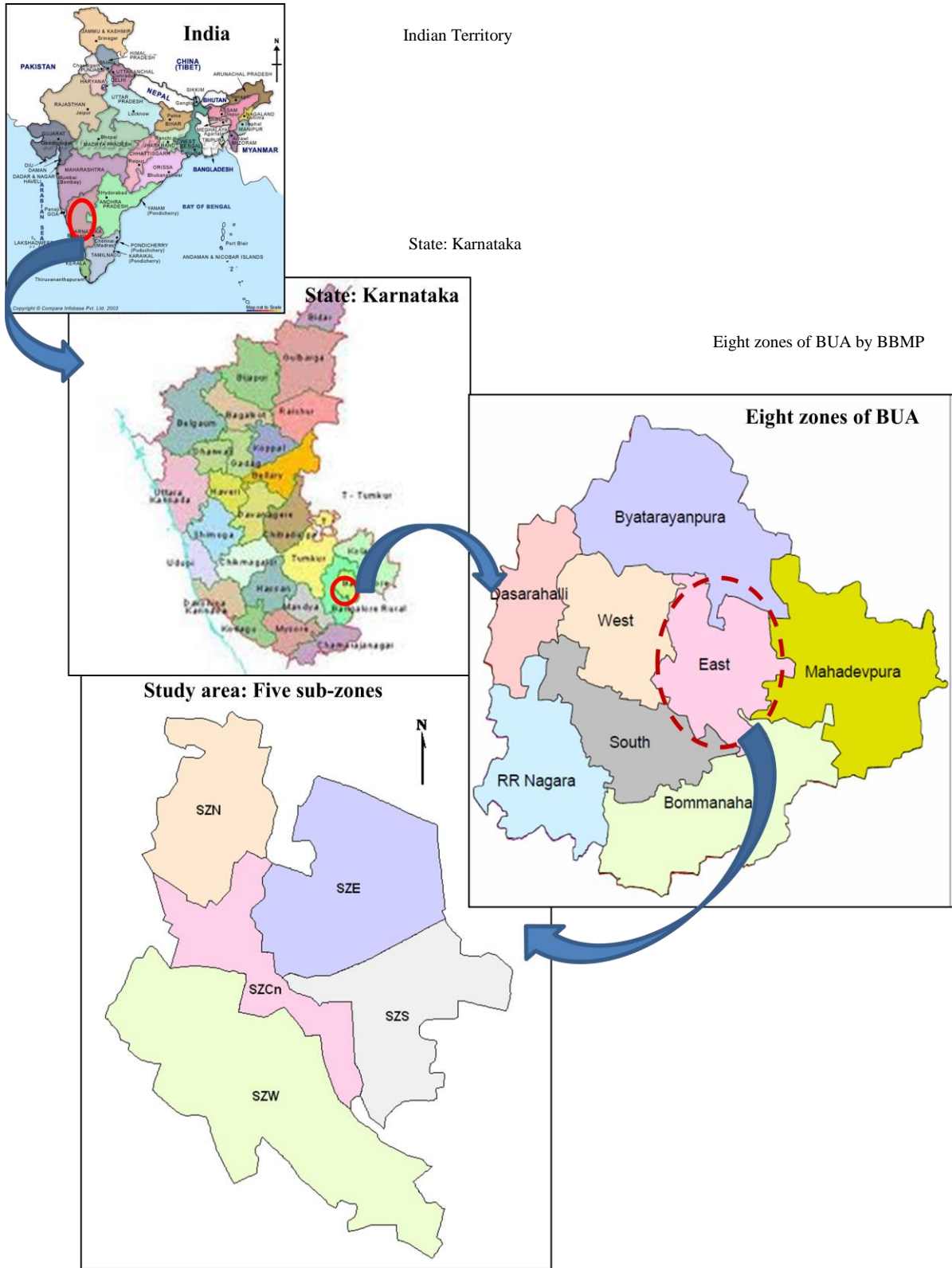


Figure 1: Study area

3.1 ASSESSMENT OF DWELLERS' PRESENT SITUATION: CHARACTERISTIC VECTOR (R_{ij})

The mean of scaled values on dwellers' present situation are termed as *characteristic vectors*, i.e., R_{ij} . R_{ij} is calculated based on dwellers' present priorities on indicators of HDI, viz, education, health, and economy. Table 3 presents the calculation of characteristic vector for an indicator.

3.2 ASSESSMENT OF DWELLERS' PREFERENCE: PRIORITY VECTORS (W_{ij})

The mean of scaled values of dwellers' preferences on parameters of HDI indicators are computed as

priority vector, i.e., W_{ij} . Mean value of each parameter for the entire eight sub-regions has been calculated based on Analytic Hierarchy Process (AHP) to get metropolitan average. It is a systematic procedure for representing the basic elements of variables under analysis in their pairwise comparison, i.e., in a matrix, in the hierarchy (Saaty & Kearns, 1985). AHP plays a significant role in decision making from a wide variety of options (Sun et al., 2009). The process, instead of finding out of the correct one, helps to find out the best option, which suits dwellers' preferences or aspiration levels. In the present research AHP has formed a framework for dwellers' preferences and quantified parameters to meet dwellers' aspirations. Table 4 presents the calculation of priority vector for an indicator.

Table 3: Computation of characteristic vectors (R_{ij}) for an indicator

Five sub-zones	Parameter (j=1)	Parameter (j=2)	Parameter (j=3)	..	(j=n)	Total of each sub-region
SzN-sz (i=1)	a_{11}	a_{12}	a_{13}	..	a_{1n}	$\sum_{j=1}^n a_{1j}$
SzE-sz (i=2)	a_{21}	a_{22}	a_{23}	..	a_{2n}	$\sum_{j=1}^n a_{2j}$
..	..	..	..	a_{ij}	..	..
SzW-sz (i=m)	a_{m1}	a_{m2}	a_{m3}	..	a_{mn}	$\sum_{j=1}^n a_{mj}$

Table 4: Computation of priority vectors (W_{ij}) for an indicator

Five sub-zones	Parameter (j=1)	Parameter (j=2)	Parameter (j=3)	..	(j=n)	Total of each sub-region
SzN-sz (i=1)	b_{11}	b_{12}	b_{13}	..	b_{1n}	$\sum_{j=1}^n b_{1j}$
SzE-sz (i=2)	b_{21}	b_{22}	b_{23}	..	b_{2n}	$\sum_{j=1}^n b_{2j}$
..	..	..	..	b_{ij}	..	..
SzW-sz (i=m)	b_{m1}	b_{m2}	b_{m3}	..	b_{mn}	$\sum_{j=1}^n b_{mj}$

3.3 ASSESSMENT OF DWELLERS' PRIORITIZED PREFERENCE: COMPOUNDED WEIGHTING VECTORS (CIJ)

From the mean value of priority vectors (W_{ij}) and the characteristic vectors (R_{ij}) the *compounded weighting vector* (C_{ij}) has been calculated. C_{ij} represents aggregate current situation of the eight sub-regions for three indicators of HDI. Considering Table 3 and Table 4 say, for example taking education related parameters, C_{ij} of education for a particular j^{th} sub-zone, say SzN-sz is:

$$C_{ij} = W_{ij} * R_{ij}$$

where, $W_{ij} * R_{ij} = a_{11} * b_{11} + a_{12} * b_{12} + \dots + a_{nm} * b_{nm}$ for j^{th} sub-region, here SzN-sz.

Similarly, C_{ij} of other sub-regions has been calculated based on the same formula for education as well as other parameters of all HDI based indicators (refer Table 5). Based on total compounded weighting vectors (C_{ij}), mean of BUA has been calculated. Inequality of a particular indicator across five sub-zones is calculated based on minimum and maximum of C_{ij} . Following the similar steps of calculation, inequality for each of the indicator has been calculated (refer Table 6). The concept of maxima-minima against urban agglomeration mean and the consequent understanding of inequality are presented in Figure 2.

Table 5: Computation of compounded weighting vector (C_{ij}) for a sub-region

Five sub-zones	Parameter (j=1)	Parameter (j=2)	Parameter (j=3)	..	Parameter (j=n)	Total of each sub-region (A)
SzN-sz (i=1)	$c_{11}=(a_{11} * b_{11})$	$c_{12}=(a_{12} * b_{12})$	$c_{13}=(a_{13} * b_{13})$	..	c_{1n}	$\sum_{j=1}^n c_{1j}$
SzE-sz (i=2)	$c_{21}=(a_{21} * b_{21})$	$c_{22}=(a_{22} * b_{22})$	$c_{23}=(a_{23} * b_{23})$	..	c_{2n}	$\sum_{j=1}^n c_{2j}$
..	..	..	..	C_{ij}	..	..
SzW-sz (i=m)	$c_{m1}=(a_{m1} * b_{m1})$	$c_{m2}=(a_{m2} * b_{m2})$	$c_{m3}=(a_{m3} * b_{m3})$	..	c_{mn}	$\sum_{j=1}^n c_{mj}$
Total	$\sum_{i=1}^m c_{i1}$	$\sum_{i=1}^m c_{i2}$	$\sum_{i=1}^m c_{i3}$	..	$\sum_{i=1}^m c_{in}$	ΣA

Table 6: Calculation for inequality for a particular indicator over sub-zones

BUA mean	Inequality	Inequality ($\pm I_1$) + ($\pm I_2$) * 100
$\mu = \sum A \div n$	$I_1 = \text{Maximum } C_{ij} - \mu$	Inequality of an indicator
	$I_2 = \text{Minimum } C_{ij} - \mu$	

Note: n= Number of sub-zones

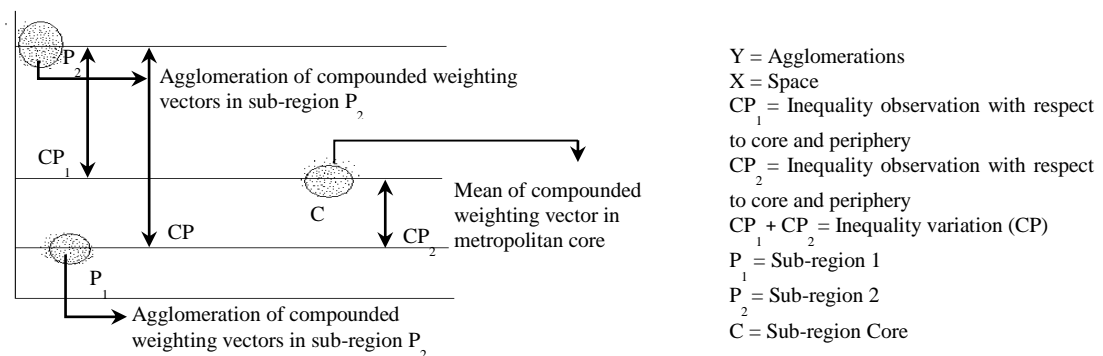


Figure 2: Conceptual diagram for understanding extent of inequality based on maxima and minima values against a main city value

3.4 AGGREGATE HDI: COMPOSITE WEIGHTING VECTORS (C)

Based on C_{ij} , composite weighting vectors for each indicator of each sub-region has been calculated. Levels of inequality of each indicator within sub-regions have also been calculated (refer Table 7). Aggregate HDI has been calculated for entire five sub-zones, which represents BUA as a whole. Finally, following the similar aforesaid minima-maxima concept of inequality, it has been calculated for BUA (refer Table 8).

3.5 ASSESSMENT OF DWELLERS' PREFERENCE ON FUTURE METROPOLITAN GOVERNANCE

Assessment of inequality in dwellers' preference for nature of future governance is used to augment efficiency of the socio-economic infrastructural

systems and consequent minimization of inequality within BUA. The preferences of governance patterns are a) absolute public ownership or b) absolute private ownership or c) hybrid public-private-partnership (ppp) (Table 9).

Dwellers' have been asked to rank their preferences regarding future governance based on HDI indicators of education, economy, and health. The ranks are converted into weightings, e.g., 0.2, 0.4, 1.0, 2.5, and 5.0 for the five options of extremely poor, poor, moderate, high, extremely high. AHP based on a C-program computer code has been similarly applied to analyze the data to obtain the priority vectors for the three different governance options. Table 9 furnishes the preferences of governance pattern with respect to an indicator of HDI. Similar calculation has been used to obtain preferences on governance for all the indicators of HDI.

Table 7: Computation of composite weighting vector (C) for BUA

Five sub-zones	Education (values of C_{ij}) a_i	Economy (values of C_{ij}) b_i	Health (values of C_{ij}) c_i	Total of each sub-region (C)
SzN-sz ($i=1$)	a_1	b_1	c_1	$\sum a_1 + b_1 + c_1$
SzE-sz ($i=2$)	a_2	b_2	c_2	$\sum a_2 + b_2 + c_2$
..
SzW-sz ($i=m$)	a_m	b_m	c_m	$\sum a_m + b_m + c_m$
Total	$\sum_{i=1}^m a_i$	$\sum_{i=1}^m b_i$	$\sum_{i=1}^m c_i$	$\sum C$

Table 8: Calculation for inequality of aggregating indicators within BUA

BUA mean	Inequality	Inequality ($\pm A_1$) + ($\pm A_2$) * 100
$M = \sum C \div n$	$A_1 = \text{Maximum } C - M$	Inequality within BUA
	$A_2 = \text{Minimum } C - M$	

Note: n= Number of sub-zones

Table 9: Computation of priority vectors on future governance of an indicator

Five sub-zones	Private a_i	PPP b_i	Public c_i	Total of each sub-region
SzN-sz ($i=1$)	a_1	b_1	c_1	$\sum_{j=1}^n a_1$
SzE-sz ($i=2$)	a_2	b_2	c_2	$\sum_{j=1}^n b_1$
..
SzW-sz ($i=m$)	a_m	b_m	c_m	$\sum_{j=1}^n c_1$
Mean of each governance type	$\sum a_i / n$	$\sum b_i / n$	$\sum c_i / n$	

Note: n= Number of sub-zones

4. RESULTS AND DISCUSSIONS

Table 10, 12, and 14 present the characteristic (R_{ij}), priority (W_{ij}), and compounded weighting vectors (C_{ij}) based on dwellers' preference on the three dimensions of HDI.

4.1 DWELLERS PRIORITIES AND PREFERENCES

4.1.1 Education

It is evident that *at present* (R_{ij}) education related parameters are relatively agglomerated in Sub zone East. Distribution of this parameter is varied in nature over the other sub zones (refer Table 10). A significant extent of inequality in education also obvious as parametric range is as high as 6.00 (i.e.,

SzE – SzC or 17.000 – 11.000). But according to dwellers' *priority* (W_{ij}) education related parameters are not significantly agglomerated within any sub zone rather it is scattered in nature as it is concentrated within North Sub zone only (refer Table 11). As the parametric range is 0.161 (i.e., SzN – SzC or 0.311 – 0.150), it seems that inequality is not very high for this indicator. This is because of dwellers' increasing awareness regarding value of education within the entire zone. From Table 10 it is also evident that parameters of education are not significantly varied in nature as the range value for C_{ij} is 0.416 (i.e., SzE – SzS or 3.008 – 2.592). The reason is dwellers' higher *preference* (C_{ij}) for good quality educational system. They are also very concerned about the total members in a family having access to the basic education based on nature/availability of educational institutions.

Table 10: Education

Sub-zones	Type of vectors	Members attending education	Nature of educational inst.	Expenditure	Loan	Perception	Total
SzN	R_{ij}	2.281	2.730	3.288	2.456	2.556	10.581
	W_{ij}	0.165	0.165	0.165	0.311	0.193	1.000
	C_{ij}	0.377	0.451	0.543	0.764	0.495	2.629
SzE	R_{ij}	2.200	3.500	3.750	3.050	2.500	17.000
	W_{ij}	0.221	0.205	0.214	0.186	0.174	1.000
	C_{ij}	0.486	0.718	0.801	0.566	0.436	3.008
SzC	R_{ij}	2.333	2.833	3.308	2.467	2.658	11.000
	W_{ij}	0.239	0.202	0.230	0.188	0.150	1.000
	C_{ij}	0.485	0.470	0.675	0.662	0.409	2.701
SzS	R_{ij}	2.714	2.893	3.036	2.321	1.929	12.893
	W_{ij}	0.208	0.166	0.204	0.268	0.154	1.000
	C_{ij}	0.599	0.598	0.594	0.437	0.364	2.592
SzW	R_{ij}	2.588	2.912	3.015	2.426	2.309	13.250
	W_{ij}	0.221	0.207	0.196	0.188	0.189	1.000
	C_{ij}	0.619	0.587	0.692	0.456	0.347	2.701
Mean of W_{ij}		0.211	0.189	0.202	0.228	0.172	1.000
Total of C_{ij}							13.631
Mean of C_{ij} (Overall BUA)							2.726

Source: The data were collected through a questionnaire survey

Table 11: Summary table of education

Type of vectors	Sub-zones	Members attending education	Nature of educational inst.	Expenditure	Loan	Perception	Total
R_{ij}	SzE	2.200	3.500	3.750	3.050	2.500	17.000
W_{ij}	SzN	0.165	0.165	0.165	0.311	0.193	1.000
C_{ij}	Parameters are not significantly varied in nature						

Source: The data were collected through a questionnaire survey

4.1.2 Economy

Here dwellers' present situation is attempted to characterize through Characteristic vector (R_{ij}). Based on dwellers' responses regarding economy, it is observed that *present* (R_{ij}) economic parameters are mostly agglomerated within the subzone of west (Table 12). The range of this particular indicator is comparatively not significant as it is 1.029 of the total responses (SzW – SzE or 12.779 – 11.750). Hence extent of inequality is not much for this indicator and except SzW, all the subzones have similar pattern of distribution of the parameters. It is explicit from the present scenario that dwellers are searching for more career options than previous to maintain expense of daily life and to improve standard of living. Again according to

dwellers' *priorities* (W_{ij}) all the parameters related to economy are not significantly agglomerated within any of the sub zone. Here distribution of this parameter is scattered in nature and it is concentrated within South sub zone. As dwellers are more aware of their current status of economy the range is 0.175 (SzS – SzW or 0.277 – 0.102), it seems that inequality is not very high for this parameter (Table 12 and Table 13). From the table it is also evident that dwellers' *preferences* (C_{ij}) for economic parameters are relatively varied in nature as the range value is 0.671 (i.e., SzW – SzE or 2.398 – 1.727). This is because of increasing consciousness among the dwellers for various career options. For family *income* and *expenditure*, dwellers' preference is highly prioritized.

Table 12: Economy

Sub-zones	Type of vectors	Earning member	Nature of employment	Family expenditure	Family income	Savings and investment	Perception	Total
SzN	R_{ij}	2.081	2.100	1.938	1.813	2.125	2.188	12.244
	W_{ij}	0.165	0.132	0.165	0.165	0.206	0.165	1.000
	C_{ij}	0.344	0.278	0.320	0.300	0.438	0.362	2.042
SzE	R_{ij}	2.000	1.750	1.875	1.175	1.550	1.670	11.750
	W_{ij}	0.262	0.198	0.170	0.135	0.113	0.122	1.000
	C_{ij}	0.523	0.347	0.319	0.159	0.175	0.203	1.727
SzC	R_{ij}	2.033	2.050	1.942	1.983	2.025	2.067	12.100
	W_{ij}	0.201	0.191	0.202	0.137	0.137	0.131	1.000
	C_{ij}	0.409	0.393	0.393	0.271	0.278	0.271	2.014
SzS	R_{ij}	2.143	2.286	1.964	2.071	1.071	2.357	11.893
	W_{ij}	0.277	0.211	0.176	0.110	0.091	0.135	1.000
	C_{ij}	0.594	0.482	0.345	0.228	0.097	0.319	2.066
SzW	R_{ij}	2.559	2.347	2.309	2.340	2.318	2.362	12.779
	W_{ij}	0.276	0.189	0.150	0.117	0.102	0.166	1.000
	C_{ij}	0.705	0.444	0.346	0.274	0.238	0.392	2.398
Mean of W_{ij}		0.236	0.184	0.173	0.133	0.130	0.144	1.000
Total of C_{ij}								10.247
Mean of C_{ij} (Overall BUA)								2.049

Source: The data were collected through a questionnaire survey

Table 13: Summary table of economy

Type of vectors	Sub-zones	Earning member	Nature of employment	Family expenditure	Family income	Savings and investment	Perception	Total
R_{ij}	SzW	2.559	2.347	2.309	2.340	2.318	2.362	12.779
W_{ij}	No significant agglomeration rather parameters are scattered in nature							
C_{ij}	Parameters are relatively varied in nature							

Source: The data were collected through a questionnaire survey

4.1.3 Health

Based on assessing *present* (R_{ij}) status of health all the parameters are highly agglomerated in Sub zone South. As the range is as high as 7.407 (SzN – SzS or 11.200 – 18.607) it seems that inequality is also very high for this parameter (Table 14) and spatial distribution of the same is significantly varied in nature. For this reason dwellers of the entire zone have expressed their aspirations for a better health care system. On the contrary, dwellers *priority* (W_{ij}) related to health parameter are also not significantly

agglomerated within any sub zone except some amount of concentration is observed within North sub zone. Here distribution of this parameter is scattered in nature. This implies the increasing demand for efficient health care in sub-zones. It is observed from Table 14 and Table 15 that dwellers' preference (C_{ij}) for parameters of health are highly varied in nature as the range value is 1.538 (i.e., SzS – SzN or 3.772 – 2.234). This is due to the awareness for urban health and hygiene among dwellers of the entire zone which indicates high inequality in the field of health.

Table 14: Health

Sub-regions	Types of vectors	Members availing medical services	Nature of medical institutions	Expenditure	Insurance	Perception	Total
SzN	R_{ij}	2.063	2.375	2.331	2.419	2.013	11.200
	W_{ij}	0.149	0.149	0.254	0.194	0.254	1.000
	C_{ij}	0.307	0.354	0.592	0.470	0.511	2.234
SzE	R_{ij}	2.750	2.975	3.225	2.800	2.825	14.575
	W_{ij}	0.331	0.205	0.180	0.166	0.118	1.000
	C_{ij}	0.910	0.611	0.579	0.465	0.334	2.899
SzC	R_{ij}	3.033	2.792	2.950	2.842	2.900	14.517
	W_{ij}	0.311	0.185	0.157	0.159	0.188	1.000
	C_{ij}	0.668	0.465	0.629	0.776	0.367	2.906
SzS	R_{ij}	3.929	4.214	3.679	3.464	3.321	18.607
	W_{ij}	0.220	0.167	0.213	0.273	0.127	1.000
	C_{ij}	1.160	0.872	0.628	0.623	0.489	3.772
SzW	R_{ij}	2.853	2.765	3.029	1.721	1.897	12.265
	W_{ij}	0.295	0.207	0.171	0.180	0.147	1.000
	C_{ij}	0.888	0.510	0.476	0.273	0.357	2.504
Mean of W_{ij}		0.261	0.182	0.195	0.194	0.167	1.000
Total C_{ij}							14.315
Mean of C_{ij} (Overall BUA)							2.863

Source: The data were collected through a questionnaire survey

Table 15: Summary table of health

Type of vectors	Sub-zones	Members availing medical services	Nature of medical institutions	Expenditure	Insurance	Perception	Total
R_{ij}	SzS	3.929	4.214	3.679	3.464	3.321	18.607
W_{ij}	No significant agglomeration rather parameters are scattered in nature						
C_{ij}	SzC	0.668	0.465	0.629	0.776	0.367	2.906
	Parameters are highly varied in nature						

Source: The data were collected through a questionnaire survey

4.2 EXTENT OF INEQUALITY

It is evident from Table 16 that extent of inequality of education in terms of dwellers' C_{ij} within BUA is only 15 % of BUA's mean value. Hence, the value of educational inequality is not significant. The excess indicates that spatial characteristics of dwellers' preferences are less varied and less 'agglomerated' in nature. It is also evident that dwellers of SzE have highly preferred educational parameters, which is a maxima of BUA's mean. The sub-region is evolving as a new node of growth. On the contrary, dwellers of SzS have already availed advanced types of educational facilities, they are subsequently less responsive to education, which is a minima of BUA's mean.

It is evident from Table 16 that extent of inequality of economic indicator within BUA is above 30% of BUA's mean value. It portrays a moderate level of economic inequality. The excess indicates that spatial characteristics of dwellers' preferences are moderately varied in nature. It is also evident that due to high cost of living in SzW dwellers are more concerned about their economic status and for that reason, have highly preferred economic parameters and this is a maxima of BUA's mean. Whereas dwellers of SzE are less responsive to economy, which is a minima of BUA's mean.

Extent of inequality of health in terms of dwellers C_{ij} within BUA is above 50 % of BUAs mean. This indicates a high level of health inequality. This indicates that spatial characteristics of dwellers' preferences for health related parameters are significantly varied and 'agglomerated' in nature. It can be inferred that dwellers of SzS are more concerned about their state of health care and have thus laid a high preference on health related parameters, which is a maxima of BUA's mean. Whereas, preferences of dwellers of SzW are relatively less for the same indicator, which is a minima of BUA's mean.

4.2.1 Aggregate HDI: Computation of Composite Weighting Vectors

It is explicit from Table 17 that based on the three dimensions of HDI in aggregate (C) that out of the five sub-zones, four are below the BUA's average. Among them, SzN is the lowest with 6.905, as dwellers preference for C is the least. On the contrary, as dwellers of SzS responded highly (8.430 parts of 38.193) and it is well above BUA average. It implies the existence of socio-economic inequality is less within the entire zone. On the whole, it is interesting to observe from Table 18 that extent of inequality in terms of all three indicators is just 20 % of BUA's mean, which is lower than all the three values computed as per individual indicators, as shown in Table 18. Hence within BUA extent of inequality is low in general.

Table 16: Inequality of indicators

Indicators	BUA mean	Range		Inequality	Inequality ($b_1 \pm a_1$) + ($b_1 \pm a_2$) [mean%]
Education	2.726 (b_1)	Maximum (SzW)	3.008 (a_1)	0.307($b_1 \pm a_1$)	0.416 [= 15.26]
		Minimum (SzE)	2.592 (a_2)	0.109 ($b_1 \pm a_2$)	
Economy	2.049 (b_1)	Maximum (SzE)	2.398 (a_1)	0.349 ($b_1 \pm a_1$)	0.672 [= 32.78]
		Minimum (SzS)	1.727 (a_2)	0.323 ($b_1 \pm a_2$)	
Health	2.863 (b_1)	Maximum (SzS)	3.772 (a_1)	0.909 ($b_1 \pm a_1$)	1.538 [= 53.73]
		Minimum (SzW)	2.504 (a_2)	0.629 ($b_1 \pm a_2$)	

Table 17: C aggregating three dimensions of HDI

Sub-regions	Total weighting of education	Total weighting of economy	Total weighting of health	Composite weighting
SzN	2.042	2.629	2.234	6.905
SzE	1.727	3.008	2.899	7.633
SzC	2.014	2.701	2.906	7.621
SzS	2.066	2.592	3.772	8.430
SzW	2.398	2.701	2.504	7.603
Total	10.247	13.631	14.315	38.193
			BUA mean	7.639

Source: The data were collected through a questionnaire survey

Table 18: Assessment of inequality variation based on C: Overall HDI indicators

BUA mean [38.193/5]	Range		Inequality	Inequality variation ($b_1 \pm a_1$) + ($b_1 \pm a_2$) [mean %]
7.639 (b_1)	Maximum (SzS)	8.430 (a_1)	0.791 ($b_1 \pm a_1$)	1.525 [= 19.96]
	Minimum (SzN)	6.905 (a_2)	0.734 ($b_1 \pm a_2$)	

Source: The data were collected through a questionnaire survey

Table 19: Aggregate global priority vectors of future governance

Sub-regions	Indicators	Private	PPP	Public	Total
SzN - Mean	Education	0.295	0.288	0.417	1.00
	Economy	0.333	0.300	0.167	1.00
	Health	0.320	0.224	0.256	1.00
SzE - Mean	Education	0.319	0.356	0.325	1.00
	Economy	0.316	0.344	0.341	1.00
	Health	0.357	0.374	0.269	1.00
SzC - Mean	Education	0.331	0.350	0.319	1.00
	Economy	0.344	0.386	0.269	1.00
	Health	0.401	0.298	0.301	1.00
SzS - Mean	Education	0.345	0.337	0.319	1.00
	Economy	0.343	0.404	0.253	1.00
	Health	0.395	0.300	0.304	1.00
SzW - Mean	Education	0.367	0.319	0.313	1.00
	Economy	0.316	0.379	0.305	1.00
	Health	0.318	0.381	0.301	1.00
Mean	Education	0.331	0.330	0.339	1.00
	Economy	0.330	0.363	0.267	1.00
	Health	0.358	0.315	0.286	1.00

Source: The data were collected through a questionnaire survey

4.3 ASSESSMENT BASED ON DWELLERS' STATED PRIORITY AND PREFERENCE FOR FUTURE URBAN GOVERNANCE

In this section, assessment on weightings of future options of governance has been presented. Table 19 has furnished the stated preferences of nature of governance with respect to the three dimensions of HDI. Within all sub zones, dwellers' preferences are varied from ppp to private type governance for the educational indicator. A moderately high range of preference is reflected for private governance as future option. The preference is mainly agglomerated within the sub zones of SzC, SzS, and SzW. Future preference of public governance for education is less preferred by the dwellers across all sub zones, except SzN. This is homogeneously distributed over all the sub zones. Table 19 also shows that dwellers from all sub zones, except SzN, have highlighted preference for *ppp* as future governance in economy and agglomerated over the sub zones. Dwellers' least preference has been observed for the public governance and it is

spatially varied in nature. Preferences for private governance are homogeneously distributed over five sub-zones. It is evident from the table that dwellers from SzN, SzC, and SzS have highlighted preferences for private governance in health as a future option and these are said to be agglomerated within these sub zones. This preference also said to be scattered within SzE and SzW and these are closely ranged. Public sector is least preferred by dwellers in all the sub zones as desired governance of health and it is homogeneously distributed over the space.

5. CONCLUSIONS

On the whole, results and interpretations of analyses of local data imply that agglomerative nature of socio-economic inequality regarding composite set of HDI indicators is comparatively less for educational indicators. Agglomerative nature of socio-economic inequality is relatively higher for health indicators followed by economic indicators across spatial configuration of BUA. It is evident that dwellers from the entire area are

availing relatively better quality of educational infrastructure, still they are more aware and willing to pay for the best quality education, which is modern and having state-of-the-art facilities. For this reason, as a future strategy, dwellers' confirm their preference for *public* type governance in augmenting the strengths and opportunities in education system. As dwellers are enjoying a relatively higher access to career planning opportunities, they have given high preference for maximum number of earning members in their families to sustain the high urban expenditure pattern. Dwellers in general have preferred public governance for augmenting prospects of job sectors and investment sectors in boosting economic system of BUA. There is a strategic demand to develop proper health care system for the entire BUA, which can be ideally met by *ppp* type governance. Dwellers from all sub-regions have preferred for *ppp* type government. To fill up the deficiency in health sector in terms of number of health institutions and auxiliary health care services, proper strategies on social health awareness, can be governed by *ppp* type governance.

The paper recommends further investigations of normative aspects of socio-economic development characterized by gender, ethnicity, race, and culture (Panda & Agarwal, 2005). Future researches may be carried out by collating areas like socio-economic and environmental vulnerability and resilience in the context of inequality within an urban agglomeration. Finally, a comparative standpoint of multiple inequality assessments governed by different aspects of quality of life and covering a range of urban agglomeration situation may be conducted to arrive at a holistic research platform.

In conclusion, selection of parameters and assessing them to measure socio-economic inequality within an urban agglomeration is always a challenging work. This paper has tried to select best possible parameters at present time keeping their aspirations in mind. Here the results and interpretations, and overall findings on preferences as drawn from the analyses of local data have established the significance of application of HDI based indicators. The present study also established the methodology to measure socio-economic inequality within an urban agglomeration and how to combat that from dwellers' perspective.

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