Linking Urban Form & Quality of Life in Kolkata, India

1.0 Introduction

Today we live in an urban age. It is expected that by 2050, 70% of the world's people will reside in urban areas (UNFPA 2007). But the alarming fact is who will be these new urbanites and what is their present, which they will be carrying forward? With Asia and Africa set to double by 2030, future urbanisation will largely be a developing world phenomenon. India is expected to be the epicenter of this massive socio-economic shift and urban majority centre. Today, Indian cities like Mumbai, Delhi and Kolkata already figure among the top 10 Megacities of the world and the trend is expected to follow. Yet it is in these developing nations the problems of social equity and quality of life (QoL) is most pressing. Many of the new urbanites will be poor with lack of basic amenities. Their future, the future of cities in developing countries, the future of humanity itself, all depend very much on decisions made now in preparation for this growth (UNFPA 2007). It is apparently suggestive that the manner in which the subcontinent responds to urbanisation over the next two decades will define the sustainability of the future world.

While sustainability of city is multifaceted, spatial urban form and its relation to the efficiency of the city is the most acknowledged issue in the world environmental agenda. (Jenks et al 1996) Many scholars argue that sustainable urban form is a key towards achieving a sustainable development and that QoL is a vital component of it. This is so because efforts to promote sustainability are unlikely to be fruitful if they impinge too severely on perceptions of human well-being. Moreover, as cities promote the goal of a 'livable city' through compact-polycentric approaches, potential importance of spatial factors in determining wellbeing grows more important. Yet there exists very little empirical research to establish the claims.

This paper explores these ubiquitous links between spatial urban forms to QoL in the high-density rapidly urbanizing economy of the Kolkata Municipal Area (henceforth referred as Kolkata), India. While such intensification strategies may be feasible for cities with comparatively lower densities like Los Angeles with 2,836 per/km^2 but to seek the same for the highly dense Kolkata, which already hosts 24,760 per/km^2, will be unjustified. This will only add to the already existing problems of infrastructure overload, overcrowding, congestion and environmental degradation. This analysis is the variation at the scale of the census wards of the Kolkata, which can be considered as neighborhoods of Kolkata. There exists liberal precedence acknowledging that neighborhoods are justifiable unit of analysis and that can efficiently measure the local conditions that affect domains of human life.(Sawicki and Flynn 1996, Greenberg 1999 and Meersman 2005).

Drawing on the international research that identify the key domains impinging the QoL in urban communities, the indicators at the neighborhood level of Kolkata has been used to assess the link between the city's current urban form and the QoL. The methodology of localized social space analysis has been modified and applied in the local scale in Kolkata for the first time. This study first revisits the theoretical underpinnings of research into QoL and sustainable urban forms separately and tries to elaborate on the associated links between them found in literature (section 2). Section 3 describes the study area and data sets used followed by a detailed assessment of the methods utilized (section 4). Section 5 discusses the results of the multivariate empirical analysis and finally the article concludes with the discussions on the findings and their implications on urban form policy in section 6.

2.0   THEORETICAL BACKGROUND

2.1   Urban QoL in Research

QoL has its origin from the domain of health; however, defining an appropriate concept, as well as an appropriate measure, of the well-being or the QoL of a community has been debated and controversial issue. Urban QoL is a multi-dimensional concept and has a long history of research (Foo 2000, Bonaiuto et al. 2003, Li and Weng 2007, Møller 2007, Brereton et al. 2008, Lee 2008, Moro et al. 2008).The efforts to explore QoL have been witnessed in multiple disciplines from psychology, medicine, public health, economics (Easterlin 2001 and Fritjers et al. 2004), and very recently being recognized as an important component of sustainability (Rogerson 1999). Although often used in connection to economic factors of growth and development (Myers 1988), the basic definition of QoL lies in the concept of Maslow's theory of five different kinds of needs, which linearly accrete from objective physiological needs to subjective sense of self-fulfillment. Following Maslow, first one has to achieve the basic objective needs and then one can tread towards a higher self satisfaction.

Comprehensively, urban QoL in general terms may be described as to represent how well human beings needs are met or the extent which individuals or community perceive satisfaction in various domains of urban life.(Costanza et al.2007) The importance of QoL in development discourse lies in the effective allocation of scarce resources. As stated by Lee (2008), QoL information can be used to diagnose previous policy strategies and to draft future policies. The neologism livability, from the adjective liv(e)able, is now often applied to the built environment of a town or a city. The recent interest in QoL and sustainability has spurred developments in exploring the effects of spatial organization of cities that could explain the socioeconomic outcomes and variation in QoL (Vemuri and Costanza 2006).Although various attributes influence QoL, there is a growing conviction that character of built environment or the aspect of urban form is one of them. Recent studies towards the sustainability of urban forms hints towards the omnipresent links between spatial city structures and QoL (Jabareen 2006). Broadly it means that certain spatial arrangement of urban system is able to develop a new source of competitive advantage that will make it easier to plan and develop the city in a sustainable manner, which in turns will significantly improve the QoL of inhabitants. Several international initiatives like the Healthy Cities by WHO(1986), the Sustainable Cities Programme of UN-HABITAT/UNEP, the Millennium Development Goals (MDG), attempt to improve QoL of the global population (Ulengin et al. 2001). UNDP's Human Development Index (HDI) monitor the development of countries, mainly the improvement of QoL, using three dimensions of human development; a healthy life, knowledge, and a decent standard of living. These dimensions can be considered reflective of the three factors that define sustainability – social, economic and environment.

Despite this growing arguments that implementation of sustainable systems cannot be successful if they detract from QoL of the people in these systems(Bell and Morse 1999), empirical studies still have not reached a consensus on the effect of sustainable urban forms on QoL. This is more so because different studies employ different definitions, variables and measurement methods, which make it difficult to generalize the findings. Moreover due to insufficient documentation and huge literature gap about studies to establish the relevance in less developed countries, has also raised the question as to whether a spatial pattern of urban system in the cities of developing countries also has similar effects in determining people's QoL. The little work that has been done are largely confined to developed nation and this dimension of urban form is usually taken for granted as an integral part in advocating compact urban forms.

2.2   *Sustainable Urban Forms in Research*

Of all the urban forms, compact urban development has largely been accepted as the ultimate panacea for achieving sustainable development. (Haughton and Hunter 1994). Different notions have emerged in literature when defining compact development. Although usually refers to spatial arrangement of the city (Williams 2000). We define it as the result of a planning process that aims to increase built area and population densities, to intensify urban economic, socio-cultural activities and to manipulate urban environment settlement systems in pursuit of the environmental, social and global sustainability benefits derived from the concentration of urban functions (Burgess 2000). Intensification has been a major strategy for achieving compactness, uses urban land more efficiently intensifying the density of development and activity. Many empirical researches (Dawkins and Nelson 2003; Landis 2006; Massam 2002; Pendall 1999; Shen and Zhang 2007) have provided results in favour of compact development policies. These authors argue that compact development improves a city's competitive advantages and livability, which in turn improve QoL of urban residents. On the other hand empirical analysis of Newman and Kenworthy (1999) and Williams (2000) have provided mixed results. Many researches, when studied at disaggregate satisfaction level, showed a direct negative correlation between QoL and density, especially when compared with the low density suburb with the highly congested city centre. (Bramley and Powers 2009). It is here the contradiction of compact urban forms to QoL surface. Furthermore, the empirical evidences that directly link QoL and compact development are scarce.

The effect of intensification might be different in the high-density cities of developing countries because cities in the developing countries are more likely to face problems of managing the impact of intense compact development (as the QoL dimension) rather than the spatial (sprawl) or energy dimension. Moreover, since the cities in developing countries already host a high density it would be very interesting to unearth the paradigms of sustainability in terms of urban form and QoL. De la Cruz (2009) argues that smart growth regulation work less effectively for densely populated U.S cities. These empirical evidences implies that city needs to be planned regarding to its spatial context and its socio-spatial diversity (Sandercock 2000).

The presence of relatively small body of literature on the study of urban form in relation to QoL can be attributed to the absence of any specific methodology or indicators that can help in linking and quantification of both separately. While urban form has been measured in both landscape metrics: shape, pattern (Huang et al 2007) and population metrics: population density, Index of inequality – GINI (see Huang et al 2007, Tsai 2005), QoL indicators become more of derived from the domains of life variables like Housing, Infrastructure efficiency, education, jobs, transportation (accessibility) (Tesfazghi, Martinez & Verplanke 2010). Difficulty arises because the available indicators of measurements of QoL and Urban form in research are often overlapping and do not specifically group to any sphere. Since achieveing high QoL through equity and not depleting the natural resources beyond its regenerative capacity, is the ultimate aim of any planning activity (Caruthers and Ulfarsson 2008; Dissart and Deller 2000; Massam 2002; Ulengin et al. 2001), thus studying QoL in connection to sustainable urban spatial structure is definitely needful. Here we try to understand this association in context of the high-density city of Kolkata, India using objective contextual information from easily obtainable sources. The contextual data used elaborates the significant societal, economic and environmental constructs that comprise a city structure at neighborhood level. Furthermore it will elucidate that just imitation of compact development might not be an answer towards sustainable future of cities like Kolkata.

3.0   STUDY AREA AND DATA SET

The city of Kolkata, the capital of the state of West Bengal, India is the main business, commercial and financial hub of eastern India and the north-eastern states. The city is more than 300 years old and it served as the capital of India during the British Governance until 1911. One of the largest metropolitan regions of the world, Kolkata serves as the global example of the potentials and problems facing mega-cities in developing nations (Banerjee 2005). Kolkata city, under the jurisdiction of the Kolkata Municipal Corporation (KMC), now has an area of 185 km^2 subdivided into 141 wards (considered as neighborhoods). The area is spread linearly along the banks of the River Hooghly in a north–south direction. The east–west dimension of the proper city stretches from the Hooghly River in the west to roughly the Eastern Metropolitan Bypass in the east (Figure 1). Kolkata presently hosts more than 5 million populations, with its principle agglomeration accounting to 15 million urbanites. Although the city has a very high growth rates in terms of population but the pace of urban services has not been matched (Laksmanan2008). Lack of growth in income opportunities, very little resources and distributional inefficiencies has left a huge gap in service provision.
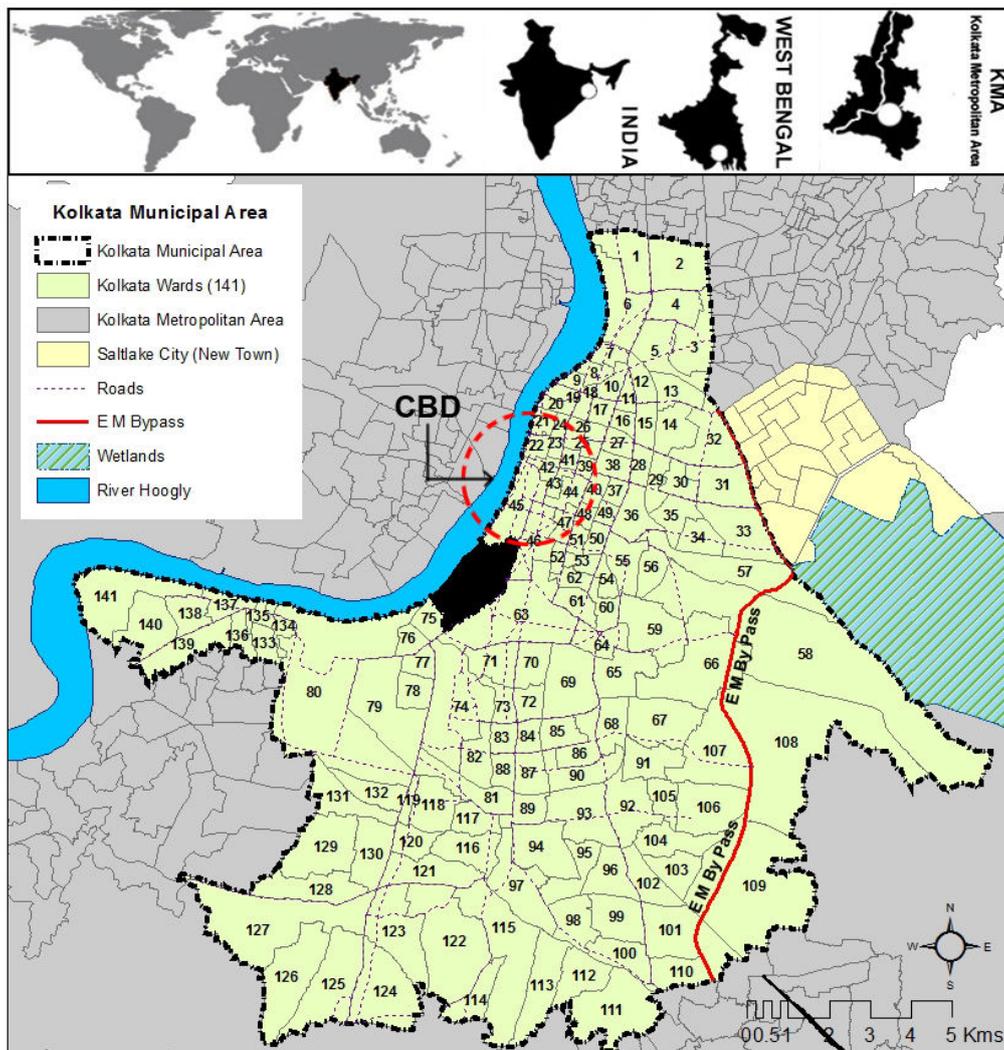

Figure 1 Regional, National and Local setting of Kolkata

The 'inner city' of Kolkata Municipal Corporation already hosts a high density urban form of 24760per km^2. (Census 2001) greatly exceeding the World Health Organizations recommendation of 2500 persons/km^2.In the history of humanity perhaps Kolkata is the only city to have absorbed the biggest mass migration "with incredibly meager resources" (Chaudhuri, 1990). This rapid growth of population, coupled with severe geographic limitations, has resulted in extreme congestion, urban blight, and a myriad of economic, social and environmental problems that burden the city with insurmountable obstacles. Unlike other cities in developing nations, planning policies since 1960's, were directed towards multi nuclei rather than concentrating on strengthening the city centre. The development of new-towns was a catalyst in that direction. But the city has been very repulsive to the polycentric approach, rather the city centre continued to peak, depicting a strong mono-centric trend. Kolkata Development authorities were unsuccessful in enhancing attraction of these new centers. In 1975 the new satellite town of Saltlake city and 1990, the Rajarhat New-town were developed on the eastern fringe of Kolkata city. While studying the factorial ecology of Kolkata Berry and Ress (1969) and Dutt et al (1989) pointed out that the city is still in a transition and shows a very strong monocentric trend. However development of new centers has been observed by Dutta et al(1989) as compared to the previous study. Kolkata is a colonial city and its colonial past has transcended into the very DNA of the city. Its impact has given birth to a complex new society and culture. It is a city of star contrasts "between wealth and poverty, power and helplessness, within the legacy of both indigenous colonial practices" (Downton P 2000). Now the question arises that whether such a city, ready to burst to its seam in terms of population growth but not well prepared for it, can transcend itself towards a sustainable future? Thus it becomes imperative to study the trends of QoL in relation to urban form. Resultantly, the study presented here follows a pattern of empirical investigation using Kolkata wards as surrogate for neighborhoods in an urban setting.

The data and methods used in this study address the present need for a comprehensive objective assessment of urban QoL in relation to urban form at the neighborhoods. Multitude factors that reliably measure the urban form and QoL are used. The multiple indicators are employed in the study to measure social, economic and environmental sustainability. Like any research in developing country availability of data in terms of both spatial maps and statistical information is a challenging task. This becomes more exigent owing to the absence of any GIS database and restrictions in data dissemination policy of Govt. of India (GOI), even for academic research purpose. Kolkata being only 60 miles from the India-Bangladesh international boundary, topographical paper maps of 1:50,000 available at the Survey of India, GOI, are considered restricted for public use. Hence the only sources of paper maps are the maps of Kolkata Metropolitan Development Authority, GOI and National Atlas and Thematic Mapping Organisation, GOI. These paper maps were used to prepare GIS map for Kolkata in form of *.shp files in ArcInfo 10.0 Desktop. The bounding units in this analysis are administratively derived City of Kolkata GIS based ward polygons. This defining unit is reasonable as it's been determined in the literature that administratively derived boundaries reasonably represent non-overlapping nested residential groupings, that although may be flawed, are usable in most cases (Sampson et al. 2002). This will serve as a baseline for synthesizing model results in this study. Demographic, Housing and amenities and built environment related variables were obtained at ward level for the year 2001 from Directorate of Census, GOI. The land price data is obtained from the Ministry of Urban development, GOI. The other data pertaining to transportation, only bus data is used as it is the most widely used mode of transportation within the city. This data was available from the Motor Vehicles Department, GOI. West Bengal Pollution Control Board is responsible for monitoring the Air and water pollution data. Since PM_{10} is major and harmful air pollutant, this data is considered in the study. The emission data was available by monitoring station wise, Spatial kriging interpolation which provides most robust results (Sarkar 2005) was used to derive the ward level pollution. The resulting 49 variables used cover a majority of the

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Domains of human life that QoL. Variables like population density, compactness and crowding was considered as a measure of urban form.

Table 1. Variables and Data

Variable	Description
Distance from Central Business District (CBD)	Euclidean distance from geometric centroid of each ward to geometric centroid of CBD (Ward no. 45)
Population density	Total no. of persons per sq kms
Family Size	Total no. of persons per Household (HH)
Sex-ratio	No. of female to 1000 male
Pop Growth	Growth of population %/year
Pop <6	% of population below 6yrs
Minority Pop	% of Schedule caste/Schedule Tribe population
Slum Pop	% of slum population
Literate Pop	% of literates to total population
Female Literate	% of female literates to total population
Working Pop	% of working population to total population
Female Working	% of female working population to total population
Household (HH) Density	No. of Household per Sqkm of each ward
Compactness	% of HH - % of built-up areas per ward
Crowding	% of population - % of built-up area per ward
Lighting Fuel_Electricity	% of HH using electricity for lighting.
Lighting Fuel_Kerosene	% of HH using kerosene for lighting.
Drinking Water source_inside	% of HH using drinking water within premises for drinking
Drinking Water source_<100mts	% of HH has drinking water source within 100 mts
Drinking Water source_>100mts	% of HH has drinking water source more than 100 mts away
Kitchen_inside	% of HH has kitchen within the house
Kitchen_outside	% of HH has kitchen in open air
Cooking Fuel_LPG	% of HH use LPG for cooking
Cooking Fuel_Kerosene	% of HH use kerosene for cooking
Cooking Fuel_Coal/coke	% of HH use coal for cooking
Cooking Fuel_Firewood	% of HH use firewood for cooking
Cooking Fuel_cowdung	% of HH use cow dung for cooking
Bathroom_inside	% of HH has bathroom within the house
Toilet_Pit latrine	% of HH has pit latrine
Toilet_WC	% of HH has Water closet
Sewerage closed	% of HH do not have closed drainage for waste water outlet
Asset_Car	% of HH own car
Asset_2-wheeler	% of HH own 2-wheeler
Asset_Banking Service	% of HH avail banking services
Industry_Red	% of High pollution potential Industry
Industry_Orange	% of Medium pollution potential Industry
Industry_Green	% of low pollution potential Industry
Industry Fuel_Coal	Total amount of coal used per ward (in Kg/year)
Air Pollution_PM_{10}	Conc. of PM_{10} (Kriging Interpolation of Monitoring stn data)
Land use_OP	% of open space
Land use_Ind	% of industrial
Land use_Res	% of Residential
Land use_Comm	% of Commercial
Land Price 2001	2001 Average Residential land price per ward (Rs/Sq yard)
Land Price 2000	2000 Average Residential Land price(Rs/Sq yard)
Access_Hospital	no of hospital within 2 kms from the ward centroid

Variable	Description
Access_Primary School	no. of primary schools per ward
Bus Route length	Total kms of bus route/ward
Bus available	Total no of bus /ward

4.0   METHODOLOGY

On obtaining the significant data, it was aggregated, interpolated or extracted to derive the variables at the ward level. Consequently, exploratory data analysis was carried out to better understand the relationship of different variables. For dimension reduction of the 49 variables exploratory factor analysis was carried out in SPSS Statistical software (IBM SPSS Statistics). Factor analysis has the advantage of rearranging original variables into fewer underlying constructs to retain as much information contained in the original variables as possible (Landau and Everitt 2004). In this study principal axis factoring method was used to extract the factors, along with Varimax rotation with Kaiser Normalization to retain only those factors whose eigenvalues exceeded 1.0. Factor loadings range from −1 to +1, with a larger absolute value indicating a stronger relationship between the respective factor and variable. Furthermore the factor loadings can be classified as strong, moderate, and weak corresponds to absolute loading values in the range of >0.75, 0.75–0.50 and 0.50–0.30 (Liu et al 2003). Factor scores are computed for each ward to represent its contribution in each case. Emphasis was also put on the comprehensibility of the factors. Only those factors were retained whose meaning was easily comprehensible within the scope of the study. Finally the factor scores were imported to ArcInfo and Trend Surface analysis was performed to fit a sixth-degree Trend Surface Map fitted to factor scores. This trend will help in viewing the current trends in urban form in comparison to Urban QoL.

5.0   RESULTS AND DISCUSSION

The factor analysis resulted in 9 factors with eigenvalue greater than 1.0. Although factor 7 and 8 had eigenvalues greater than 1 but they did not elaborate on any specific underlying construct, they only exhibited variation of a single indicator. Hence while interpretation these two factors were not included. The original 49 variables were reduced to 9 new uncorrelated factors which explained a cumulative variance of 74% after rotation. Resultantly only 26% loss of information occurred in the process. (Table 2)

Table 2 Percentage Variance

Factors	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.94	27.13	27.13	8.27	18.80	18.80
2	9.20	20.91	48.04	6.85	15.58	34.38
3	3.32	7.54	55.58	4.06	9.24	43.61
4	2.18	4.96	60.54	2.87	6.52	50.13
5	1.74	3.96	64.50	2.80	6.35	56.49
6	1.31	2.97	67.47	2.78	6.32	62.80
7	1.09	2.48	69.95	1.95	4.44	67.24
8	.99	2.25	72.20	1.88	4.28	71.52
9	.81	1.84	74.03	1.10	2.51	74.03

The spatial distribution of the factors (Figure 2 – 7) shows that high serviced facility neighborhoods are generally associated with both highly dense and dispersed urban forms. Only those factors are mapped which had more than 0.4 loading on more than one variable.

The results reveal that factor 1(Figure 2) explains 19.0% of total variance and the variables relate to population metrics of Urban form, hence this factor can be termed as "Built environment and Habitation". This factor increases with the distance from the city centre. As one move away from the city centre less compact urban forms are witnessed. The neighborhoods around the city centre are predominantly commercial with high land prices so the economically weaker population are pushed away from the city centre and live in

conditions devoid of better amenities and facilities. It is evident that the city centre is losing population showing a trend of gentrification. Factor 2 (Figure 3) relates to "Poverty tenets" versus affluence with positive loading on using of LPG for cooking, availing baking services, owning assets like 2-wheeler, high literacy and residential land use. These parameters depict neighborhoods with high economic affluence in contrast to poverty. Spatially, newly developed areas like south of Kolkata and new town developments at the north eastern parts shows affluent neighborhoods. The third factor (Figure 4) includes a cluster of variables defining "In migration and politics of urbanization". This migration generally pertains to cross border Bangladeshi migration. This factor positively loads on use of kerosene as cooking fuel, high % of schedule caste/tribe (SC/ST) population, growth of population. The politics of urbanization is inherent in this factor. SC/ST is socially backward population certified by the government and receives special social benefits in their urban life. Generally to gain the vote bank migrant populations are provided this social benefit. Female working population is high because of subsistence and special reservation in jobs by the government for SC/ST population. The loadings of 4th factor (Figure 5) depict the "Socio-cultural" dimension. It shows high positive loadings on sex-ratio and female literate population. In a country like India where there is very high female foeticide, high sex-ratio and female literacy pertains to socio-culturally upgraded population. Surprisingly socially upgraded neighborhoods are spatially located on the eastern side which is the direction on the new towns and also pertains to areas with affluence in the southern part of Kolkata. Factor 5 loads positively on the availability of bus routes and buses; it is also highly correlated to the availability of car. This factor indicates the construct of "Availability of public transport". This factor shows the increasing dependency on public transport as one move away from CBD but surprisingly the car ownership also loads significantly on this factor. This directly correlates that unlike developed nations where car dependency is more owing to lack to public transport, in developing countries like India owning a car is an aspiration indicator which grows with income. It bears no correlation to availability of public transport like bus. Another phenomenon worth mentioning here is the availability of alternate cheap modes of transport like cycle rickshaw or the auto rickshaw which replaces the need to avail car. Factor 6(Figure 6) is typically an urban form construct and explains neo-urbanization and "City growth direction". It loads heavily on growth of population variable and negatively loads on slum population, industry location. This factor when interpreted in conjugation of the new town locations says clearly that the city is growing towards the north-eastern direction. Factor 9 (Figure 7) is a direction towards the Environment externalities like "Air quality and Industrial pollution" by industries using coal as fuel. It loads positively on the no. of high polluting industry, coal usage and PM_{10} concentration. This shows that old areas of Kolkata in the north and newly added wards on the western side have high industrial pollution. These wards are highly correlated to location of slum population and wards with high inequality quotient. The spatial expressions of the factor scores provided a good incite towards the association of urban forms and QoL at the neighborhood levels.

To understand the spatial trends in these factors Trend Surface (TS) analysis was carried on these factors. This would enable in viewing the clustering and dispersal pattern of QoL variables in relation to the urban form variables. The results of the trend surface map depicted a strong correlation between the patterns of urban form variables like the TS of Factor-1(Figure 8) which shows that one moves away from the city centre the compactness in urban form decreases. This is indication of a strong mono centric trend. It depicts that high density areas are clustered in the city centre along with high urban facilities serviced neighborhoods. As for TS of Factor-2(Figure9) the trend also showed clustering but it the direction of clustering was in the opposite direction to the general urban form. Like the urban form factor it also showed a mono nuclei structure. The high affluent neighborhoods are concentrated at the southern and north eastern part of the city. It gradually degrades as one move towards the west or the centre. The western part of Kolkata does not have high affluent neighborhoods more so because of the clustering of the industries in the west. TS of Factor 3 (Figure10) in migration show sectoral trends with pockets of low quality neighborhoods.

Since these form the major class of unskilled labor force, these areas are generally associated with slums and degraded QoL. Thus a multi centre clustering can be related to this construct. The TS of Factor 4 (Figure11) i.e. socio-cultural dimension is sectoral and multi-nucleated. It reveals that neighborhoods which have high female literacy and sex-ratio are spatially allocated in pockets. These neighborhoods located away from industrial areas, they are predominantly residential and correlate positively with affluence and less compact urban forms. This dual city structure can be attributed to the colonial past of the city. Mapping of Factor 5, has not been done as it only depicted one strong construct which was found evenly spread within the city and did not provide any prominent trend. TS of Factor-6 (Figure12) i.e the city growth direction highlight those neighborhoods which are closer to the new towns with high urban QoL. The structure of the trend is again mono nucleated and highest clustering is seen towards the north eastern direction near the access to the new towns. The TS of Factor9 (Figure13) spatially segregates the zones with high air pollution caused due to industries on these zones. The trend is multi nucleated clustered around the industrial zones. These neighborhoods can be classified as low quality areas and correlates to compact urban forms. Thus crowding and compact urban forms can be associated with low QoL in case of Kolkata. Another aspect highlighted by the TS analysis is that utilization of space is inversely proportional to compact urban form.
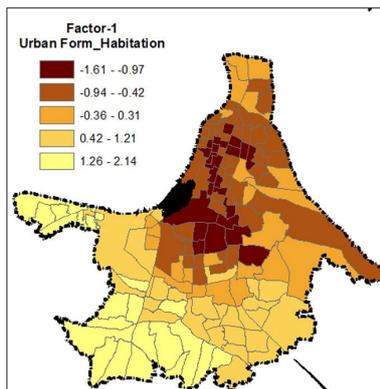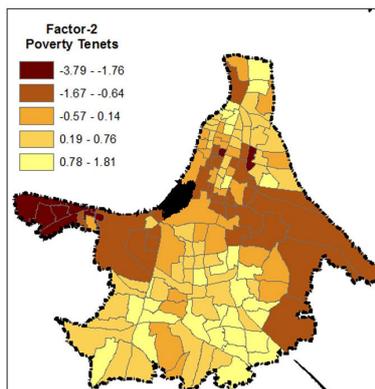

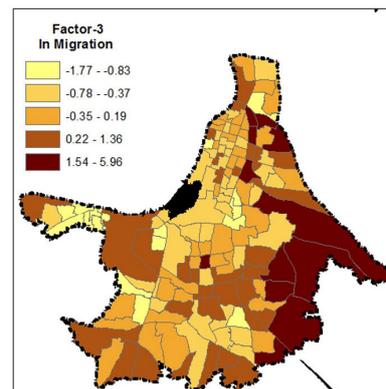**Figure 2** Built Environment

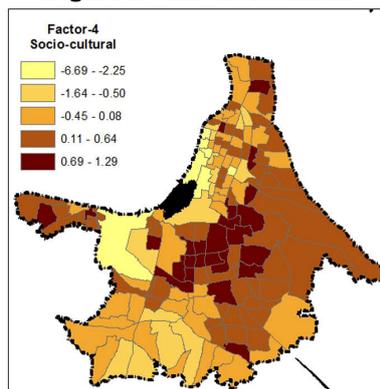**Figure 3** Poverty tenets

Figure 4 Migration

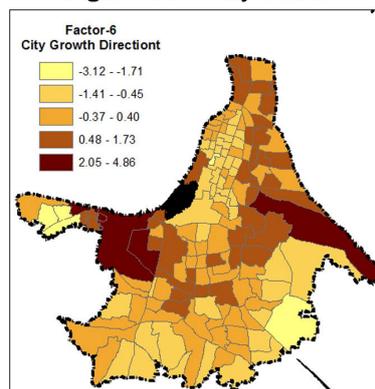**Figure 5** Socio-cultural

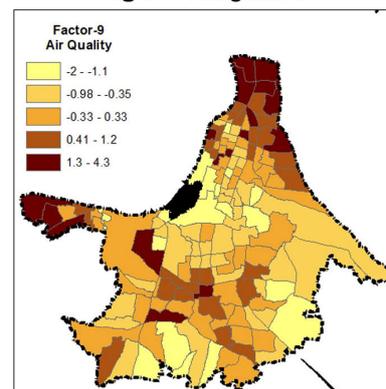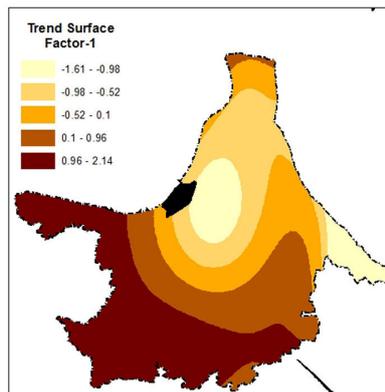**Figure 6** Growth direction

Figure 7 Env. Externatlity
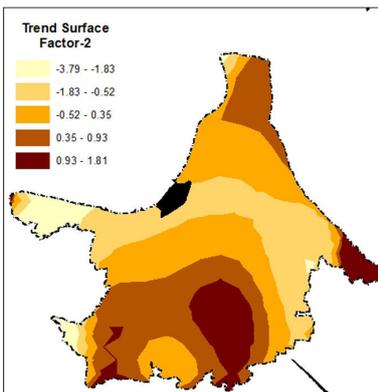
Figure 8 Built Environment

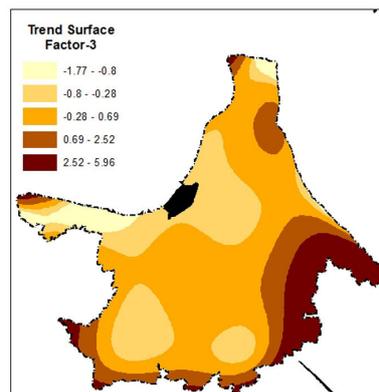**Figure 9** Poverty tenets

Figure 10 Migration
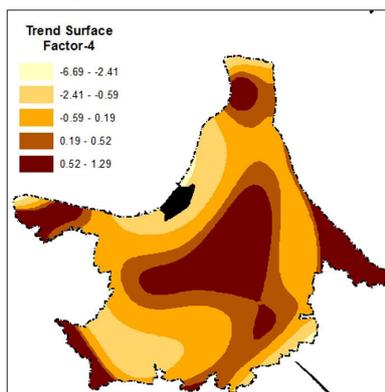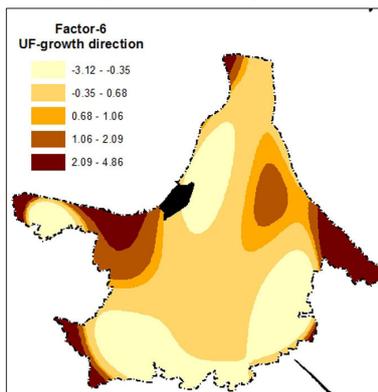

Figure 11 Socio-cultural
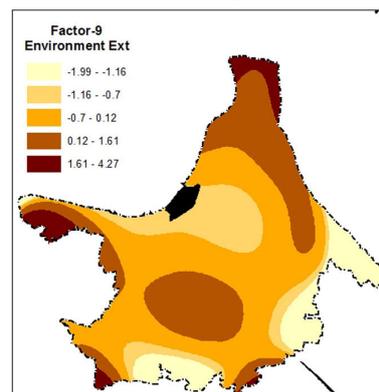

Figure 12 Growth direction

Figure 13 Env. Externatlity

6.0   CONCLUSION

In reviewing the above findings, it appears that there is a connection between QoL and compact urban forms. Dependence on the city centre is still important but a growing trend in direction of the new town developments has been identified, probably for the first time since 1960's. It was since then the city policy makers has been promoting the development of multi nuclei approach which has still not been realized. As shown above the factor loadings are spatially better explained by the trend surface maps. By giving a visually clearer picture of the general distribution of the factor scores, the trend surface helps to penetrate more deeply into the socio-cultural and the socio-economic environment of Indian systems and how it affects human activity in the spatial structure of the city. From this study it is evident that the uses of multivariate techniques like the factor analysis and trend surface maps provide refined scientific basis of spatial patterns, clarifying assumptions through results that were valid. The findings for the city cannot be generalized for any other city in developing countries but it can plausibly represent the lower bound of the relation between urban form and QoL. Crowding or compact urban form is inversely associated with QoL. The study reveals socio-economic status to be dominant aspect of the geography of Kolkata. The dominant spatial pattern is the compact-high quality neighborhoods at the city centre and low density-high quality new towns at the periphery. The wider significance of this study is that it strengthens the existing argument that compact development should tailored to suit the context of development. The uniqueness of the city of Kolkata unfolds in its politics of urbanization. With the "urbanization of neoliberalism", an urban politics of extremes has emerged in Kolkata. While on one hand it patronizes the slum dwellers to ensure the vote bank and provides tenuous access to livelihood and shelter, on the other hand it has emerged as biasness towards the bourgeois class. The development of new towns were intended to infill the deficient of housing, specifically named – "Housing for the poor", but through time these new growth centers have turned out to be a "bourgeois landscape of

anesthetized gentrification" (Roy 2011) Its is here the dual structure of the city questions, that whether compact poly-nuclei development is a sustainable solution for the city of Kolkata. Sustainability of Kolkata probably does not lie in improvement of the poverty tenets but more on the legitimacy of patronizing the gentleman class.

7.0   REFERENCES

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