Objective Quality of Life in Aizawl City

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Abstract : *Socio-spatial inequality is an important subject matter of human geography. Assessment of urban quality of life is significant to assess intra-urban inequality in social and environmental terms across various localities. By using principal component analysis, spatial inequality in objective quality of life in Aizawl City is measured at locality level. High ranked localities were found at central location and important junctions where buildings are mixed with both residential and commercial functions. On the other hand, the lowest ranked localities are the most peripheral localities which are mostly older settlements that have been incorporated into the city proper through legislative decisions.*

Introduction

Quality of life (QOL) is a broad and multi-faceted concept. No single discipline can deal effectively with questions about quality of life (Hill *et al.* 1973). It has been studied by a range of disciplines like sociology, geography, economics, planning, psychology and public health, among others. With its increasing popularity and widening application, QOL becomes an elusive concept, the meaning of which is very much dependent on the context within which it is used (Smith 1996). The concept is now a nebulous term, with multiple related concepts, including 'well-being', 'level of living', standard of living', and 'liveability' (Van Kamp *et al.* 2003; Craglia *et al.* 2004; Johnston 2009). Despite repeated attempts to differentiate between these terms for conceptual clarity (see Smith 1973; Van Kamp *et al.* 2003; Langlois and Anderson 2002; Andrews 2001; Bryne 2007), they are used interchangeably by some scholars (Andrews and Withey 1976; Saitluanga 2014).

Quality of urban life is becoming an important issue with increasing urbanization as the latter is usually accompanied by environmental degradation, cultural erosion and a number of social and economic problems (see Marans and Stimson 2011). Harvey (2011:232) has rightly pointed out that "if we think about the likely qualities of life in the next century by projecting forward current trends in our cities, most commentators would end up with a somewhat dystopian view". Difference in quality of urban life is generally associated with residential differentiation and spatial segregation, poverty, unemployment and a lack of adequate social and physical

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infrastructure, crime, violence, homelessness and overcrowding. Negligence of increasing disparity in quality of life may generate deep dissatisfaction and underlie episodes of social unrest and dysfunction.

In 2011, there were 82 local councils in the entire city of Aizawl City. The local council is the lowest unit of local administration and lowest unit of enumeration. They are considered as suitable units of spatial analysis due to their small size, cohesiveness and presence of sense of belongingness among its residents. From methodological point of view, small areas are appropriate sites to study intra-urban difference since patterns or degrees of inequality are more visible and the criticism of ecological fallacy is diminished at lower levels of aggregation (UNCHS 2000).

Objectives of the Study

The main purpose of the present study is selection of appropriate objective QOL indicators for the city of Aizawl and analysis of spatial inequality in QOL at locality level in the city. These will help in identifying the socio-economic and other problems faced by neighbourhood communities so that policies and programs may be taken up by the stakeholders.

Methodology

Due to unavailability of primary data for some indicator variables, random stratified sampling method was employed to generate a sample of households for the entire city of Aizawl. A sample household of 5 per cent from the total household constitutes the sample size for each locality. Before taking the actual survey, a pilot survey was undertaken first to determine appropriate variables to be included in the study. Those features which were poorly understood, difficult to interpret and were of little or no importance to the public were excluded from further analysis. Thereafter, a schedule was designed to collect objective parameters for measuring urban quality of life (Table 1).

To prevent some variables having undue influences on the analysis, indicator variables were first normalized using the minimum-maximum method which put the indicators to have an identical range (0 to1). The formula of Min-Max method is $X = 1 - [(X_{max} - X_{ij}) / (X_{max} - X_{min})]$ where X_{ij} is the value of the indicator variable i of the Local Council, X_{min} is the minimum value of the indicator variable i and X_{max} is the maximum value of the indicator variable i.

Principal component analysis (PCA) is employed here to develop a composite index of quality of life. The technique is a data reduction method used to derive a composite, smaller set of correlated but independent variables known as components from a large set of variables. Each of the components

may be thought as a 'super variable'. Mathematically, principal components are linear combinations of variables with weights in terms of their eigen vectors. These eigen vectors are derived from the correlation matrix of the variables.

$$Z_1 = a_{11}x_1 + a_{12}x_2 + \ldots + a_{1q}x_q$$

$$Z_2 = a_{21}x_1 + a_{22}x_2 + \ldots + a_{2q}x_q$$

$$Z_q = a_{q1}x_1 + aq_2x_2 + \ldots + a_{qq}x_{qm}$$

Each principal component is a linear combination of Z's obtained as

Where *x1, x2,...,xq* are the variables (indicators), *q* the number of variables and *Zi(i=1,...,q)* represents the principal components. *aij* are the component loadings which are chosen as weights applied to the variables *xj* in the above equation so that the principal component *Zi* satisfy the following conditions:

(i) they are uncorrelated (orthogonal);

(ii) the first principal component accounts for the maximum possible proportion of the variance of the set of *xs*, the second principal component accounts for the maximum of the remaining variance, and so on until the last of the principal components absorbs all the remaining variance not accounted for by the preceding components, and

$$a_{i1}^2 + a_{i2}^2 + \ldots + a_{iq}^2 = 1$$

where i= 1,2,...,q.

Table 1. Indicators of Urban Quality of Life, Aizawl City.

Code of Indicators	Definition of Indicators
F_Grad	Percentage of female graduate population.
Edu 12	Number of persons who have studied up to Class 12 and above/household.
Bank	Number of bank accounts/ household.
Profe	Percentage of professional and technicians from total population.
M_Grad	Percentage of male graduate population.
Computer	Number of computers/household.
Income	Average monthly household income.
4Wheel	Number of four wheel vehicles/household.
Rent	Average house rent value per household.
Electric	Average last month electricity bill.
Hospital	Number of health centers/1000 population.
Playground	Average distance to playground.
No_Agri	Percentage of workers engaged in non-agricultural sectors.
Community	Number of community owned assets/1000 population.
Bank_D	Average distance to nearest bank.
Water	Number of water connections/household.
RCC	Number of reinforced cement concrete (RCC) buildings/household.
F_Lit	Female literacy rate.

Analysis

Principal component analysis (PCA) requires computation of correlation analysis and test statistics like Kaiser-Meyer-Olkin (KMO) and Bartlett's test Sphericity to assess the appropriateness of using the technique. The correlation coefficient matrix shows that most of the variables were inter-correlated and there was no extreme multi-colinearity. The value of KMO for the selected data is 0.890 which is good enough to run PCA. The Bartlett's Test of Sphericity also showed a significance level of 0.00 and we can reject the hypothesis since the probability is less than 0.05. Then, PCA was run in the computer software Statistical Package for Social Sciences (SPSS) to extract communalities and components. Using Kaiser's criterion of taking eigenvalues more than 1, three components were extracted which altogether explain 66.75 per cent of total variation in the data set. The percentage of variation explained is considered good enough to carry forward the analysis.

After component loadings were estimated, the individual indicators with the highest component loadings are grouped into intermediate composite indicators. Since we extracted three components, there are also three intermediate composites as shown in the right-hand side of Table 2. The intermediate composites were normalized squared rotated component (factor) loadings. The squared factor loadings represented the proportion of the total unit variance of the indicator, which was explained by the component. The weights are normalized squared factor loadings and scaled to unity sum. For instance, the weight of the first variable F_Grad (0.176) is derived by the squaring of the highest loading of F_Grad variable (0.880) divided by the explained variance which is the portion of the variance of the first factor explained by the variable F_Grad. For e.g. 0.176 = (0.880 x 0.859)/4.412. In the same manner, the weights of the other variables were derived and included in the intermediate composite index.

The first column of Table 2 shows component loadings, the second column shows communalities and, the third one shows the intermediate composite indices. The first component consists of variables like percentage of female graduate (F_Grad), percentage of population who have studied up to class 12 (Edu12), number of bank account per household (Bank), percentage of population who are engaged in professional and technical works (Profe), percentage of male graduate (M_Grad), number of computer per household (Computer), and average monthly household income (Income). The component may be labelled as 'socio-economic' dimension. It is the most important component that

determines variability in objective QOL as it explains 24.51 per cent of the total variance.

The second component explains 21.92 per cent of the total variation. It includes three variables including number of four wheelers per household (Wheel4), rent value (Rent), and average monthly electricity bill per household (Electric). All the component variables have high positive loadings. Other variables that have significant loadings include Income (0.572), Computer (0.564), M_Grad (0.524), RCC (0.488), Profe (0.482), and F_Lit (0.44). This component

Table 2. Intermediate Composite Indices of Objective Quality of Life.

Variables	Components			Commu-nality	Squared Factor loadings (scaled to unity sum)		
	1	2	3		1	2	3
F_Grad	**0.880**	0.098	0.164	0.810	**0.176**	0.002	0.007
Edu12	**0.796**	0.357	0.182	0.794	**0.144**	0.032	0.009
Bank	**0.692**	0.232	0.174	0.563	**0.109**	0.014	0.008
Profe	**0.680**	0.482	0.107	0.705	**0.105**	0.059	0.003
M_Grad	**0.633**	0.524	0.197	0.714	**0.091**	0.070	0.011
Computer	**0.610**	0.564	0.346	0.810	**0.084**	0.081	0.033
Income	**0.596**	0.572	0.247	0.743	**0.081**	0.083	0.017
Wheel4	0.146	**0.828**	0.025	0.707	0.005	**0.174**	0.000
Rent	0.285	**0.816**	0.183	0.780	0.018	**0.169**	0.009
Electric	0.260	**0.767**	0.147	0.677	0.015	**0.149**	0.006
Hospital	-0.150	0.199	**0.748**	0.622	0.005	0.010	**0.153**
Playground	0.049	0.038	**0.737**	0.547	0.001	0.000	**0.149**
No_Agri	0.386	0.106	**0.698**	0.647	0.034	0.003	**0.133**
Community	-0.389	0.118	**0.657**	0.597	0.034	0.004	**0.118**
Bank_D	0.269	0.267	**0.654**	0.571	0.016	0.018	**0.117**
Water	0.456	0.301	**0.563**	0.616	0.047	0.023	**0.087**
RCC	0.320	0.488	**0.515**	0.606	0.023	0.060	**0.073**
F_Lit	0.243	0.444	**0.497**	0.503	0.013	0.050	**0.068**
% of explained variance	24.51	21.92	20.32				
Expl. Var. (Eigenvalue)	4.412	3.946	3.657				
Expl./Total	0.367	0.328	0.304				
Total Var.	12.015						

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.

Note: Expl.Var. is the variance explained by the component and Expl./Total is the explained variance divided by the total variance of the three components.

may be labelled 'household amenity' dimension.

The third component includes variables like average distance to nearest health centre (Hospital), average distance to nearest playground (Playground), percentage of workers engaged in non-agricultural sector (No_Agri), average distance to nearest bank (Bank_D), number of water connection per household (Water), number of reinforced cement concrete buildings per household (RCC), and female literacy rate (F_Lit). All these variables have loaded positively while community variable has negative loading. This component may be labelled as 'accessibility' dimension.

Once the intermediate composite indices have been constructed, they were aggregated by assigning a weight to each of them equal to the proportion of variance explained by the respective component. In other words, the weights assigned to the intermediate composite indices or weight of respective component

Table 3. Weights for Objective Quality of Life Variables.

Variables	Domain Weight	Weight for respective factor	Weight Score (W_{ij})	Resulting Weight (? W_i = 1)
F_Grad	0.176	0.367	0.064	0.089
Edu12	0.144	0.367	0.053	0.073
Bank	0.109	0.367	0.040	0.055
Profe	0.105	0.367	0.038	0.053
M_Grad	0.091	0.367	0.033	0.046
Computer	0.084	0.367	0.031	0.043
Income	0.083	0.328	0.027	0.038
Wheel4	0.174	0.328	0.057	0.079
Rent	0.169	0.328	0.055	0.077
Electric	0.149	0.328	0.049	0.068
Hospital	0.153	0.304	0.047	0.065
Playground	0.149	0.304	0.045	0.063
No_Agri	0.133	0.304	0.041	0.056
Community	0.118	0.304	0.036	0.050
Bank_D	0.117	0.304	0.036	0.049
Water	0.087	0.304	0.026	0.037
Rcc	0.073	0.304	0.022	0.031
F_Lit	0.068	0.304	0.021	0.028

equals the explained variance divided by total variance of each factor in Table 2. Weight Score (Wi) is obtained by multiplying the variable weight and weight of respective component. Finally, the resulting weight or final weight is obtained which is rescaled again to sum up to one to preserve comparability.

After the final weights were obtained, the rank of each Local Council was obtained by the product of normalized variable and the resulting weight. Each Local Council was ranked and mapped as per their rankings as shown in the figure 1.

Results and Discussion

Our analysis shows that Zarkawt obtained the first rank in objective QOL. Zarkawt is one of the most centrally located and most accessible neighbourhoods within the city. It is one of the oldest localities in Aizawl. This locality comprises of two adjacent hillocks - Macdonald Hill and Babutlang. The first two British Missionaries started their services from Macdonald Hill in 1894. Adjacent to this hillock in the southwestern part is another hillock called Babutlang which was a residential area for the government clerks known as *babus*. In between these two hillocks is the main Zarkawt point where a few Mizo clerks were settled. The area became one of the most prominent places in Aizawl. The first High School in Mizoram was established in this locality and a number of senior government officer quarters were also constructed. Presently, it contains several important offices and landmarks including Chief Minister's Office, Mizoram State Museum, Mizoram State Archive, and other important government offices. The most important route of the city runs across the neighbourhood and commercial activities occupy the lower floors of the buildings due to their higher bid-rent while the upper floors were residential units. The locality, therefore, is a residential cum administrative cum commercial area.

The second highest ranked locality is Tuikhuahtlang which may be described as a residential cum administrative centre. The locality lies at a hill top that overlooks many other localities. Many important bungalows and offices like Legislators' bungalow, All India Radio station and other important offices are located here. The official residence of the Governor of Mizoram is also located at a near distance.

At the bottom of the ranking lie two peripheral localities namely Rangvamual and Phunchawng. These two localities are located at a relatively far distance from the city proper in comparison to other localities. Although Rangvamual is one of the oldest localities in Aizawl, it has been failing to grow and develop due to distance effect and undue

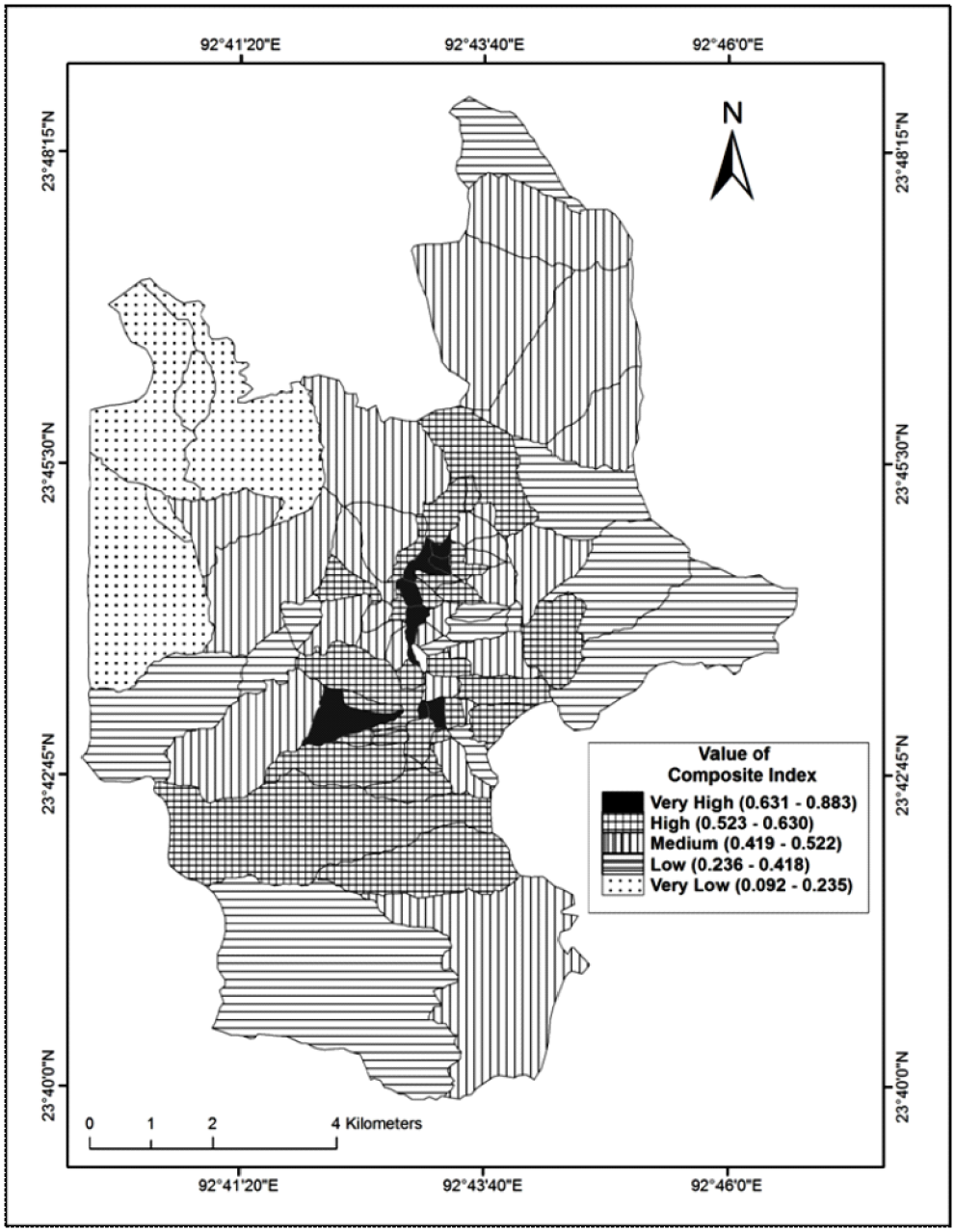

Figure 1. Composite Scores of Objective Quality of Life, Aizawl City.

Table 4. Quality of Life - Ranking and Classification of Localities in Aizawl City

Class	Localities
Very High	Zarkawt (1), Tuikhuahtlang (2), Dawrpui (3), Ramhlun Venglai (4), Bungkawn (5), Upper Republic (6), Chanmari (7), Laipuitlang (8).
High	Bawngkawn(9), Tuikual South (10), Nursery (11), Kulikawn (12), Model (13), Khatla (14), Zotlang (15), Electric (16), Ramhlun South (17), Thakthing (18), Bungkawn Vengthar (19), Ramthar (20), Dawrpui Vengthar (21), Khatla South (22), Mission Veng (23), Chaltlang (24), Republic (25), Falkland (26), Chanmari West (27), ITI (28), Chaltlang North (29), Khatla East (30), College Veng (31), Dam Veng (32), Saikhamakawn (33), Mission Vengthlang (34), Aizawl Venglai (35), Tlangnuam (36), Bethlehem (37).
Medium	Ramhlun Sport Complex (38), Bawngkawn South (39), Durtlang Leitan (40), Tuikual N (41), Venghnuai (42), Vaivakawn (43), Chawlhhmun (44), Kanan (45), Hunthar (46), Dinthar (47), Ramhlun Vengthar (48), Maubawk (49), Ramhlun North (50), Saron (51), Thuampui (52), Chawnpui (53), Edenthar (54), Ramthar North (55), Luangmual (56), Chhinga Veng (57), Durtlang (58), Mel Thum (59), Muanna Veng (60), Venghlui (61), Durtlang North (62), Bethlehem Vengthlang (63), Republic Vengthlang (64).
Low	Armed Veng (65), Govt. Complex (66), Armed Veng South (67), Salem (68), Zonuam (69), Tuithiang (70), Zemabawk North (71), Hlimen (72), Zuangtui (73), Zemabawk (74), Chite (75), Selesih (76), Lawipu (77).
Very Low	Tanhril (78), Sakawrtuichhun (79), Tuivamit (80), Rangvamual (81), Phunchawng (82).

negligence by the state government. Till 2010, there were no government owned schools in these two localities. Presently, Rangvamual has two private higher secondary schools while Phunchawng has only one. All the middle and primary schools found in these localities were government aided schools. No health centre, public library and indoor stadium were found in these two adjoining localities.

Conclusion

Broadly, the high ranked localities were found at central location and important junctions where buildings are mixed with both residential and commercial functions. On the other hand, the lowest ranked localities are the most peripheral localities which are mostly older settlements that have been incorporated into the city proper through legislative decisions. They are neither outgrowth nor outward expansion of the city. Physically, they are differentiated from the city proper by either a forest or a vacant land. They do not have adequate infrastructures and human resources to uplift their socio-economic conditions. They possess a characteristic of rural-urban fringe where economic activities range from purely rural to purely urban. Due to congestion of the city proper, suburbanisation of middle class population is taking place in certain localities while poorer non-local migrants were attracted by least developed peripheral localities like Rangvamual and Phunchawng.

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