Urban Planning Proposal Based on Quality of Life Index Assessment: A Case Study of Kochi City

Rajvi Desai[#1], Krupesh Chauhan[#2]

[1]B.E. Civil, C. K. Pithawala College of Engineering & Technology, Surat, Gujarat, India
[2]Professor, S. V. National Institute of Technology, Surat, Gujarat, India

Abstract

Quality of Life Index is a multidimensional concept as it depends on the fulfillment of the biological, social, economic and psychological requirement. The Quality of Life index can be used to comment frequently on key issues that affect and contribute to the public debate about how to improve the Quality of Life index for the city. Although it is not easy to find the most suitable indicators for the measurement of the Quality of Life, appropriate definitions can be made depending upon the goals of the researcher. A survey is conducted for the Kochi city within a municipal boundary having an area of 94.88 sq.km and population are 6.01 lacs as per 2011 census which has a 74 No. of wards. Samples are collected within all study zones. 600 samples are collected for Kochi city. On the basis of analysis, the Quality of Life index has been found for six different study zones. The overall Quality of Life index is 5.10 in Kochi city due to weakest Transportation, Recreation and Storm water network. The urban planning proposals are proposed for very poor parameter in the city and according to public priority based.

Keywords – *QoL Index, recreation, urban planning proposals*

I. INTRODUCTION

The term *Quality of Life* (QOL) references the general well-being of individuals and societies. QoL index is the product of the interplay among social, health, economic and environmental conditions which affect human and social development. The term is used in a wide range of contexts, including the fields of international development, healthcare, and politics. QoL should not be confused with the concept of standard of living, which is based primarily on income. Instead, standard indicators of the QoL include not only wealth and employment but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging. There are two ways to assess how well people live. One is to consider to what extent the country provides conditions deemed essential for a good life. In this approach the emphasis is on societal input. Since there is little certainty about what people really need, called this 'presumed' quality-of-life. The other approach is to assess how well people thrive. In this approach the emphasis is on societal output, called this 'apparent' QoL.

II. STUDY AREA

A survey is conducted for the Kochi city within a municipal boundary having an area of 94.88 sq.km and population are 6.01 lacs as per 2011 census which has a 74 No. of wards (Fig. 1). For study purposes, divided this whole city into six different study zones and five different income groups like HIG, HMIG, LMIG, LIG and EWS.

With a population of 601,574 as of 2011, the city of Kochi has Kerala's highest population density parameter with 6340 people per Sq. Km. As of 2011, Kochi had a metropolitan area population of 2,117,990. The female-to-male ratio is 1,028:1,000, significantly higher than the all-India average of 933:1,000. Kochi's literacy rate is 97.5%. The female literacy rate lags that of males by 1.1%, amongst the lowest such gaps in India. Kochi is located on the southwest coast of India at 9°58′N 76°13′E, spanning an area of 94.88 Sq. Km. The city straddles the backwaters, encompassing the northern end of a peninsula, several islands and a portion of the mainland.
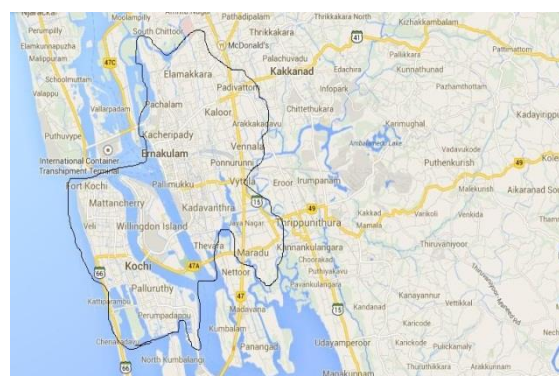

Fig. 1: Study area for the present study

When speaking about 'quality-of-life' in a nation denoted how well its citizens live. There are two ways to assess how well people live. One is to consider to what extent the country provides conditions deemed essential for a good life. In this approach the emphasis is on societal input. Since there is little certainty about what people really need, called this 'presumed' quality-of-life. The other approach is to assess how well people thrive. In this approach the emphasis is on societal output, called this 'apparent' QoL. Finding out the Quality of LifeIndex for Kochi City and giving proposals according to the public is the need of this study. Conducting a survey will help us to find out the needs of public regarding the parameters such as environmental, health, economic, political, education, and infrastructure. Based on the above discussions, the objective of the present study is to develop urban planning proposals based on Quality of Life Index assessment.

A. Climate, Rainfall, Run Off

The city area falls within the tropical climate. The average annual rainfall in the region is about 3,099 mm. The southwest monsoon yields more than 60% of the total precipitation and that of the north –east monsoon is about 25% of the total rainfall. According to hydrological records maximum recorded high tide level for rainy months of mid-May to mid-November works out as +0.44 m and maximum recorded low tide level is 0.155 m relative to MSL. The recent study of the run off of the catchment and discharge efficiency of the drains in the Kathrikadavu - Pullepady area Central Business District (CBD) in Kochi Corporation, it was seen that, the average efficiency of the drain is only 43.31%. Out of the 34 catchment areas studied, 12 have less than 25% efficiency and only one has 100% efficiency among the secondary, tertiary drains. The hydrological characteristics of the region make surface water drainage, an important element of urban renewal efforts.

The present drainage system depends on canals as primary drainage source, secondary drains which discharge to primary canals or backwaters, the drain along road sides are the area drains with or without covering slabs. The drainage network is not based on a drainage study /plan, but done in an ad hoc and piece-meal manner. The drains are built arbitrarily without calculating run off. The area drains and drains from premises do not have silt pits to intercept silt and solids. They discharge directly into road side area drains these drains are silted to very high degree and clogged due to solid waste especially plastics. The shown in Fig 2 and Fig 3 are examples of present scenario of drainage system in Kochi.

Fig. 2: Palluruthy Zone (Zone 2)

Fig. 3: Fort Kochi Zone

Three levels of drainage systems can be categorized as:

Primary canals: major natural canals, which are running in north-south direction and a few natural canals, cut across the sand bars. The primary canals which convey the storm water run-off to the back water system are highly degraded because of encroachments, waste dumping, silting, weed growth, low maintenance and lack of protective measures. It is found that almost all the tidal canals are in filthy conditions. This is due to the dumping of wastes into the canals and lack of facilities for cleaning them due to inaccessibility of cleaning vehicles and machines. It is very necessary that this canal and the shorelines are protected and maintained properly for better living of the people.

Natural and man-made secondary drains: Natural secondary drains are the feeder drains/canals of primary canal. The man made secondary drain encompasses major roadside drains, which go beyond the level of area, drains and which link with the Primary drains (tidal canals) running in north-south direction.

Area Drain:. The area drains are the drains which discharge the storm and sullage water from a neighbourhood to secondary drain. The city has large network of area drains, which act as major storm water receivers. There is no regular pattern for this and lies along small roads and bye lines. The area drains are absent in many of the areas especially in areaswith urban proliferation. These drains need immediate attention. These are the primary cause for water logging in the various neighbourhoods in the city. The total length of the area drain is assessed to 1229 km. Out of this, 330 km in Kochi corporation area and 196 km in municipalities and panchayathsareas requires up gradation and are proposed for inclusion in the cost projection.

III. LITERATURE REVIEW

The conquest of happiness elaborated the concept of happiness as a relative sense of joy that varied from one culture to another and also from one individual to another [1]. Quality of Life Index is the product of the interplay among social, health, economic and environmental conditions which affect human and social development. There are certain definitions given on Quality of Life Index including the World health Organization (WHO).

The purpose of the Quality of Life Index (QOLI) is to provide a tool for community development which can be used to monitor key indicators that encompass the social, health, environmental and economic dimensions of the QoL in the community. It is intended to monitor conditions which affect the living and working conditions of people and focus community action on ways to improve health. Indicators for the QOLI include:

Social: Children in care of Children´s Aid Societies; social assistance beneficiaries; public housing waiting lists etc.

Health: Low birth weight babies; elderly waiting for placement in long term care facilities; suicide rates etc.

Economic: Number of people unemployed; number of people working; bankruptcies etc.

Environmental: Hours of moderate/poor air quality; environmental spills; tones diverted from landfill to blue boxes etc.

QOL models have commonly been developed that reflect collective personal values, preferences and expectations, while at the same time, combine life conditions and statistics of a traditional nature as shown in Fig. 4.
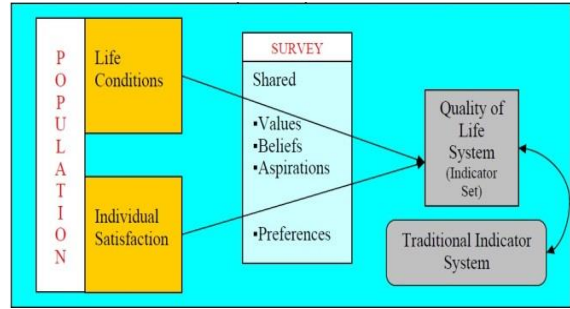

Fig. 4: QoL system model

A. *Determination of index*

The evolution of the Quality of LifeIndex (QoLI) was based on the model developed by Mr. Kenneth E. Hornback and others. The model has been discussed in this chapter. The following values shown in Table 1 are required to be obtained in order to evolve the life index values.

Table 1: Description of different value

S_{ij}-	Thesubjective, or satisfaction measure for allfactorsgiven bypeople to anormalized scale 1-10.
O_{ij}-	Theobjectivemeasurefor allthe factors asgiven byexperts also normalized to scale 1-10.
W_{ij}-	Theimportanceweightingwhich theindividual attaches to a particular factor,relativeto all theotherfactors, on a rank order scale.

All the above mentioned three values were obtained from individual and experts who were permanent residents of this city. A special form was prepared based on the work of Mr.Hornback.

IV. METHODOLOGY

First step is to define the study area or decide boundary of the study. In this study city of Kerala state i.e. Kochi has been defined as a study area within their municipal boundary. Second step is to decide study objectives. Third step is the literature review collection. Literature is to be collected as well as studied related to QoL. Fourth step is data collection. There are two types of data: Objective data and Subjective data. Objective data are collected by visiting municipal offices whereas Subjective data is being collected by field survey means visiting that particular area. Fifth step is to analysis the collected data. Sixth step is to prepare a mathematical model for the assessment of QoL. From this model QOL Index has been found in various income groups and as well as zone wise for the whole city. Seventh step is to find influencing parameters for QOL Index.

Finally planning aspects have been proposed for the improvement of the QoL Index. Essential recommendations and suggestions are also made for the betterment of Quality of Life Index. And additionally gave an urban planning proposal for weakest parameters.

V. DATA COLLECTION

Sample sizes decide on the basis of population and also area. So 600 samples are selected for Kochi city and divided the city into six different study zones so as 100 samples are to be taken for each study zone and additionally these 100 samples are further divided into 5 different income groups like HIG, HMIG, LMIG, LIG and EWS equally. Analysis is done with the help of the Microsoft Excel Programme by two ways like zone wise analysis and income group wise analysis and preparing a graph for all 30 parameters according to zone wise and income group wise. Find out the QoL index for six study zones. On the basis of analysis, found a weakest parameter as well as what is the public demand to improve which parameters initially.

A. Issues

Analysis from the drainage sector reveals that 60% of the Kochi city area lacks proper drainage system. The existing network is inefficient, inadequate and majority of the drains are in filthy conditions. A number of identified areas in the city are frequently flooding during even moderate rains. The drainage systems empty their water and waste loads into water bodies and backwaters through the fairly flat terrain subjected to tidal effects.

VI. RESULT ANALYSIS

In this study, an attempt has been made to evaluate the 'Quality of Life Index' for Kochi city, by making use of the mathematical model developed by Kenneth E Hornback and others. The value of the index is measured on a scale normalized to 1-10. The value of index nearer to 10 indicates an excellent QoL, whereas the value nearer to 1 indicates the worst QoL.

In this way, the QoLI for all study zones has been evaluated as shown in Table 3.

Table 3 shows that Study Zone - 6 is having the highest Quality of Life Index i.e. 5.28 due to rapidly increasing that residential area, whereas Study Zone - 2 is having the lowest one i.e. 4.83 in Kochi . On the

basis of analysis, it was found that QOLI of Kochi is 5.10.

VII. URBAN PLANNING PROPOSALS

QoLIfor Kochi city is 5.10 and Urban Planning proposal is to be given for the weakest parameter for Kochi city. But here urban planning proposals are given as per public demand and according to UDPFI guidelines. All physical and social infrastructure are according to the needs of the people and UDPFI guidelines. Accordingly given three urban planning proposals are Transportation, Recreation, and Strom Water. Proposals are given for short term (5 Years).

A. Transportation

Transportation parameter is very poor as compare to other parameter in all 6 Zones. The development strategies for traffic and transportation in Kochi are worked out with the aim to support the concept of making Kochi City Region a 'Global City'. The strategies also aim to ensure safe and economical commuting between place of origin and destination, convenient and quick access to all areas, reduction of pollution and congestion, energy efficiency and conservation, safety for all sections of the road and transport users. The strategies are identified at regional level and at the level of planning area and are as follows:

The regional transport corridors are overstressed due to the commuting traffic. These corridors mainly include the following viz. Chellanam –Fort Kochi road, Vypeen- Munambam road, National Highway-47 connecting Aroor and Angamaly, National Highway-17 connecting Edappally and Calicut, National Highway 49 connecting Kochi and Madurai via Muvattupuzha, Thripunithura – Vaikom road, Edappally – Perumbavoor road, Kochi - Munambam via GIDA Bridge, Palluruthy – Kumbalangy road etc. It is necessary to strengthen these corridors, augment the existing transport facilities and open out new transport facilities.

B. Parking Infrastructure

As an alternative to surface and multi-storied car parking facilities, automated car parking system is proposed. In this system of car parking, cars are lifted to the parking lots by means of a lift and from the parking stall by means of wheeling or mechanically operated transfer dollies or cradles.

Table 2 : ZonewiseFactorIndex

Zone	MajorFactors(Fj						
	Environment	Health	Economic	Social	Political	Education	Infrastructure
a	4.8	5.17	5.2	4.48	5.11	5.0	5.08
b	4.8	4.79	4.8	4.71	4.54	4.8	4.96

c	5.1	5.11	5.0	4.90	5.54	5.3	5.45
d	5.1	4.98	5.1	4.92	5.24	5.5	5.51
e	4.9	4.87	5.4	4.88	5.14	5.7	5.42
f	5.2	5.23	5.2	5.08	5.28	5.2	5.43

Table 3: QoLIndex

Sr. No.	ZoneName	QoLI	Rank
a	Zone– 2(Palluruthy)	**4.83**	6
b	Zone– 1(Fort Cochin)	**4.93**	5
c	Zone– 3(Pachalam)	**5.18**	4
d	Zone– 4(CentalZone)	**5.19**	3
e	Zone– 5(Edapally)	**5.24**	2
f	Zone– 6(Vyttila)	**5.28**	1
	Kochi City	**5.10**	-

C. Pedestrian Facilities

Walking is such a basic human activity that it has frequently been overlooked in the quest to build sophisticated transportation systems. As a result, accidents involving pedestrians are a regular phenomenon in most of the urban areas. Improving the pedestrian environment on a street-by-street, neighborhood-by-neighborhood basis should be undertaken on priority basis. The pedestrian facilities that need to be considered are:

- Sidewalks or walkways
- Marked crosswalks and enhancements
- Pedestrian Overpasses/Underpasses
- Road side appurtenances

Bus terminals are provided in areas where it is easily accessible for public. A self-financing and revenue generating model for bus terminals and stops through a combination of commercial floor space and advertisement rights is proposed for Kochi City. Accordingly, private operators will be allowed to operate both terminals and bus stops with revenue accruing to them from commercial floor space and advertisement rights. The terminals and bus stops will have all the passenger amenities and adequate information system regarding bus arrival and departure timings etc. Parking facilities are provided in areas where there are lot of traffic congestions, such as bus terminals, markets and shopping complexes. It is provided according to guidelines and norms.

D. Recreation

Recreation parameter also plays an important role in bringing down the factor (Fj), which is identified by conducting survey in Kochi city. So as to improve this parameter some planning proposals has to be given. There are many issues regarding recreation whereas no open space available to use as a recreation within the CBD. Childrens are not having playgrounds or parks nearby their residents and there is no sufficient places are there in the city where people can go for the weekends. Improper management of recreation department, lack of awareness related to sustainability are major issues.

Open spaces form an essential part of urban land use which provide for social and environmental needs in addition to passive & active recreational demands. In planning, open spaces mainly constitute playgrounds, parks, and other recreational areas. The total open space within the city boundaries also consists of permanent agricultural land and land under water. The total recreational space available is 176.12 ha that is 0.48% of total area. This area is much less when compared to the minimum standard of 0.05 hectare/1,000 populations. It is seen that the open spaces within the city are not evenly distributed. A significant feature of the land use of Cochin is the high proposition of agricultural land within urban boundaries. With the increase in population and scarcity of land, these areas form potential land for conversion in to urban uses. During the past decades, large areas of land have thus been reclaimed from backwaters, low lying paddy fields and marshy lands to supplement the developed land. But at the same time, it is very important that a part of agricultural land may be retained within the plan area to cater to the open space requirement of future population. The vacant spaces owned by state and currently not put to rational use can be utilized as green cooling areas of the city. It is strongly suggested that the roads going to come up in the urban areas ought to have professionally planned green shoulders. Even on existing roads, wherever space constraints do not imperiously stand in the way, such green strips can be incorporated. Important measures should be taken to increase public open spaces, parks & playgrounds as the present area which comes under open spaces is far

below the standards. The available area as open space in the Kochi City Region is to be increased up to 247 Ha by demarcating different areas. These areas included is also much less than the standards, which is 10 m² per person as per Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines and the per capita green areas & open spaces are a direct indicator of the environmental quality.

Here provided open spaces in the form of gardens, Play grounds and other recreational activities. It is provided according to the norms and guidelines and also easily accessible by public in each zones for spending their free time in weekends. Separate play areas forchildren are also provided.

E. Storm Water Network

Kochi city is the largest urban agglomeration in Kerala situated in the coastal plains with extensive backwater system and tidal canals. Kochi City Development Plan (CDP) area consists of:

- Highly urbanized Kochi corporation area;
- Two less urbanized municipalities; and
- 13 adjoining panchayaths.

The topography of Kochi is almost flat. The average altitude towards the eastern fringes is about 7.5 m above M.S.L but towards west most part of the city is only about 1.00 m above M.S.L. Kochi is characterized by sand bars running in north – south direction with tidal canals in between. In the absence of sufficient wide drains and also because of the general flatness of the terrain, the city is facing acute drainage problems. Several preliminary studies were conducted regarding the drainage of the city, which clearly proved the inadequacy of the primary, secondary and tertiary drains either because of the size, design or maintenance level.

VIII. STRATEGIES AND ACTION PLAN

Strategies and action plans in this proposal are framed for achieving the above vision. Probable solutions for improving primary canals are:

- To be made free from siltation, encroachments, deepened, widened and side protected;
- Side roads and access facilities to be provided for maintenance, especially for using vehicle and equipments;
- As the north-south running canals cannot be effective in draining off storm water rapidly, providing intermediate outlets towards back waters are essential. These connections have to be towards west in Ernakulum area, towards east in mattanchery area, fort Kochi area and to east/west in Palluruthy area. The purpose of these is to

provide multiple overflow outlets to back waters, which will considerably reduce the storm water build up in lengthy N-S canals;

- Multiple over flow outlets. The main drains in Kochi are very long becoming deeper at out fall end, out fall end may even be much lower than the high tide level. Due to increased time of concentration, the drains get overloaded and overflow. This can be eliminated by multiple outlets at different points.
- Run off need to be diverted partly to relieve the pressure on existing drain; and
- Diversion of run off is also partially possible by interconnecting canals.
- Improving the carrying capacity of existing drains by widening & increasing slope.

Provision of pumping facility may have to be resorted at certain problem areas where natural flow alone cannot create rapid discharge. Pumps are more effective at drainmouths discharging to back waters. Such pumping system can be used to pump water in during summer to destroy mosquito larvae and to flush canals.

IX. FUTURE OUTCOMES FROM URBAN PLANNING PROPOSALS

These proposals are given to improve the QoL Index of Kochi city but it will improve only after the application of the proposals is being done efficiently. The proposed impact after implementation is shown in Table 4.

Table 4 : Impact on QoLI after Implementation

Sr. No.	ZoneName	QoLI	Rank
a	Zone– 2(Palluruthy)	**6.03**	6
b	Zone– 1(Fort Cochin)	**6.13**	5
c	Zone– 3(Pachalam)	**6.38**	4
d	Zone– 4(CentalZone)	**6.39**	3
e	Zone– 5(Edapally)	**6.44**	2
f	Zone– 6(Vyttila)	**6.48**	1
	Kochi City	6.30	-

X. CONCLUSION

This study has given the Zone wise QoLIof Kochi city as 5.10. Thus for improving QoLIfor Kochi city is a main purpose to serve as a residential city. And if QoL increases more people will get attracted to the city automatically. QoLI helps people to choose their location for living and helps in improving living standards of people. It becomes easier for city dwellers to decide the zone, which gives best QoL. Kochi city faces a problem of many parameters but

on the basis of survey or based on public needs, there are 3 main parameters that have to develop initially because the people are more suffering from that parameter. The weakest three parameters are Transportation, Recreation, and storm water network.

Study Zone 1: The QoLIof Study Zone 1 is 4.93. Some of the parameters like transportation is very poor for this zone.

Study Zone 2: The QoLIfor study zone 2 has the lowest value i. e. 4.83 among all other study zones. It covers a number of villages so as its less awareness about infrastructure and other parameters.

Study Zone 3: The QoLIof Study Zone 3 is 5.18.

Study Zone 4: The QoLIof Study Zone 4 is 5.19. It is the CBD area as well as some of the new development area so as QoLIis good in this zone.

Study Zone 5: Study zone 5 has a QoLI5.24 comparatively well among all other study zones. Allbasic infrastructure, housing condition, transportation like all facilities are good in this zone.

*Study Zone 6:*QoLIfor study zone 6 has a higher value (5.28) due to its newly developed area. All basic amenities are provided in this zone on the basis of that people migrate in this zone and another reason behind that is beside study zone 6 which is fully developed as residential as well as an industrial zone.

REFERENCES

[1] Bertrand Russell,Conceptual Framework and Structure of a Europe System of Social Indicators., (1930).

[2] BurcUlengin, FusunUlengin, UmitGuvenc, A multidimensional approach to urban QoL: The case of Istanbul, Istanbul TeknikUniversitesi, IsletmeFakultesi, 80680 Macka Istanbul, Turkey., (2001).

[3] Carlos Discoli, Irene Martini, Methodology aimed at evaluating urban life quality levels, Research Group 1, IIPAC (Built Environment Policy Research Institute), FAU (School of Architecture and Planning), UNLP (National University of La Plata),Street 47 N∘162, DC 478, La Plata 1900, Argentina., (2013).

[4] Dennis P. Andruliset. al., QoL in the Nation's 100 Largest Cities: Challenges for Improving Health and Well-Being", Brooklyn, New York. (2004).

[5] DasimahBt Omar, Assessing Residents, QoL in Malaysian New Towns,UniversitiTeknologi MARA, Asian Social Science., (2009).

[6] Dr. AmitKapoor , Liveability Index, The best cities in India", Institute for Competitiveness., (2011).

[7] Economist Intelligence Unit"sQoL index,The Economist Intelligence Unit"sQoL index, United Kingdom.,(2009).

[8] ElhamLashkari, MehrshadKhalaj,Urban Environment Quality Improvement Planning Case Study: Moft Abad Neighborhood, Tehran, Iran., (2010).

[9] HamamSerag El Din, Ahmed Shalaby, Principles of urban QoL for a neighborhood", Cairo University, Faculty of Engineering, Department of Architecture, Egypt, Housing & Building National Research Center (HBRC), Egypt., (2012).

[10] Heba Allah Essam E. Khalil,Enhancing QoL through strategic urban planning, Department of Architecture, Faculty of Engineering, Cairo University, Egypt., (2012).

[11] Joshua J. Lewer, et. al.,Do Non-Economic QoL Factors Drive Immigration?,,Bradley University, Peoria, USA., (2009).

[12] M.D.Pandey, J.S.Nathwani, Life quality index for the estimation of societal willingness-to-pay for safety,. (2004).

[13] P. Krishnakumar ,the QoL of LIG: a micro level study, Kerala Research program on local level Development Centre for Development studies, Thiruvananthapuram. (2001).

[14] Robert W. Marans ,Quality of Urban Life Studies: An Overview and Implications for Environment-Behaviour Research, Asia Pacific International Conference on Environment-Behaviour Studies, Salamis Bay Conti Resort Hotel, Famagusta, North Cyprus., (2011).

[15] RusenKeles,The QoL and the Environment, Asia Pacific International Conference on Environment-Behavior Studies, Salamis Bay Conti Resort Hotel, Famagusta, North Cyprus. (2011).

[16] Stanely Greenfield,The QoL Concept, Booz allen Public Administration Services, Environmental Protection Agency, United States.

[17] StanislavKolenikov,The methods of the QoL assessment", NES, Moscow., (1998).

[18] Sujatha.S,"QoL of individuals is a holistic approach, 8thAustralian QoL conference, Deakin University.,(2006)

[19] Suzanne M. Skevington,Advancing cross-cultural research on QoL, Kluwer Academic Publishers, Netherlands., (2001).

[20] TauhidurRahman, Ron C. Mittelhammer and Philip Wandschneider,Measuring the QoL across Countries, Washington State University, Pullman,USA., (2005).

[21] ValérieAlbouy,Pascal Godefroy, StéfanLollivier, Measuring QoL, portrait social, France., (2008).

[22] Vicente Royuela, Rosina Moreno and Esther Vayá, Influence of QoL on urban growth: A case study of Barcelona, Deakin University.,(2006).

[23] Wendy Kennedy,Subjective Wellbeing and Ethnic Identity, 8thAustralian QoL conference, Deakin University.,(2006).

[24] Wolfgang Schulz,Explaining Quality of Life -The Controversy between Objective and Subjective Variables, EuReporting Working Paper No. 10, Vienna., (2000).

[25] Yung-Jaan Lee ,Subjective quality of life measurement in Taipei, Deputy Mayor, Taoyuan City, Taoyuan 33053, Taiwan, ROC., (2008).