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List of Abbreviation

QOL	Quality of Life
HDI	Human Development Index
GMC	Guwahati Municipal Corporation
PQLI	Physical Quality of Life Index
GDP	Gross Domestic Product
UNDP	United Nations Development Programme
PCA	Principal Component Analysis
WHOQOL-Group	World Health Organization's Quality of Life-Group
DAS	Detroit Area Study
NE	Natural Environment
HCE	Human Constructed Environment
HBE	Human Behavioural Environment
GMDA	Guwahati Metropolitan Development Authority
PWD	Public Works Department
GMA	Guwahati Metropolitan Area
LPG	Liquefied Petroleum Gas
PCBA	Pollution Control Board Assam
GMCH	Guwahati Medical College Hospital
MMCH	Mohendra Mohan Choudhury Hospital
AUWSSB	Assam Urban Water Supply and Sewerage Board

Abstract

Enhancement of quality of life (QOL) has been the explicit or implicit goal of public policy in all societies for several centuries. QOL has been the focus of numerous studies but universally acceptable definition of the concept has not been developed yet. In fact, a common criticism against the concept of QOL is that it lacks specificity and has as many meanings as life has aspects. It is a multidimensional concept and context dependent. QOL refers to description and evaluation of the nature or conditions of life of people in a certain country or region. Life quality is formed by exogenous forces, with respect to an individual or a social group, forces like production technology, infrastructure, relations with other groups or countries, institutions of the society, natural environment, and also by endogenous factors including interaction within the society and values of a person or a society. During the last couple of decades, the world has developed but the benefit of development has not been favorable for several new problems that have cropped up in the form of environmental degradation, economic inequality and deterioration of social fabrics. Another characteristic feature of the development process in last few decades is the growth of urban areas. The process of urbanization in the developing countries is not commensurate with the level of economic development Urbanization has been a world wide phenomenon and the Indian cities are not exception to it. In the North East India urbanization had a late start. But relation between urbanization and development is distinctly weak in the region. The city of Guwahati is the largest urban centre in the North Eastern Region of India and it is the capital of the state of Assam. The process of urbanization has started getting momentum only after shifting of the state capital from Shillong to Guwahati in 1972.

Since then Guwahati has been experiencing heavy pressure of population. Expansion of the city has led to haphazard growth of buildings on plains and on the hills. Growth of buildings and houses has destroyed the natural water bodies often leading to water logging. Another major problem in the city is congestion of traffic. Rapid urbanization creates enormous stresses on natural environment also. There is dearth of open space for citizen and decline in greenery. As a result of increase in trade & commerce activities along with growth of

vehicular population and rapid urbanization, level of pollution has also increased. Slums have grown up in and around the city. Increase in solid wastes is another major problem in Guwahati. Besides all these, lack of adequate urban services such as water supply, sanitation, sewerage, lighting and transport are some major problems along with deficient recreational and welfare facilities in the city. The huge gap between demand and supply of urban amenities, infrastructural facilities and poor environmental condition adversely affect well-being. Therefore, this study has been conducted on QOL in Guwahati city.

The proposed study aims at studying the relationship between QOL and environment in the city of Guwahati in order to find the factors affecting QOL. It also examines if the factors of QOL are uniform across different income groups and among different localities. At the same time the study evaluates the objective and the subjective dimension of QOL.

Considering all issues found in relevant QOL studies**,** a framework has been constructed for the present study. This conceptual framework places QOL as the central focus while taking into account interaction between men and environment. Environment has been considered in a broader sense comprising physical, economic and social attributes of urban areas. The conceptual framework involves a synthesis of local environmental attribute and takes into account both objective and subjective dimensions. QOL is defined more broadly to include not only the quality of life circumstances, but also what respondents think about those circumstances. In the study, overall QOL has been measured to see the extent to which respondents are satisfied when thinking about their life as a whole which has been measured in terms of satisfaction from life on a five point Likert Scale.

A case study has been conducted in the municipal area in Guwahati to test the conceptual framework empirically. Both primary and secondary data have been used in the study. Two-stage sampling has been used for collecting primary information and the number of households surveyed is 379. Keeping in view the objectives and nature of data, several statistical methods have been used. To explore the structure of the interrelationship among the variables factor analysis has been applied. After this factor scores have been used to explore the underlying dimension of QOL by using ordered probit regression analysis.

Here, underlying dimension means underlying explanatory factors of QOL. To examine if the factors of QOL vary across areas and across income groups, a regression model has been constructed. In this regression analysis all the explanatory variables are dummies representing different localities and different income groups along with their interaction effects. To examine correlation between objective and subjective QOL, indices for each household have been derived by considering the scores of the first principal component

By applying factor analysis, 11 factors have been extracted. They are familial capacity, satisfaction from environmental condition, pollution, availability of clean water, contentment from neighbourhood qualities, safe and affordable living, mode of travel, sense of security, urban amenities, water related problems and accessibility of services. By applying ordered probit regression analysis, 7 factors have been found to be statistically significant to affect QOL. In this regression analysis the dependent variable is the self reported overall QOL (QOL_2). The significant factors obtained from this ordered probit regression analysis are familial capability, satisfaction from environmental condition, pollution, safe and affordable living, convenient transportation, security concern, and accessibility of services.

After finding the explanatory factors of QOL, it has been examined whether these factors vary across areas and among income groups. By regressing scores of the respective factors on dummies for area, income and their interactions, it has been found that factors like familial capability, safe and affordable living, convenient transportation, security concern, and accessibility of services are dependent on either area variation or income variation or both. But satisfaction from environmental condition does not depend upon either area, income groups or on their interaction. At the same time, the explanatory power of the model constructed for explaining variation in the factor 'pollution' is very weak.

To see if there is any variation in satisfaction from overall QOL, mean values of overall life satisfaction for low, middle and high income group have been calculated. It has been found that mean value of life satisfaction is the highest for rich, followed by middle and

low income group which may happen because income may enhance satisfaction through satisfaction of material wants. At the same time, mean value of satisfaction from overall QOL has been found to be the highest in traditional residential area. It shows that QOL is better in traditional residential area in comparison to commercial and newly established residential areas.

From the study of subjective QOL it has also been found that satisfaction from condition of traffic is the lowest in all the selected areas and for all income categories except for low income group. For this low income group, the level of satisfaction is the lowest from cost of living in the city. They have ranked satisfaction from condition of traffic as the third least satisfied item with a very small mean value of satisfaction. Low level of satisfaction from condition of traffic could be an indication of poor traffic and environmental condition in Guwahati.

To know whether objective and subjective dimension comprises any useful construct of life, factors of objective and subjective QOL have been explored separately. From the study of subjective dimension, it has been found that satisfaction from urban amenities and services, liveability and environmental quality are significant factor of QOL. The significant factors of objective QOL have been found to be material condition of living, pollution, socio economic status, susceptibility to water logging problem, mode of travel as well as community participation and waste management. From the study of objective and subjective dimension separately, some new dimensions have come up. They are satisfaction from urban amenities, material condition of living, susceptibility to water logging, community participation in waste management and socio economic status. These factors could not emerge in study of QOL by combining both objective and subjective dimensions. The correlation coefficient between objective and subjective dimension of QOL has been found not to be so strong.

Finally, taking into consideration all the findings, it can be said that QOL is a multidimensional phenomenon which takes into account several dimensions. It has been found that besides material achievement, satisfaction is also an important factor of QOL. The

study has also found that provision of basic minimum urban utility services and urban infrastructures have to be upgraded simultaneously to ensure life quality. Therefore, all sections of the society have to work hand in hand with the administration to make Guwahati a better place to live.

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CHAPTER 1

Introduction

1.1 Background

Enhancement of quality of life (QOL) has been either explicit or implicit goal of public policy in all societies for several centuries. But regardless of the fact, QOL has come into popular usage since the late 1960's only, as an extension of the set of measuring instruments to judge the impact of development policies and efforts (Beukes, 1997). The concept has been playing an increasingly important role in social science research as it has been realized that economic growth and development do not necessarily result in improvements in QOL. Therefore, research and development have started giving ample attention to the concept as an endeavor to study the elements which determine QOL and to propose mechanisms which could contribute to its improvement (Lever, 2000).

The empirical and theoretical exploration of QOL, which started in late 1970s, has a long history. It has its origin in the concept of welfare or well-being of a community. Philosophers like Aristotle (384-322 BC) wrote about good life and suggested that public policy could help nurture it. In course of time, the notion of indicators came to be in vogue. It was the early mercantilists who first developed a system of economic indicators. Two centuries later, this notion was used by the economists in the 1930s and 1940s as an indicator of growth to show the balance of precious metals flowing into and out of a country. Classical economists did not require any such indicators because of their non-interference policy. But the neo classical or marginalists school argued that there was no direct relationship between goods or commodities and well-being. For them, goods and commodities were only vehicles of values where as well-being was dependent on the extent to which people were able to realise these values. Because of this reason one should measure the use value instead of measuring some raw economic variables. Bentham called it amount of benefit, advantage, pleasure or happiness produced by

economic and non economic activities. Bentham was convinced that the concept of utility could convey an abstract measure of use value. There was always a clash among authors on the topic of cardinal verses ordinal measurement of utility (Hankiss, 1983 and Chipman, 1960).

In the early and middle 1960s, however, the issues of use values, social welfare and well-being were raised once again. Faced with tension and multiplying economic, social and other problems, the economists were convinced that economic growth alone could not ensure the optimum progress of social welfare and well-being either as mediated by automatic market forces. Industrial production and its negative side effects were growing in geometric proportion. As a result, there was demand for a direct measurement of social welfare and well-being. This cause was taken up by social statisticians and sociologists, who launched, first, the social indicators movement.

Obviously, the rise and rapid diffusion of this 'movement' was related to particular political climate of the late 1960s and early 1970s. When social indicators began to blossom in the 1960s, sociologists advanced developments both in analytical approaches and in the need for expanding data gathering efforts. Sociologists advanced the ideas of measuring, monitoring, evaluating and forecasting with statistical time series of components of the human condition. Measures of QOL began to be introduced into surveys in the 1970s and in the 1980s sociological research on QOL became stronger (Sirgy et al., 2006). In this period of prosperity, some of the most developed Western societies raised doubt about economic growth as major goal of social progress. In the political debates of that time it was claimed that public poverty and sufferings were the social cost of economic growth. Against this background, it seemed to be arguable whether 'more' should continue to equal 'better' and it became increasingly a public claim to prefer quality to quantity (Noll, 2002). To a certain degree the changes towards 'post-materialism' in value orientations and perspectives of social development reflected diminishing marginal utility of material wealth, but they were also due to emerging characteristics of a postindustrial society. Accordingly the concept of 'quality of life' was

born as an alternative to the more and more questionable concept of material prosperity in the affluent society. It was considered to be a new multidimensional and much more complex goal of societal development.

1.2 Quality of life (QOL) –a definition

QOL has been the focus of numerous studies which carry different meanings to different people. To some, it may mean how happy they are and to others, it may mean the level of economic status, education, health or security. Many researchers agree that the notion of QOL is too broad to describe. In fact, a common criticism against the notion is that it lacks specificity and has as many meanings as life has aspects (Forward, 2003). Some representative definitions of QOL have been discussed below.

Sen (1999) assesses QOL in terms of capability approach to achieve valuable functioning. According to Sen, functioning represents parts of the state of a person- in particular the various things that a person manages to do or be in leading a life. The capability of a person reflects the alternative combinations of functionings the person can achieve, and from which he or she can choose one collection. The approach is based on a view of living as a combination of various 'doings and beings' with QOL to be assessed in terms of capability to achieve valuable functioning. But Veenhoven (2000) uses the term QOL to indicate well-being of people. According to Veenhoven, quality-of-life refers in some contexts to the quality of society and in other instances to the happiness of its citizens. In the same line the WHO-QOL Group (1995) emphasizes on multidimensional nature of QOL. This definition of QOL is subjective by nature. The WHO-QOL group defines life quality as an individual's perception of his/her position in life in the context of culture and value systems in which an individual lives and in relation to the individual's goals, expectations, standards and concerns.

But there is a group of authors who assesses QOL in terms of both objective and subjective experience. Costanza et al. (2007) evaluates QOL in terms overall assessment of human experience. According to the authors, QOL is the extent to which objective human needs are fulfilled in relation to personal or group perceptions of subjective well-being. Human needs are basic needs for subsistence, reproduction, security, affection, etc. Subjective well-being is assessed by individuals' or groups' responses to questions about happiness, life satisfaction, utility or welfare. Any policy measure taken to implement this definition has to create opportunities to meet human needs, understanding that there exists a diversity of ways to meet any particular need. Similarly, Cummins (1997) observes QOL as both objective and subjective, each axis being the aggregate of seven domains: material well-being, health, productivity, intimacy, safety, community and emotional well-being. Objective domains comprise culturally-relevant measures of well-being. Subjective domains comprise domain satisfaction weighted by their importance to an individual. This definition comes from Comprehensive Quality of Life Scale (ComQol). This is a multidimensional definition of QOL with seven domains which together are intended to be inclusive of all components of QOL. In the works of Szalai (1980), life quality refers to the degree of excellence or satisfactory character of life. A person's existential state, well-being, satisfaction with life is determined, on the one hand, by exogenous (objective) facts and factors of the person's life and on the other hand, by the endogenous (subjective) perception and assessment the person has of these facts and factors, of life and of self.

There is another group of authors who evaluate QOL explicitly in the context of environment. It is also opined that the phrase 'quality of life' (Pacione, 2003a) differs a good deal as it is variously used but, in general, it intends to refer to either the conditions of environment in which people live, (air and water pollution, or poor housing, for example), or to some attribute of people themselves (such as health or educational achievement). In the same line, Shafer (2000) presents a model to explain QOL. Shafer's definition states that 'quality of life' is created by an ongoing interaction between community, environmental and economic qualities. The community of people represents

social support networks through which its members communicate. The physical environment should be able to support conviviality so as to provide an environment that creates a healthy livable place. The interaction between these three domains is alternately defined as health, sustainability and quality of life. Shafer has defined QOL in terms of human ecological perspective. National Institute for Public Health and Environment in the Netherlands performed a major literature review and has defined QOL as the material and immaterial equipment of life and its perception characterized by health, living environment and legal and equity, work, family, etc (Kamp et al., 2003).

From the above discussion, it is clear that a unanimously acceptable definition of QOL has not been arrived yet. The concept can be approached from different point of view and it is context dependent. It is a dynamic concept in the sense that the thrust area of QOL has been changing over time. QOL relates to description and evaluation of nature or conditions of life of people in a certain country or region. It is formed by exogenous forces with respect to an individual or a social group, forces like production technology, infrastructure, relations with other groups or countries, institutions of the society, natural environment, and also by endogenous factors including interaction within the society and values of a person or a society (Kolenikov, 1998). The effect of these factors is not necessarily constant over time. For instance, environmental issues were paid relatively less attention a century ago while today ecology is undoubtedly one of the main concerns of the people.

1.3 Objective and subjective QOL

In QOL research, objective dimension represents external condition of life. It refers to reports of factual condition and overt behaviour. Objective indicators, e.g., educational level, are often aggregated at the national level. Objective indicators are, at times, grouped into composite indices which allow national and international comparisons. Objective indicators are measures based on frequency. These are tangible condition such as physical environment, economic or technical factors. Social indicators are frequently

used as objective measure of QOL. For example, variables such as infant mortality, doctors per capita and longevity are assessed in health related QOL where as homicide rates, police per capita and rates of rape are assessed to detect crime related QOL (Diener et al., 1997).

Subjective well being is concerned with how and why people experience their lives in positive ways, including both cognitive judgments and affect reaction (Diener, 1984). Subjective indicators represent individual's measurement of attitudes or appraisal of objective conditions of life. The precise meaning of subjective dimension depends on the context in which it is used. Parallel to the attempts to the use of objective characteristics for evaluating QOL, subjective indicators have gained ample attention. The basic premise of subjective well-being research is that in order to understand the well-being of an individual, it is important to directly measure individual's cognitive and affective reactions to her/his whole life, as well as to specific domains of life. Satisfaction refers to individuals' cognitive and affective evaluations of their lives (Diener et al., 2000). In the context of urban livability, subjective dimension of QOL refers to perceived well-being, livability, health, etc. Subjective indicators are mostly based on, among others, psychological responses, such as life satisfaction, job satisfaction and personal happiness. For example, when objective indicators are used, respondents are not asked to evaluate whether their living conditions are good or bad. They are simply asked to report their living conditions according to some given measures (Matikka, 2001). In addition, an economist may consider cost of living and housing in that area by using objective indicators. But subjective assessment tries to derive how satisfied the people are with their living conditions.

But such objective indicators are very often imperfect. It may suffer from both under reporting (e.g. crime rate) or over reporting (e.g. income). Moreover, selection of variables for objective indicators may involve subjective decision making. Objective indicators may not accurately reflect people's experience of well-being. Individuals' sense of well-being is an experience that is far more complex and determined in a number

of ways than assumed by descriptive social indicators based on external circumstances in a society. Therefore, it is important to take into account subjective well-being of the people concerned.

1.4 QOL and human development

The concept of human development emphasizes on positive freedom as a key element in any definition of a good society. It judges a society by policies, procedures, and structures by which needs are met—whether they promote moral responsibility, rational choice and other features of full human development. Such society can enable its citizen to aspire greatness, to develop virtues and loyalty, to become skilled and artistic, and to attain wisdom. Such opportunities can build capability. QOL is determined by such capability because it enables a person to function in the world and lead a full life (Cobb, 2000).

Human-centered development has the ultimate objective of enabling all people to enjoy long, healthy and creative lives. It weaves the development processes around people rather than weaving people around developmental process (Mears, 1997 and Haq, 1995). Economic growth is also important but it is a way, not an end. Economic growth contributes to human development only if they expand people's choice. People in developed countries have come to realise that QOL is not necessarily a simple function of material wealth (Garb et al., 2004). No society has in the long run been able to promote and sustain welfare of its people in the absence of economic growth, which is mainly a function of investment rate by a strong entrepreneurial corps backed by a motivated and skilled work force. However, in the long run it is human growth that matters most, not economic growth.

The United Nations Development Programme has been issuing the Human Development Report as comprehensive measure of human development since 1990. The Human Development Index (HDI) has remained its main highlight. The basic tenet of the Human

Development Report is that a long and healthy life, education, and a decent standard of living are the essential components of human development. As a result, the HDI has been used to measure human development through the use of three factors – longevity, knowledge and Gross Domestic Product (GDP). A maximum and minimum value is selected for each variable, and by a formula the indicators are transformed to range from zero to one, and averaged to produce the HDI. Longevity is life expectancy at birth, which is the average life-span of people who died in the year of reference. The knowledge variable is a combination of adult literacy – the percentage of adults who can read and write – and years of schooling attained by the adult population. Income originally is the logarithmic value of the per capita GDP.

The HDI can throw significant light on assessing trends and comparing countries in respect of human development. While the items of the index are as reliable and valid as their statistical systems, they are slowly responsive to changes for example, the lag in time between the action of a program and its response in the education measures and in longevity. Nor it can be said that it is satisfactory in theory, although its defenders present arguments that ground the measures in practical wisdom. Longevity, education and income are undoubtedly important elements of life experience. But these three domains do not encompass the scope of life experience and they do not measure the totality of life experience. It is a crude objective measure of QOL. The domains cannot be represented as subject to both objective and subjective measurement (Hagerty et al., 2001).

The HDI or a variant of it cannot be used as comprehensive measure of social health or QOL. The logic of the capabilities approach contradicts the idea that any composite of diverse factors can represent QOL with a single index number, as the HDI does. Education, political freedom, self-confidence and income are important capabilities, but they cannot be measured on a single scale. Another obstacle in the effective use of human development or capabilities approach in assessing QOL is the abstractness of the principles involved. Explaining the basic ideas is not easy and they could easily be misrepresented or misused in the world of practical politics (Cobb, 2000).

1.5 The problem

QOL is a fundamental social concern and economic development can be employed as a means to raise QOL. The ultimate goal of human resource development in any country should aim at improving QOL of its entire people. During the last couple of decades, a wide range of interrelated concerns have contributed to greater awareness and understanding of the concept of development. The world has developed technologically, economically and industrially in the last three decades. In spite of remarkable progress, the benefit of development has not been favorable as several new problems have arisen in the form of environmental degradation, economic inequality and deterioration of social fabrics. It has been realized by the people of advanced countries that increases in material wealth do not simply improve life quality. In the developing countries also, the emphasis on development has shifted from modernization to the provision of the poorest people's basic needs such as food, shelter and health. The objective of a basic human needs approach to development is to assure that all human beings should have the opportunity to live full lives. This approach to development is intended to improve QOL of impoverished people in developing countries.

Another characteristic feature of development process in last few decades is the growth of urban areas. Urbanization in developed countries was an exercise to organize and consolidate expanding economic activities. But in the developing countries the pace of urbanization is not commensurate with the process of economic development. Rather, it is an outcome of sheer demographic expansion and increased pressure on land in rural areas in the developing world. Urbanization has been a world wide phenomenon and the Indian cities are not exception to it. The urbanization process had a late start in the North East India and it started getting momentum in 1970s. But relation between urbanization and development is distinctly weak in the region (Bhuyan, 2004). The city of Guwahati is of strategic significance for the North Eastern Region of India and it is the capital of the state of Assam. Guwahati is the largest urban centre in Assam. The process of urbanization was initiated with shifting of the capital of Assam from Shillong to

Guwahati in 1972. Since then Guwahati has been experiencing heavy pressure of population. The city has developed into center of intense economic, commercial, transport, administrative and educational activities. It has been found that 37.85 percent of the total urban population of Assam resides in Guwahati (Govt. of Assam, 2005). There is large scale migration of population to the city in search of employment and business opportunities, education facilities, familial causes, natural calamities and other reasons. The proportion of migrants in resident population was 47.38 percent.

Guwahati has experienced tremendous growth of population over the last two decades. The population of Guwahati has increased from 1,23,785 in 1971 to 8,18,809 in 2001. The decadal growth rate of population was 22.90 in 1971 and it increased to 38.6 in 2001(Govt. of India, 2001). Such exponential increases in population and unplanned growth of settlements over the years have created enormous pressure on existing land and infrastructural facilities. The density of population in Guwahati is 3741 in 2001. The rapid expansion of the city has led to haphazard growth of buildings on plains and on the hills. The 18 hills in Guwahati municipal area are now dwelled by 1.23 lakh population which is 15.02 percent of the total population of the city. Such growth of buildings and houses has destroyed the natural water bodies often leading to water logging.

Another major problem in the city is congestion of traffic. In fact, growth of vehicles within the city has been so rapid during the last couple of years or so that the density of vehicular population in Guwahati is considered to be one of the highest in India. Besides, vehicle ownership is 22 cars and 86 motor cycles/scooters in Assam as against 8 cars and 20 motor cycles/scooters per thousand populations in Kolkata in 1998 as per the information from Central Road Research Institute, India. But the present situation has aggravated much (Choudhury, 2007). Rapid urbanization creates enormous stresses on natural environment also. There is dearth of open space for citizen and decline in greenery in and around the city.

As a result of increase in trade & commerce activities along with growth of vehicular population and rapid urbanization, level of pollution has also increased in the city (PCBA, 2007). Slums have grown up in and around the city. There are 26 slums in the Guwahati Municipal Corporation (GMC) area covering 1.6 lakh people. Increase in solid wastes is another major problem in Guwahati. There is remarkable increase in the quantity of solid waste because of overcrowding and changing pattern of life style. But the present solid waste management process is not adequate and efficient. Estimated generation of solid waste is 750 metric tonne in 2010 as against 350 metric tonne to 500 metric tonne per day in 2005 in the city. Solid waste generated from domestic and commercial activities has become a major concern causing extensive environmental problems and threat to human health. Besides all these, lack of adequate urban services such as water supply, sanitation, sewerage, lighting and transport are some major problems along with deficient recreational and welfare facilities in the city. The shortage of housing facilities in the year 2001 was to the tune of 3.1 percent which increased to 6.9 percent in 2005. It has been estimated that there would be 40 percent increase in the demand for houses in 2005 over the requirement of 304,437 dwelling units in 2001 (Govt. of Assam, 2006). There are 1,87,001 households in the municipal area of Guwahati of which 24,263 households have closed drainage, 92,940 have open drainage and 69,798 have no drainage facilities in their houses (Govt of India, 2001a). The incommensurability between urbanization and development process has led to an uneven distribution of population and concentration of different kinds of activities. Such high increase in population coupled with inequitable growth of amenity and infrastructural facilities in the city have resulted in congestion, over crowding and conflicting demand for space and utility services. Such dilapidated environmental condition undermines QOL (Ng, 2005). Therefore, this study has been conducted on QOL in urban environment in Guwahati.

This study assumes significance from the point of view of policy making process which may provide inputs on the factors of QOL and can establish a benchmark for assessing changes in quality of community life with changes in environmental conditions.

1.6 Objectives

The main objectives of the study are-

1. To study the relationship between QOL and environment in the city of Guwahati in order to find the factors affecting QOL. Here, environment comprises physical, economic and social environment.
2. To examine if factors of QOL vary among income groups and among different areas and
3. To evaluate the objective and the subjective dimension of QOL.

The first objective may help to find the important dimensions of environment that have to be taken care of while implementing policy decisions regarding QOL. Comparison of QOL among different areas and among different income groups may find out if any particular income group or areas needs special attention in any specific issues relating to QOL. Evaluation of objective QOL may find the factors of external condition of living but QOL is not a function of material condition of living only. Therefore, subjective QOL has also been assessed in terms of satisfaction

1.7 Hypotheses

The objectives stated above and literatures available on the topic help frame the following hypotheses-

1. Factors of QOL vary among different areas and among different income groups and

2. Objective condition and subjective satisfaction together comprise the dimensions of QOL and they correlate poorly.

1.8 Study area and reference period

The study area is the city of Guwahati as demarcated by the GMC. Field work was conducted from April 2006 to October 2006. This is a cross sectional study since panel study is impossible keeping in view time and resource constraints.

1.9 Methodology

This study is mainly based on primary data. But secondary data have also been used to give description the study area 'Guwahati'. Two stage sampling has been applied to collect primary information by using structured questionnaire in the GMC area. Keeping in view the objectives and nature of data, several statistical methods have been used. They are discussed below.

1. Factor analysis has been applied to identify dimensions of QOL. It adds to the understanding of the construct of life quality. Then explanatory factors of QOL have been identified by applying ordered probit regression analysis.

2. To see if factors of QOL vary across area or among income groups, regression models have been used with dummy variables and their interaction effects.

3. Principal component method has been applied to construct indices for every household for both objective and subjective dimensions. Then, correlation coefficient has been used to study relation between objective and subjective QOL.

1.10 Outline of the work

The present study has been organized in the following chapters.

Chapter 1 provides an introduction to the study by giving the background of QOL studies, definitions on QOL and distinguishes between objective and subjective dimensions of QOL. In this chapter, the statement of the problem, objectives, hypothesis, study area and reference period, methodology, outline of the work, scope and limitation of the study have also been incorporated.

Chapter 2 presents review of literatures and conceptual framework of the study.

Chapter 3 introduces the study area—the city of Guwahati. It includes description of infrastructural facilities, living conditions and status of environment.

Chapter 4 gives a description of methodology used for the study. It describes the nature of information collected and the statistical methods that have been used to analyze data.

Chapter 5 describes the relation between QOL and environment. The explanatory factors of QOL have been found out. In this chapter, it has been tried to examine if factors of QOL vary among different income groups and among different areas. This chapter also offers a comparative study of objective and subjective dimension of QOL.

Chapter 6 discusses findings of the study. It also suggests a number of measures for improving QOL in Guwahati and ends with conclusion of the study.

1.11 Scope of the study

This study assumes significance because of the following reasons-

1. It may help policy-making process for maintaining good quality of environment to ensure a better QOL of the people.

2. The results may be useful for creating awareness among laymen, social and health workers, and the authorities on the prevailing condition of life in the city.

1.12 Limitations of the study

The proposed study is not without limitations. Some of the limitations are mentioned below.

1. To study the relationship between QOL and environment a simple aggregative or linear additive model has been used. The key assumption underlying the technique is absence of measurement error. There is scope of further improvement in this respect.

2. This is a cross sectional study. But longitudinal study can give a clearer picture about the relation between QOL and environment and changes in it.

Besides these methodological limitations, environment has been considered as a sum total of physical, economic and social environment. While pursuing this study, interactions among these domains and their impact on QOL have not been separately approached. It can be explored in further research. In this work QOL has been measured by the condition of living environment and satisfaction from such condition. But how important these different components are in a person's life have not been taken into consideration. It is also one important issue that future research work can explore.

CHAPTER 2

Review of literature and conceptual framework

Literature survey shows that QOL is a broad issue which can be approached from various perspectives. It has been found that QOL studies have been conducted from different perspectives. Therefore, these studies by various authors have been organized in such a way to give a comprehensive idea about various dimensions of QOL, its relation with environment and conceptual frameworks used to carry out QOL research.

2.1 Studies on objective verses subjective QOL

An important question in QOL study centers on the issue whether QOL is objective or subjective in nature. There is a group of authors who propound that QOL is objective and it is measured with the help of social indicators or direct observations. But the concept of objective QOL has been challenged by another group of authors who claim that QOL is a qualitative term and there can not be any objective measurement of QOL. But at the same time it has been also believed by some authors that QOL is combination of both objective and subjective dimensions. Therefore, a synthesis of studies related to objective dimension, subjective dimensions and studies combining both objective and subjective dimensions have been discussed below.

QOL studies in the objective dimension mainly aim at constructing indices of life quality. In order to measure what extent basic needs of the world's poor have been fulfilled, the concept of Physical Quality of Life Index (PQLI) has been introduced by Morris (1979). The author is not in favour of using Gross National Product (GNP) as a measure of welfare. Morris considers QOL from an economist's point of view to measure human well being in quantitative way by combining life expectancy at age one, infant mortality and literacy to construct a composite index, giving equal weights to each indicator. Study

in the same direction has been conducted by Shin (1979) who has constructed composite indices for health, income, safety and security, housing, education, work, leisure and recreation, index of love as well as index of freedom and equality by applying the diffusion index technique in South Korea. It has been found that QOL has improved over the years. It is advancement over what Morris has done in the sense that Shin has considered many new elements in the index besides basic needs. Gradually the concept of human well being started coming into the forefront of QOL literature. Pacione (1980) has studied QOL in Strath Kelvin of Strathslide to determine the values assigned to individual factors which constitute general feeling of well-being of the people. The author has taken the following indicators - standard of living, national government, consumer services, health, job, house, districts, mobility, leisure, anticipated standard of living and anticipated environment. It has been found that the standard of living has affected QOL most significantly followed by job satisfaction. Very often QOL indicators have been also used in making policy decisions. Othick (1983) has found QOL to be a significant indicator for studying human welfare in historical perspective. Any governmental efforts for welfare enhancement must encompass aspects of good QOL. Otherwise policy measures would fail to be acclaimed. Dasgupta (1999) has presented a study on QOL indices and policy evaluation techniques. By QOL the author has referred to 'wellbeing', 'welfare' and 'standard of living'. The author states that socio economic and ecological system have been neglected by planners but integration of general resource allocation mechanism, environmental and resource economics into policy evaluation practices is essential.

In most of the studies related to objective dimension, phrases like standard of living, human development or QOL have been used interchangeably. Behera et al. (1996) assess disparities in standard of living at state level in India. Regional disparity has been observed among the states of India. Majumder (2001a) studies the cross-country divergence in standard of living. The author prefers the HDI as standard measure of QOL to GDP or labour productivity. It has been found from the study that QOL depends not only on the person's personal income but also on various physical and social conditions.

Divergence has been found in QOL measured in terms of the HDI and per capita real gross domestic product over 1960-1995 across 91 countries. Majumder (2001b) in another study tries to determine the urban QOL in 22 cities of India having one million plus population each. To determine QOL, the author has considered a set of indicators. It has been found that QOL is the worst in Delhi and Varanasi offers the best. Mishra (2002) in "Population Dynamics Environment and Quality of Life in North East" says that quality of life is adversely affected by increasing pressure of population in this region. Rising population puts pressure on the existing resources and the environment which may alter the existing system. The author finds that the North Eastern Region is lagging behind in comparison to other region in India. Ngullie (2002) has found that standard of living as well as consumption of public goods and services including negative spill over determine the quality of life in Dimapur, India. It has been found that QOL is better in those areas between the central business districts and periphery because of high standard of living. But QOL is monotonically increasing due to consumption of public goods and externalities as distance increased from central districts. The study could have been more interesting if it had taken into account the subjective aspects of QOL. Dutta et al. (1997) has described development experience in India from human development perspective in the last two decades. The study has been considered necessary because development should make provision of basic capabilities which enhanced quality of people's lives. The study shows that Indian states are in the need of efforts for improving QOL of its people. Lai (2000) has constructed an index by applying Principal Component Analysis (PCA) on the same components of the HDI to measure the progress of human development in the world. The use of PCA is an improvement in the construction of the index. From these studies, it is apparent that there may be spatial variation in QOL or standard of living. It has also been found that there may be cross sectional difference in factors or determinants of QOL. Jirojanakul et al. (2003) has investigated into the determinants of QOL of children of urban parents and children of construction workers in Bangkok. It has been found that the father's income and education, type of school, mode of transportation to school and the amount of time that the child spends on extra study courses are significant variables. But these variables affect children of urban parents and

those of construction workers differently. Extra sports related activities and extra work other than house work have been found to improve QOL of urban children. But QOL of construction worker's children have been found to be directly related to father's education and income. Takahashi (1979) has shown that there are differences in QOL across different provinces of Thailand. Therefore, from the studies mentioned above it can be said that there may be difference in factors of QOL across different areas and among different group of individuals.

With the progress of studies in objective dimension, subjective dimension has also started getting attention in QOL literature. Subjective QOL refers to the self reported well being. Subjective indicators have been employed more at individual level and measure individual's level of satisfaction or happiness with life as he or she experiences it. That is, they represent a subjective, introspective and personal experience-based concept. Subjective QOL is thus indicated by the psychological state whether affect or cognition rather than by objective conditions and settings. Seik (2000) has measured QOL in terms of overall life satisfaction in Singapore and levels of importance and satisfaction towards various aspects of life. In general, it has been found that respondents with higher household incomes are more satisfied with housing and working life and they appear to value aspects such as family life, leisure and self-development more than those with lower household incomes. On importance and satisfaction of different aspects of life, respondents have consistently rated health and family life as more important than other aspects of life, and they have remained most satisfied with the aspect of family life. The study shows that on an average people are satisfied with overall QOL but satisfaction and importance assigned to a particular aspect of life are not the same. It depends on the circumstance of living. In an effort to relate material condition of life and satisfaction from material condition, Sirgy (1998) establishes foundation for the theory of materialism and QOL which states that QOL or overall satisfaction is partly determined by standard of living. Satisfaction with ones standard of living, in turn, is mostly determined by evaluation of one's actual standard of living compared to a set goal. Materialists set their standard of living goals unrealistically high and experience dissatisfaction with their own

standard of living for the tendency to spend more than income to fulfill the set goals. Because of over spending and over consumption materialists feel that what they own is inadequate and it creates dissatisfaction. Such dissatisfaction contributes to their feelings of unhappiness with life. Some other studies have also tries to explore relation between income level and satisfaction. Clark et al. (1996) wants to examine if there is any relation between job satisfaction and income because it is believed that happiness depends upon relative income. The objective of the author is to provide a test of the theory that happiness depends upon a comparison level of income. Well being has been found to be weakly correlated with income. It has been also found that if income is kept constant, satisfaction declines with rise in level of education. Easterlin (2006) has tried to explain how happiness swings along life cycle. In the United States happiness rises slightly, on average, from ages 18 to 51. Beyond midlife, happiness edges downward as a continuing decline in satisfaction with health is joined by diminishing satisfaction with one's family situation and work; these negative trends are set considerably, however, by a sizeable upturn in later life in people's satisfaction with their financial situation. The author claims that the finding of the study supports the bottom up approach, in which the pattern of life cycle happiness is the net outcome of satisfaction in principal life domains, and satisfaction in each domain is the product of both objective conditions and goals or aspirations in that domain.

In a longitudinal study, Westaway (2006) tries to assess satisfaction with personal and environmental domains of QOL taking into account group and time effects. The sample comprises four groups of residents: relocated, awaiting relocation, site tenure allocated and a group from the squatter camp. It has been found that the groups from the squatter camp are the most disadvantaged in their personal and environmental quality of life, good health is essential for life satisfaction and housing is the most important aspect of neighbourhood satisfaction. But health is an often ignored aspect (Bowling, 1995). Bowling aims at providing population norms on the dimension of life that people perceive to be important in life and health related QOL. Bowling has conducted a national survey based on a large random sample in Great Britain. The most important

thing for the people has been found to be relationship with either family or relatives in their lives, followed by their own health, health of another person and standard of living. It has been discovered that some items which have been ranked as important by the public are absent in the most popularly used health status scale. Another study conducted by Rahtz et al. (2004) in the East-Coast area of the United States establishes that community residents' satisfaction with individual health care programmes affects overall satisfaction with community health care programmes which in turn affected community QOL and life satisfaction. Satisfaction has been measured worldwide also for better understanding differences between nations in terms of life satisfaction and aspects of socio-economic development (Abdallah, 2008). Natural, human and sociopolitical capitals are all found to be strong predictors of life satisfaction. The author claims that such study may be controversial but consideration of a subjective component can help provide important insights into the study. All these studies related to subjective dimension are mostly in support of bottom up theory in which life satisfaction is functionally related to satisfaction with one's life domains and sub domains. The opposite approach to bottom up theory is top down theory. According to the top down theory, one assumes that the person 'inside' has certain qualities or traits that enable him or her to experience life in a positive way more or less independently of outside events (Cramer et al., 2004). In this approach global feature of personality are thought to influence the way a person react to an event. This approach is mostly supported by philosopher (Diener, 1984). There is always a controversy regarding which theory is to be followed. Top-down and bottom-up theories of subjective well being are likely to remain in contention for the future also (Heady, 1991).

Literature review has shown that there are differences in perceived QOL. Blake et al. (2000) have studied QOL of African American from a family perspective on the basis of resource exchange theory. Significant differences have been noticed in perceived QOL of life of males and females, with the African males perceiving higher QOL. Milfont et al. (2004) studies environmental attitudes that might underlie ecological behaviour. Environmental attitude has been defined as collection of belief, affect and behavioural

intentions a person held regarding environment related activities or issues. Females score higher than man on preservation factor where as men score higher on utilization factor. Sometimes differences in perceived QOL may be attributed to some other factors like health status, amenities and so on. Besides difference at individual level, spatial factors also play an important role in determining subjective well being (Brereton, 2007). The author proposes an alternative set of indices based on subjective well-being data linked to regional level amenities. It has been found from the study that variation in subjective well being across nations is caused by the extent of availability of amenities such as climate, urban and environmental conditions. In another study in the same direction, Moro (2008) has found that variation in subjective well being across locations is not random, but is driven to a large extent by the endowment of location-specific amenities. Ng et al. (2005) finds that the quality of housing determines QOL and place belonging. Sarma (2004) focuses on social and psychological aspects and problems of respondents of age 60 or above in Guwahati. The main problems found among the elderly are poor health, lack of scope for utilization of time, lack of companionship, financial problem and social obligation of the elderly towards their children. The elderly finds it difficult to go out owing to poor condition of urban amenities like roads, improper lighting of the streets and increasing traffic. The perception of residential environment has been examined by Ng (2005a) also in the crowded city of Hong Kong. The common believe is that people are dissatisfied with the crowded environment. But the study mainly finds that respondents are quite satisfied with their residential environment. The author has commented that it might happen due to easy availability of services and economies of time which helps maintain satisfaction in spite of crowded living condition. Thus, it is clear that the dimensions of subjective QOL also vary across individuals and spaces.

For understanding of QOL mere exploration of either objective or subjective QOL is not enough. QOL is a multifaceted construct which requires multiple approaches from different perspectives. A thorough understanding of subjective well being requires knowledge how objective conditions influence people's evaluation of their lives. Cummins (2000) opines that if QOL is to embrace the totality of human life, then both

objective and subjective dimensions have to be included. There are always distinctions between these two approaches. The author takes 10 studies conducted on western population who are unlikely to experience marked privation. All these studies have both objective and subjective variables. Poor correlation between objective and subjective dimension of QOL has been found in this study. This happens due to the mechanism called homeostatis. The purpose of homeostasis is to keep people feeling positive about themselves and their lives, despite variations in their surrounding environment that could lead to negative states, such as depression, stress, and anxiety (Garretto, 2000). It is normally maintained within a quite narrowly defined range and the processes of adaptation explain independence of objective and subjective QOL. But a very poor objective condition can defeat homeostasis and once this occurs, the objective and subjective QOL correlates strongly. The finding is supported by many other studies. In case of low income group strong correlation has been observed between like satisfaction and income in a study conducted in Calcutta among slum dwellers, sex workers and homelessness by Diener et al. (2001). It has been found that the relation between income and life satisfaction is strong. Howell et al. (2006) have found that wealth is positively correlated with income level of poor and marginalized section. This is apparent from a case study conducted among 'Orang Asli' of Peninsular Malaysia conducted by the authors. Clearly, income has a strong relation to life satisfaction among these very poor individuals.

But it has been also found that an increase in real income is unlikely to increase subjective well being of the people who are enough rich. Dodds (1997) examines a variety of approaches to well-being from different views introduced by a host of authors like Michalos, Scitovsky, Easterlin, Galbraith, Rawls, Sen, Maslow, Boyden and Neef. Well-being is interpreted as a state of mind, as a state of the world, as human capability or as satisfaction of underlying needs. From this study, it has been found that an increase in real income is unlikely to increase perceived well-being in the already affluent societies. Chan (2002) examines the degree of change in responses provided by panel respondents in both objective and subjective measures of economic well-being of the

elderly in Singapore and Taiwan for four years. The degree of association between these two types of measures has been found to be weak. The findings support the hedonic treadmill argument that individuals adjust their expectations as their material conditions change. Richmond et al. (2000) tries to analyze perceived QOL of non farm rural Ontario resident both in terms of absolute and relative QOL. It has been found that absolute or overall QOL is most influenced by respondents' personal life and environmental satisfaction where as relative QOL is attributed to the amount of land surrounding home, education, income, length of residency and presence of children at home. The relation between satisfaction and objective life circumstances has been found to be significant but not strong in a study by Marshall et al. (1996) among the homelessness and mentally ill homelessness person. The authors wants to examine life satisfaction associated with objective life circumstance independently of the co-variation of psychological systems and if there is any causal relationship between objective and subjective well-being. Panel data over a period of two years links objective housing status with subsequent income and subsequent satisfaction with housing. Further, the study suggests that objective life circumstances are primarily associated with domain specific rather than general life satisfaction. Objective indices of life quality appear causally linked with subsequent domain specific life satisfaction in an attempt to study the relation between objective dimension and subjective dimension. The author tries to explain life satisfaction by income which is an objective variable. Thus, it has been found that objective and subjective QOL are poorly correlated. Although poorly correlated, these two measures are important in studying QOL. Ruggeri et al. (2001) has combined both objective and subjective information to assess QOL in psychiatric patients. The authors combine both subjective and objective information to assess QOL in psychiatric patients. The authors comments that objective measures are more suitable in detecting treatment effect and subjective information is important to interpret objective data. Such low correlation between these two dimensions has been explained in a different way by Saris (2001). The author opines that the methodological reason for repeatedly finding a weak relation would be measurement error, non liner relation or suppression of the relationship by other variables.

From the foregoing discussion, it has been found that satisfaction from one domain may affect satisfaction from other domains which in turn may spill over to overall life satisfaction. Objective indices have been found to be causally linked with subsequent domain specific life satisfaction. But the important thing to notice is that objective QOL correlates poorly with subjective QOL. Whether the study is objective or subjective in nature, environmental quality is getting more importance in evaluating QOL now- a-days owing to the fact that environment is a source of human well being. Owing to environmental degradation, material affluence and high standard of living can not ensure superior life quality. Therefore, some QOL studies conducted in the context of living environment have been discussed below.

2.2 QOL and environment

QOL is linked to environment. The quality of environment plays an important role in determining QOL. To explain how environment and QOL are interlinked Alcamo et al. (2003) has provided a four-year international work programme designed to meet the need of decision- makers for scientific information on the links between ecosystem change and human well-being. This report tries to show that ecosystem influences the level of well-being by various types of functions. The direct and indirect services provided by the ecosystem have implication for QOL and vice versa. There is a theory that subjective appreciation of life depends in the first place on the objective quality of life; the better the living-conditions in a country, the happier its inhabitants will be (Veenhoven, 1995). Livability-theory as propounded by Veenhoven focuses on absolute quality of life, rather than on relative difference. People are presumed to be happy in good living conditions even if they know that others enjoy even better conditions. 'Good' living-conditions are presumed to be conditions that fit human nature well; in other words, living-conditions that are 'livable'. For most animals livability is largely an ecological matter, for the human species societal qualities are involved as well. The livability of one's society is the degree to which collective provisions and demands fit with individual needs and capacities. Livability-theory is closely connected to the idea that there are universal

human needs. It sees human societies as collective arrangements to gratify these needs, and assumes that societies can be more or less effective in that respect. Without taking into consideration the aspect of environmental well being the extent of human development is not complete. Therefore, it has been proposed that element of environment has to be included somehow to have better idea about human well being (Dasgupta, 1999; Neumayer, 2001 and Sagar et al., 1998).

There are plenty of studies which show that environmental quality affects life. Parikh (2004) establishes link between the impact of air pollution on human health and subsequently to increased morbidity. The author presents a case study of air pollution in Mumbai to estimate the health costs using the cost of illness approach. It has been found that morbidity is highly attributed to air pollution. Besides air pollution, the problem of waste is one of the major challenges which become intense with urbanization and changing lifestyle especially in developing countries. The problem of solid waste has direct bearing on QOL (Baud et al. 2001; Anand, 1999; Murad, 2007 and Afroz et al. 2009). Especially for India solid waste is a major problem (Dahiya, 2003). According to the author, it is mainly due to lack of institutional cover and poor financial situation of local government. Similar case study has been conducted in ten European countries by Welsch (2006a) to explore the relationship between pollution and reported subjective well-being (happiness). To examine how self reported well-being varies with prosperity and environmental condition, a set of panel data from happiness surveys has been used along with data on income and air pollution. Air pollution has been found to play a statistically significant role as a predictor of inter-country and inter-temporal differences in subjective well-being. Another study by the same author (Welsch, 2006b) has shown how self-rated subjective well-being (life satisfaction or happiness) varies with income and environmental quality. The happiness function so established allows the determining of the implicit monetary value of improved environmental quality by computing the marginal rate of substitution of income for abatement. Welsch extends life satisfaction approach to a comprehensive welfare analysis by estimating not only the monetary benefits of air pollution abatement but also the associated costs in terms of income

foregone. The author makes strong assumption of cardinality to compare the mean value of satisfaction and mean value of air pollutant at the whole-country level. With respect to pollution this paper focuses on nitrogen dioxide. Using a cross-national data set with 54 countries, air pollution has been found to play a statistically significant role as a predictor of inter-country and inter-temporal differences in subjective well-being. It has been found that citizen having better environmental amenities enjoy better QOL in comparison to those who have been suffering from high levels of atmospheric pollution, environmental disasters and traffic congestion from a case study in China (Smyth et al., 2008). Rehdanz et al. (2007) try to explain differences in self-reported levels of well-being in terms of environmental quality. The evidence suggests that even when controlling for a range of other factors higher local air pollution and noise levels significantly diminish subjective well-being. But differences in perceived levels of air and noise pollution are not capitalized into differences in house prices because housing market is regulated by Government in Germany. MacKerron (2008) has examined the relation between life satisfaction and air pollution in London. It has been found in the study that life satisfaction is significantly negatively associated both with subjectively perceived levels of air pollution and with air pollutant measurements. These studies clearly show that there are differences in environmental qualities over space and such differences in environmental qualities or amenities have differential effects on QOL.

Within the broad environment, the condition of housing is the first and basic environment in which people live. Along with environmental quality, the nature of housing condition and neighbourhood is also equally important to determine QOL. Quality of housing also plays an important role in determining QOL. Fakharuddin (1991) studies quality of urban life in Lucknow. It has been found that housing and material standards are strongly correlated with QOL. Oktay (2002) analyzes housing environment in the context of climate of Northern Cyprus. According to author, the basic environment of a person's life is the house where a person lives. But it has been found that new housing development and climatic condition are not being considered at all in orientation and formation of new residential building in Northern Cyprus. The finding supports the fact that material

condition of living is an important aspect of life standard. Bonaiuto et al. (2003) explores the relationship between inhabitants and their neighbourhood of residence in urban environment in the city of Rome. This study focuses on the relationship between people and their residential environment at home, neighbourhood and city level. The authors have used two instruments to measure quality of relationship between inhabitants and their urban neighbourhood. People who are more satisfied with building density or volume have been found to experience a better aesthetic quality of buildings. The author proposes for further research on both objective and subjective environmental evaluation which could be subsequently considered, compared and complemented within environmental management strategies and interventions. Grootaert (1986) finds that levels of living depend not only on individual characteristics, but also on living environment. Rather QOL has been found to be an important factor for decision of residential location. Blomquist et al. (1988) ranks 253 urban countries on the basis of secondary data, to assess their QOL for three subsets of amenities: climate, environmental quality and urban conditions. The authors estimate prices of amenities with the help of implicit price function having wage and housing expenditure differentials. The QOL ranking is based on national hedonic model having wage and housing expenditure differentials. The preference for a given wage and housing condition depends on amenities. The housing-related environment matters considerably in residents' QOL and in their sense of belonging. Therefore, housing is an element to be taken special care of in the context of urbanization (Westaway, 2006).

The present day environment is an artifact of man made environment which is the result of urbanization. Very often urbanization and industrialization move together. Studies have shown that both industrialization and urbanization have affected life quality. While studying QOL among people living in mining and non mining area of Goa, Noronha et al. (2005) find that environment of mining areas affects QOL of people living in the surroundings. Boro (1994) assesses the impact of industrialization on physical and socio economic environment in Guwahati. The survey reveals that 75 percent of the industries cause pollution in different forms like smoke, noise, water borne effluents and smell. It

affects human health plus physical environment and has changed the traditional agricultural life style of the people in this area. In a study conducted by Saikia (1995), the impact of growth of 'Guwahati' as urban center on the economy of three villages centre has been studied. The villages have been selected on the basis of proximity to the city. It has been found that the residents of nearest village are benefited by the growth of employment opportunities in the city and wage of those villagers' increases who stays back. Adverse economic consequences in the form of less intensive agriculture, lack of self sufficiency and migration of educated people have been observed in the other two villages as they are far away from urban centre. Saikia (1996) reports on spatial development of the Guwahati city and how it affects living condition. The author comments that there is lack of proper drainage system and the system of solid waste collection is not hygienic and scientific. It has also been reported that provision of open space and recreation services are inadequate and causes severe problems. As a consequence of urbanization, Borgohain (1996) observes wide economic disparity in the society of Guwahati. Economic disparity has been found to be the least in new residential area and the highest economic disparity is observed in relatively new residential areas. Another study by Sarmah (2001) which evaluates health needs of slum dwellers in Guwahati, finds that the environment in the slum is not conducive for good living condition. Hema and Jamal (2004) also study the perception of environment of slum dwellers of Thakur Rabindranath area of Srinivaspuri in Delhi city. It has been found that slum dwellers are aware of effects of socio cultural pollution on their mental health, habits or social values but their condition of living is very unhygienic. Slum dwellers feel that water stagnation, sewage, open toilets and lavatories, waste disposals and fuel based items contribute the most to air and water pollution. The following studies make it clear that condition of neighborhood significantly affect QOL. For this reason it is also equally important to take into account residents views regarding these problems while implementing any plan of community development.

QOL is determined by both external conditions of living and psychological responses to such condition by an individual. Whereas it is impossible for policy makers or any

designated authority to alter the internal reaction to a phenomenon from outside, one can concentrates on improving the external condition of living which in turn can trigger off change in the internal psychological responses. Buettner (2009) has found that people are ready to bear costs for any measure implemented with a purpose to improve regional attributes including quantity and quality of public services for improvement of QOL. Spash (2009) reports on empirical work extending the standard economic approach to valuation by including psychological and philosophical factors to measure any effort for bio-diversity conservation. The author finds that inclusion of such subjective components can lead to more convincing results than the economic indicators alone. That is, improving QOL also requires the preservation of ecosystems and maintenance of environmental quality besides improving income and material condition.

The above mentioned studies have shown that there is no standard procedure to conduct research on the topic. It is wide ranging and the approaches used by different authors are different in most of the cases. Yet few authors have provided some conceptual framework to guide QOL study. Some of the conceptual frameworks or schema that underlies QOL research has been discussed subsequently.

2.3 Conceptual frameworks used in QOL studies

The conceptual frameworks discussed below address different issues. But they have mostly discussed components of life or the interrelationships among environment, ecology and QOL. Human depends on their environments to satisfy needs and desires. There is always interaction between human and environment. Very often human being transforms environment which may be called an artifact of natural environment. It has also been called urban area or city. The process of transformation in which human behaviour is modified in the effort to cope with, adapt to or change environment to achieve a better person–environment adjustment has been explained in Bubolz' ecological approach (Bubolz,1980). The artificial environment or man made environment has to be take special care of to sustain in the long run. Camagni et al. (1998) has

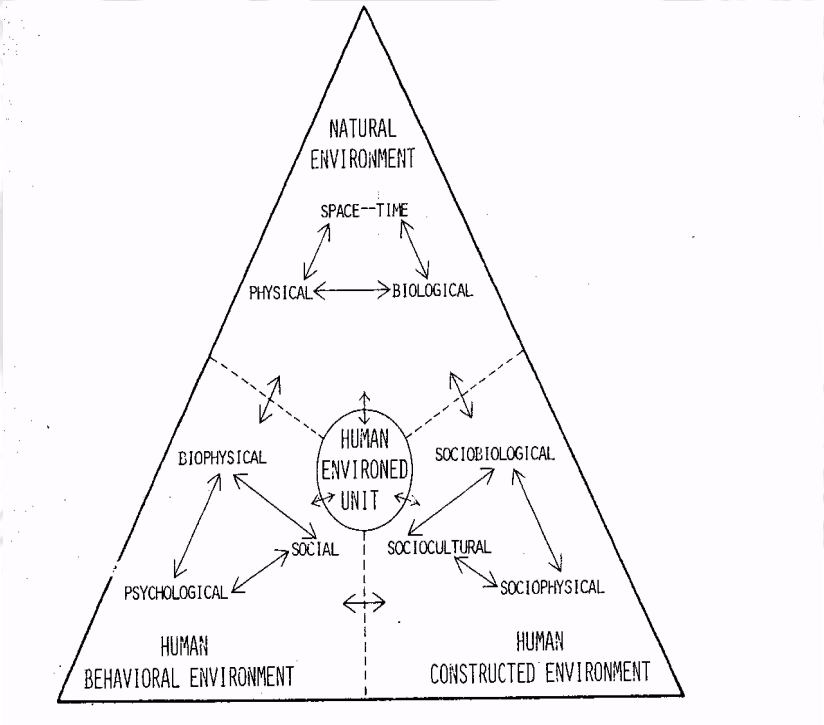
developed a model to approach sustainability and livability of city environment. Here, environment is interpreted in a broader sense to cover ecological, economic and social environment. Another conceptual framework by Shafer's (2000) integrates human ecosystem and sustainable communities to show that QOL is created by an on going interaction between community, environmental and economic qualities. The conceptual framework provided by Shafer emphasizes on sustainability of interaction between physical and economic environment whose resultant balance should be reflected in society. In the same direction to make cities more sustainable and to improve QOL, Newman (1999) has constructed a model. This model emphasizes on reduction of resource use to cut down the quantity of wastes.

Few empirical studies have been conducted to provide some guidelines to improve QOL. One such works is done in Detroit area region of Michigan City (Marans, 2003). The quality of neighbourhood and environment are crucial for enhancing QOL. Sirgy et al. (2002) has conducted research to show that satisfaction of neighbourhood attributes affect life satisfaction through a satisfaction hierarchy. To improve QOL, a person should be capable of doing his or her functions well. Sen (1993) has introduced the capability approach which has brought about revolutionary change in the concept of human development studies. The capability is the evaluation of actual ability to perform various activities to live in descent way. Sen's idea is intrinsic in the concept of environmental quality of life introduced by Rogerson which has considered characteristics of man as well as environment (Rogerson, 1995). All the approaches mentioned above have been discussed separately below.

2.3.1 Bubolz's ecological perspective

Bubolz (1980) has proposed a holistic human ecological approach. The model provides a framework for conceptualization and analysis of QOL in which the perspectives of several disciplines could be utilized from a system approach. Such framework focuses on structure of the field and the interfaces between systems unlike the traditional interdisciplinary sense in which one synthesizes the analysis.

Let the human ecological framework be explained first. A human ecological framework derives from general ecological model in which organisms are regarded as interacting with their environment, i.e. as an ecosystem. A human ecosystem involves production, circulation, transformation and storage of energy, matter and information through biological, physical and social progresses. A human ecosystem has three central organizing concepts: human environed unit, environment, interactions and transactions between and within the components. A general model of human ecosystem has been presented by the author as reproduced in Figure 2.1.



From Bubolz et al. (1980)

Fig. 2.1: The human ecosystem

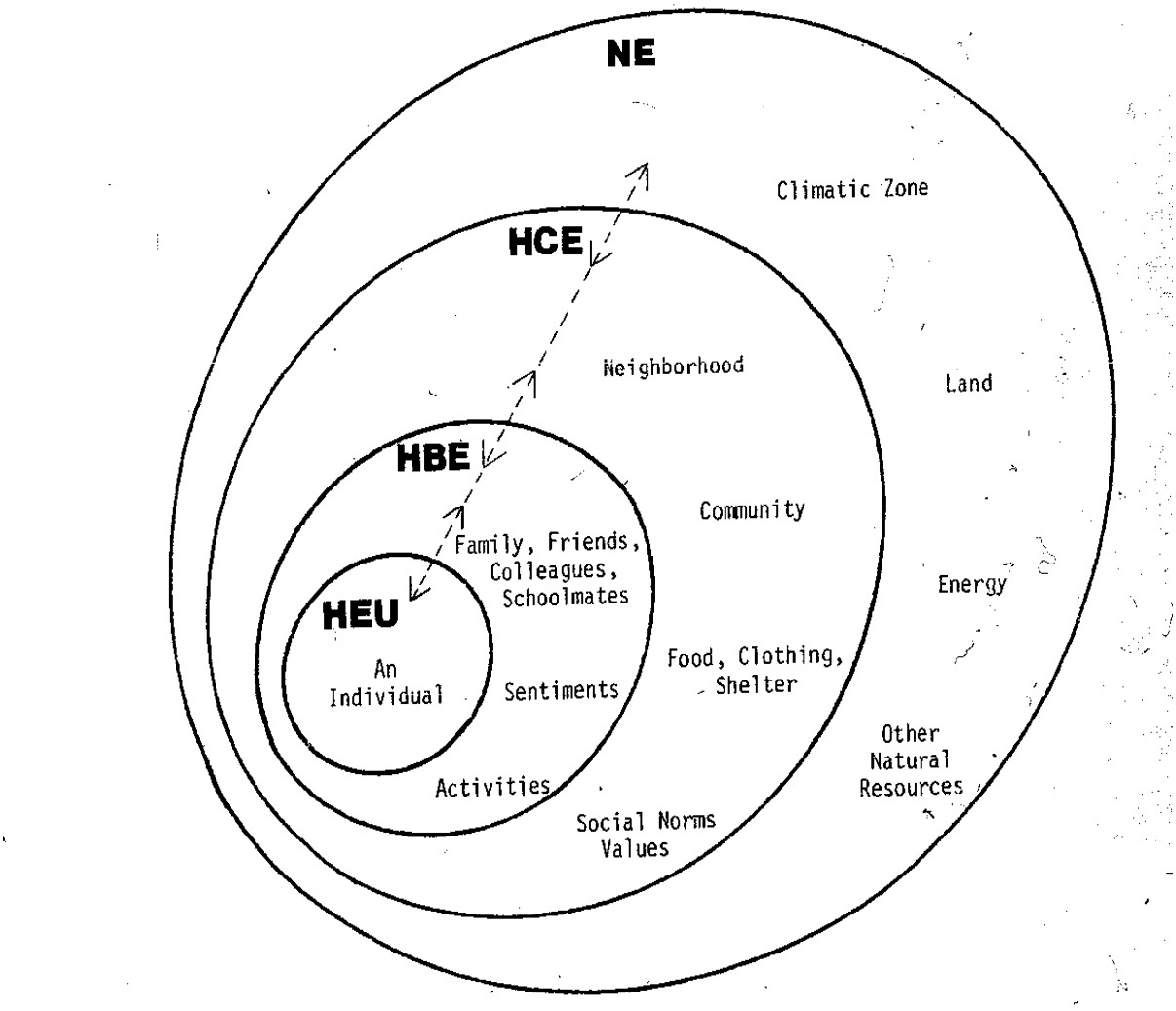
Here, environment includes three conceptually distinct but interrelated environments: natural, human constructed and human behavioural. These environments furnish resources and conditions necessary for life and constituted a life supporting system. The natural environment (NE) is defined as the environment formed by nature with space –

time, physical and biological components. These interdependent components constitute the basis for human life support system.

Human environment unit lying at the center of Figure 2.1 can be either a single individual (with biophysical, psychological and social dimensions) or plurality of individuals who share same feelings of unity, common resources, goals, values and interests. The human environed unit is located in a particular space at a point in time with some sense of common identity. A family is an example of human environed unit.

Human constructed environment is an artifact of natural environment. Human changes the natural environment and create the human constructed environment (HCE). Human transformations of physical and biological environments, other human, social and cultural constructions such as educational, political and religious environments have been included in the human constructed environment. The environment constituted by human beings for other human beings is called the human behavioural environment (HBE). It is the environment of socialized human beings and their interrelated behaviour: biophysical, psychological and social.

Bubolz uses Figure 2.2 to illustrate environment as separate and distinct in order to present their components more clearly. But they are embedded within each other in which the HBE is within HCE, which, in turn, is within the NE. All of these environments and their components have been considered to exist objectively in the sense that they are there regardless of whether or not individuals or groups are aware of them. Environments also possess reality to the extent and manner in which they are perceived by the human environed units



From Bubolz et al., 1980

Fig.2. 2: A human ecosystem with example of the near HBE, HCF and NE

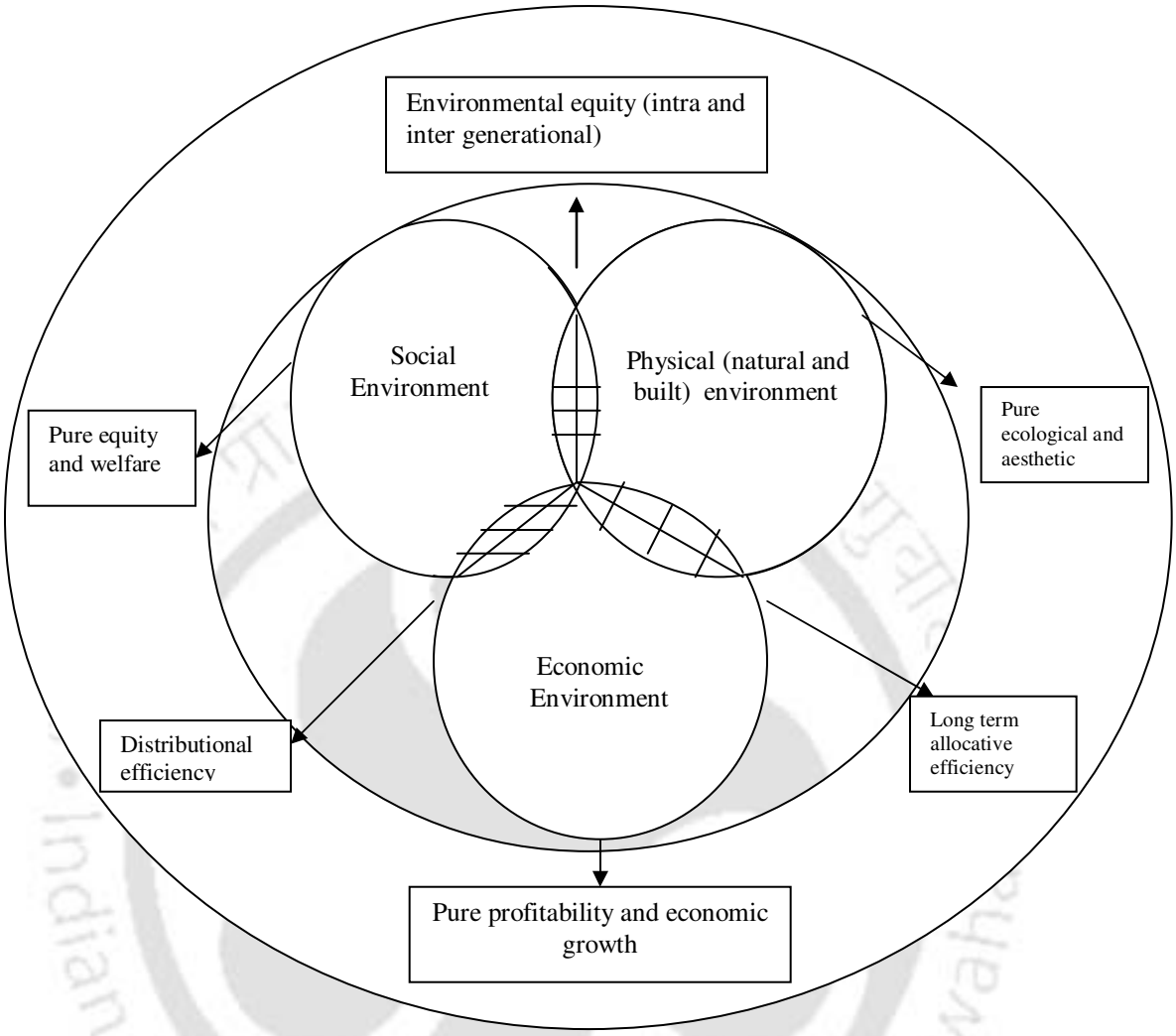
Interaction in an ecosystem occurs when any part of an ecosystem influences any other part and is influenced or acted upon in turn. Human depends on their environments to satisfy needs and desires. Thus, much human behaviour is modified in the effort to cope with, adapt to or change in environments to achieve a better person–environment fit. In this process of transformation one is always affected by the other.

2.3.2 Camagni's model of sustainable city

Camagni et al. (1998) has developed a model, which focuses on sustainability and livability of city environment. In a city three different environments coexist: the physical (natural and built) environment, the economic environment and the social environment. Each of them explains a part in combination the existence and continuity of a city. Here, environment is interpreted in wider sense than the pure ecological one, enlarging its definition to economic and social environment. These three environments interact deeply among themselves and generate both cost and benefits.

The economic environment justifies the presence of a city through agglomeration economies concept, i.e. through the exploitation of specific socio economic advantages owing to spatial proximity, namely indivisibilities and synergies. Social environment provides opportunities for individuals to avail many social amenity resources and guarantee socialization opportunities and access to many public goods. The third environment in a city is the physical or natural/built environment. Physical environment is expected to provide externalities such as presence of urban green areas and environmental facilities, clean air, a pleasant city form, pleasant social environment and peaceful living. The interaction among economic and physical environment, physical and social environment and social and economic environment may give birth to both positive and negative externalities.

Keeping in view the externalities that these three environments generate, the concept of urban sustainability can be assessed in two fold ways: static sense and dynamic sense. A city would be sustainable in static sense if sum of all positive externalities stemming from all these three types of environment are greater than the sum of all negative externalities caused by the interaction. The dynamic interaction is about the co-evolution of these three types of environment. Ethics, equity, regulations, market incentives have been considered alternatively as elements to be included into the picture in order to ensure true sustainability for economic development.



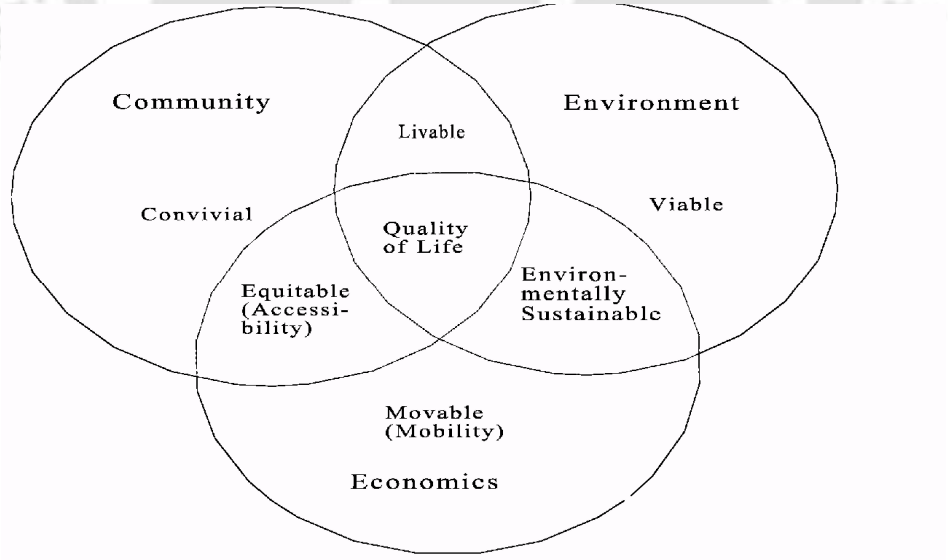
From Camagni et al.,1998

Fig. 2.3: The locus of sustainability principles and policies

Interaction among economic, social and physical environment have been shown by using a model represented by Figure 2.3. This model shows that the condition under which such a co-evolution can actually be reached is a transformation. Any short-term policy of change must be accompanied by long term perspective. The progressive change should be accompanied by distributive efficiency and environmental equity principles. The model also shows that condition of sustainability can be reached under the condition of transformation integrated with regulatory principles governing these three environments. To experience sustainable development, a city requires a multifaceted strategy in which socio economic interests are brought in harmony with environmental and cultural interests.

2.3.3 Shafer's scheme

Shafer's (2000) research is based on the concept of human ecosystem and sustainable communities. Shafer looks upon quality of place as an outcome of interaction between physical and social domain. Sustainability is considered as the resultant of interaction between physical and economic domain where as equity is considered as the resultant of a balance between economic and social domain. This approach implies that social, spatial, environmental, economic and land-use planning can not be done in isolation. As per the implication of human ecological perspective, any community to be sustainable and to provide good QOL, equilibrium among all factors must be achieved. Failing such equilibrium, a community can not reach the optimal level. This requires public programmes and policies to be viewed in an integrated manner. The author extended the human ecosystem approach to determine how greenway facilities are contributing to QOL in the U.S.A. Green way based trails is a part of a resource that has the potential to influence many QOL factors. Shafer conceptualizes a scheme given in Figure 2.4 to recognize basic relationships between components parts of a place in terms of its physical, social and economic realms.



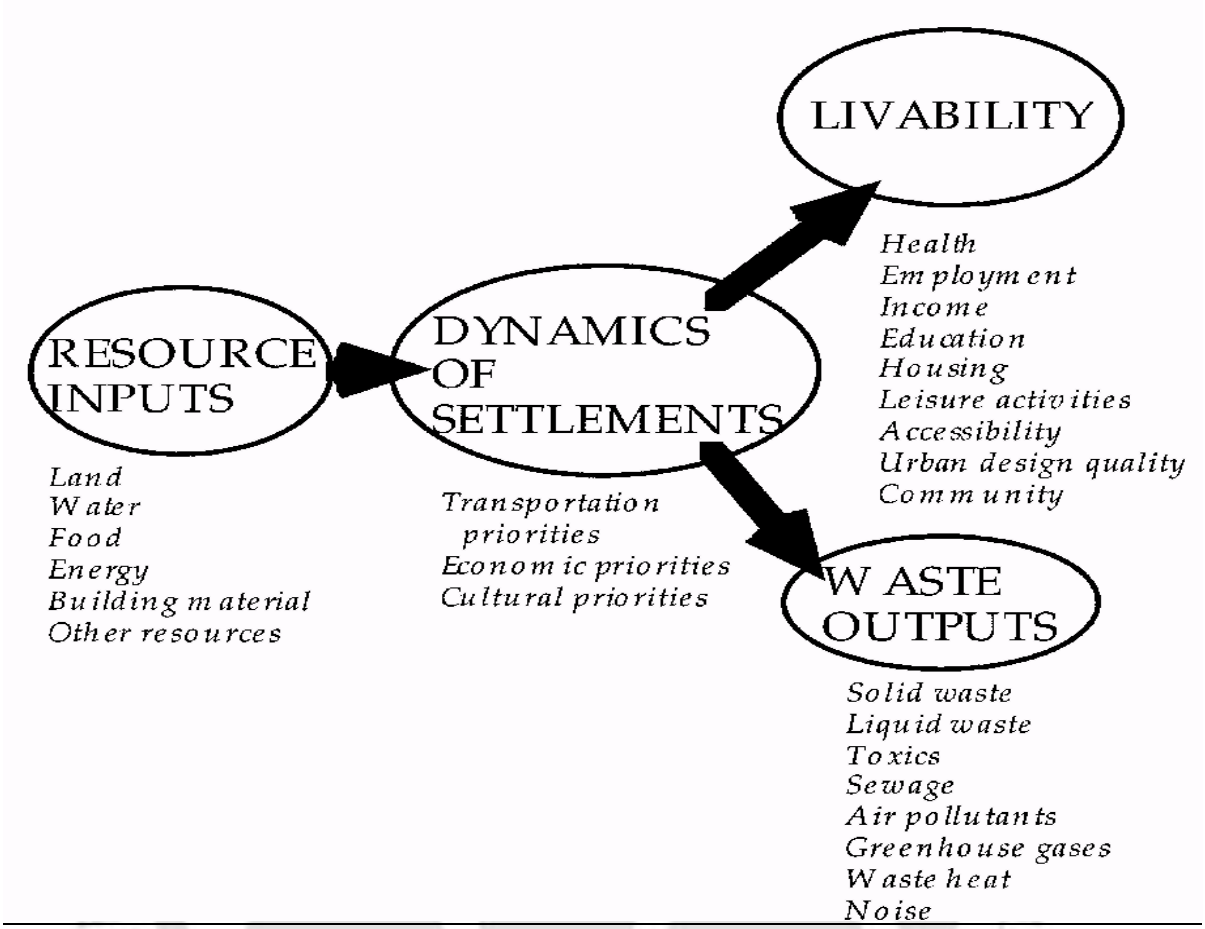
From Shafer (2000)

Fig. 2.4: A conceptual model of factors that contribute to community quality of life from a human ecological perspective.

The model indicates that QOL is created by an on going interaction between community, environmental and economic qualities. The community of a place represents social support networks through which its members participate in community life. The physical environment should provide a healthy and liveable place. The social environment should fulfill the condition of equitability by providing its members fairness and justice with their basic needs met and having equal opportunities. Facilities of any type, including trails, should be planned and designed for balancing economic, environmental and social characteristics of an area so that its residents can lead healthy and pleasant life.

2.3.4 Metabolism model

Newman (1999) has constructed a model to make cities more sustainable for improving its economy and quality of citizen's life. The author defines the goal of sustainable city as reduction of the city's use of natural resources and production of wastes while simultaneously improving its livability. Such reduction is anticipated to fit the city better within the capacities of local, regional and global ecosystem. This is called 'Extended Metabolism Model of the City' and set out in Figure 2.5. Metabolism has been explained as a biological system way of looking at the resource inputs and waste output of the settlements. This model shows how the metabolism concept is extended to include the dynamics of settlements and livability in a particular area. In this metabolism model, Newman specifies the physical, biological and human basis of city. The physical and biological processes of converting resources into useful products and wastes are like the human body's metabolic processes or that of an ecosystem based on the law of thermodynamics. This law establishes that anything, which comes into a biological system, must pass through and that the amount of waste is therefore dependent on the amount of resources required.



From Newman, 1999

Fig. 2.5: Extended metabolism model of human settlements

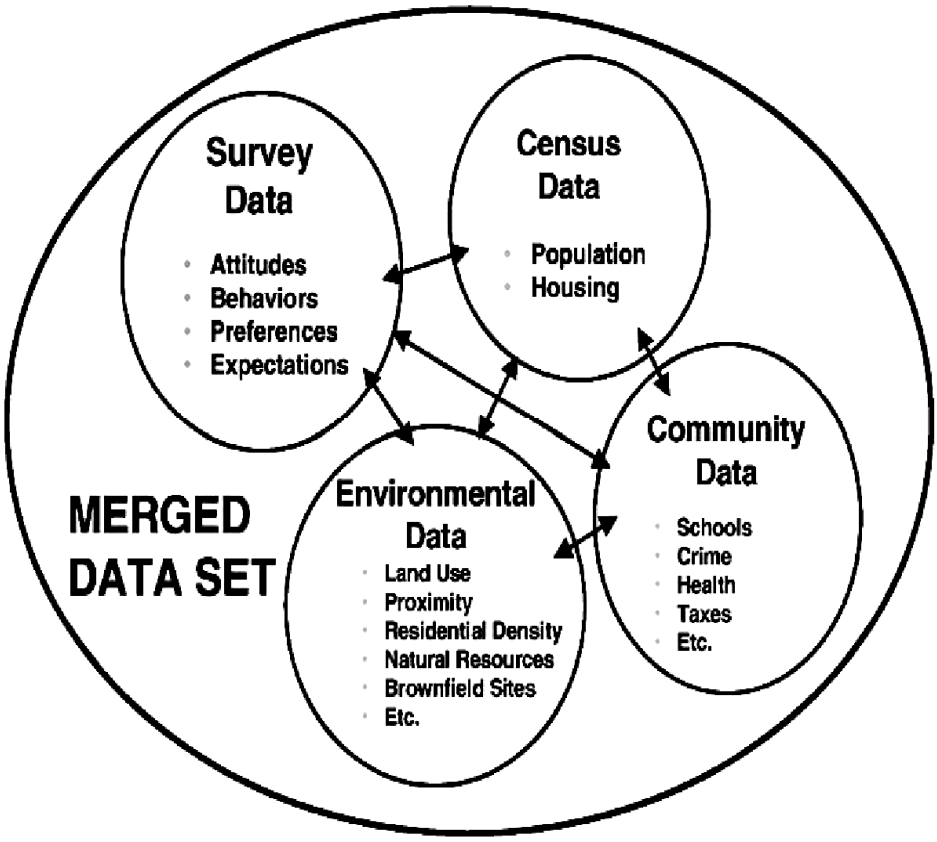
The metabolism approach to cities is purely a biological view, but cities are much more than a mechanism for processing resources and producing wastes. Rather they are about creating human opportunities. This basic metabolism concept as shown by Figure 2.5 is extended to include livability in these settlements so that economic and social sustainability could be integrated with environmental condition. Thus, the extended metabolism model can be applied at a range of levels and to a range of different human activities. It provides a framework for simultaneous achievement of reduced resources and wastes whilst improving livability in cities.

2.3.5 Detroit Area Study

Detroit Area Study (DAS 2001) is a major programme of research aiming at measuring quality of community life using both subjective and objective indicators (Marans, 2003). The program has been viewed as a mechanism for monitoring social and environmental change in the region and involves collection and analysis of demographic, behavioural, attitudinal and environmental data. The theoretical background guiding the research is a conceptual model showing relationships between objective measures of environmental quality and QOL outcome including life satisfaction, environmental satisfaction and other behavioural outcome. The main theme of this project has been identified as "Quality of Community Life". The intention behind selecting this goal is to examine a range of issues associated with the lives of people in a particular place. Furthermore, a better understanding of quality of a place and how it impacts on people's lives is an overarching goal of the study. The issues selected for the survey include people's evaluation of their neighbourhood, dwellings, assessment of government and public services, travel behaviour, use of parks, involvement in community affairs, moving intentions and residential preferences. Willingness to pay for improvements ranging from public transit to preserving farmland, attitudes towards growth and development as well as perceptions of environmental problems have been also taken into consideration for DAS 2001.

For collecting information, questionnaires have administered through face-to-face interviews and by mail. The objective community and environmental conditions associated with respondent's residential area have been collected from geographical information system. The environmental data file includes land use information, accessibility measures to recreational land, major employment centers, shopping, aesthetic and various density measures. The density measures using census data cover the number of housing units and the size of population for blocks, block groups and tracts. The census data files used information on racial mix, poverty rates, housing tenure and income statistics.

Figure 2.6 suggests numerous possibilities to examine relationships between contextual data and questionnaire responses using bivariate and multivariate analysis. For example,



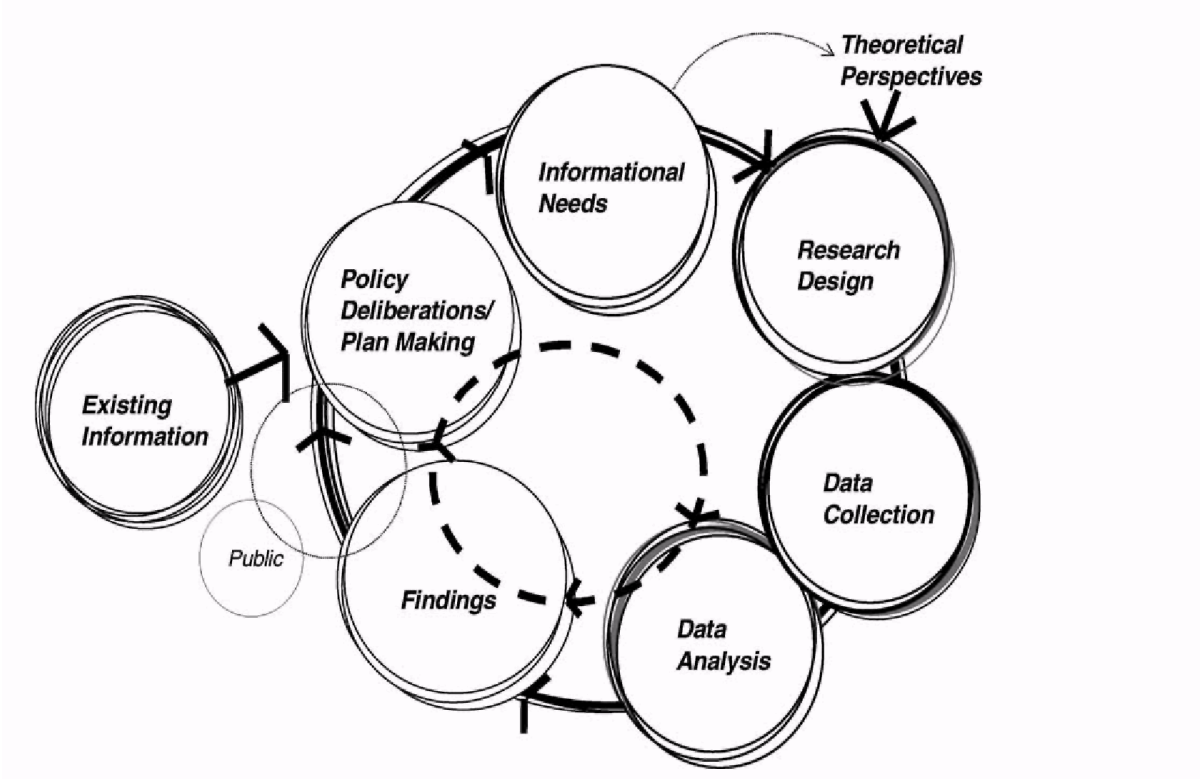
From Marans, 2003

Fig. 2.6: Datasets from DAS 2001

an analysis may address the question of how density of population affects people's response to crowing, their knowing the neighbours and interaction with them. Thus, innumerable opportunities to explore relationships within and between objective and subjective indicators have been found in this study.

The model in Figure 2.7 which guides DAS 2001 activities has been expanded in two ways. First, the research component has been shown in four parts: research design, data collection, data analysis and findings. The design for the research is often guided by various theoretical perspectives and has been constrained by budgetary considerations.

Second, the expanded model suggests that relationships between policy and research are interactive and ongoing.



From Marans, 2003

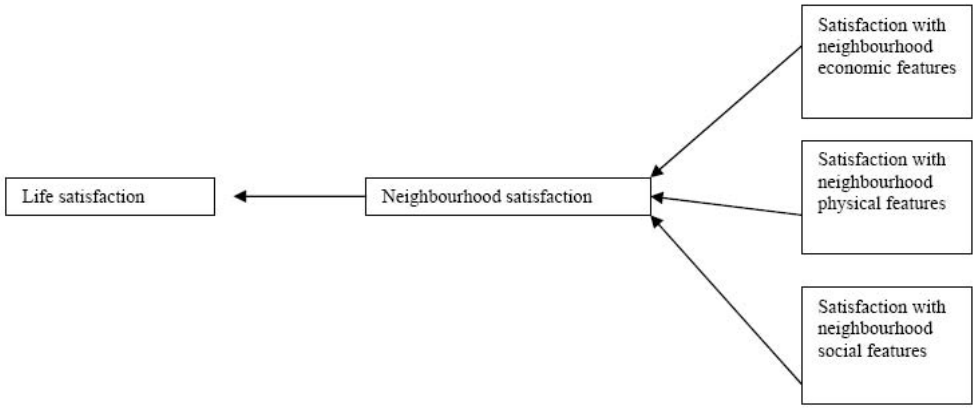
Fig. 2.7: Detailed model showing used in DAS 2001 showing relationship between policy, planning and research

DAS 2001 have been carried out to provide information about QOL of residents to policy planners and other decision makers both at private and public sectors at regional and country level. At the same time, providing information about contribution of place to QOL experience is the basic goal of the study. Place includes a particular community and neighborhood where people live along with amenities and environmental conditions. The quality of the community, neighbourhood and their attributes together with the quality of ambient environment largely reflect actions by planners and environmental designers. These are considered to be crucial constituents for enhancing human well-being.

2.3.6 Neighbourhood satisfaction model

Sirgy et al. (2002) has conducted an empirical investigation into the matter how features of neighbourhood affect neighbourhood satisfaction. The author divides the main neighbourhood satisfaction into three major categories: physical, economic and social. Satisfaction from physical features include satisfaction from : upkeep of homes and yards, landscape in the neighbourhood, the street lighting in the neighbourhood, crowding and noise level, nearness of neighbourhood facilities needed and quality of environment in the community. Social features take into account satisfaction with: social interactions with neighbours, outdoor play space, people living in the neighbourhood, ties with people in the community, crime in the community, race relations in the community and sense of privacy at home. Economic features comprise satisfaction with: home value in the neighbourhood, cost of living in the community, socio economic status of neighbourhood and neighbourhood improvement.

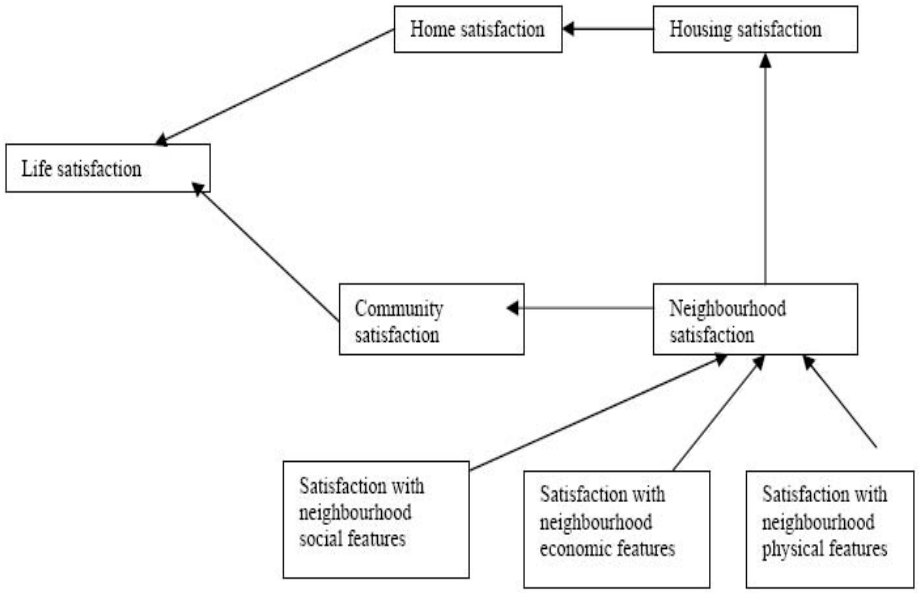
Three conceptual models have been developed to explain how satisfaction with neighbourhood features can affect resident's QOL. Model 1 is conceived by the author as shown in Figure 2.8. It illustrates that neighbourhood features affects life satisfaction through neighbourhood satisfaction. Satisfaction with economic, social and physical features of neighbourhood affect neighbourhood satisfaction and it in turn, influences life satisfaction.



From Sirgy, 2002

Fig. 2.8: Neighbourhood features and its effects on life satisfaction through neighbourhood satisfaction (Model 1)

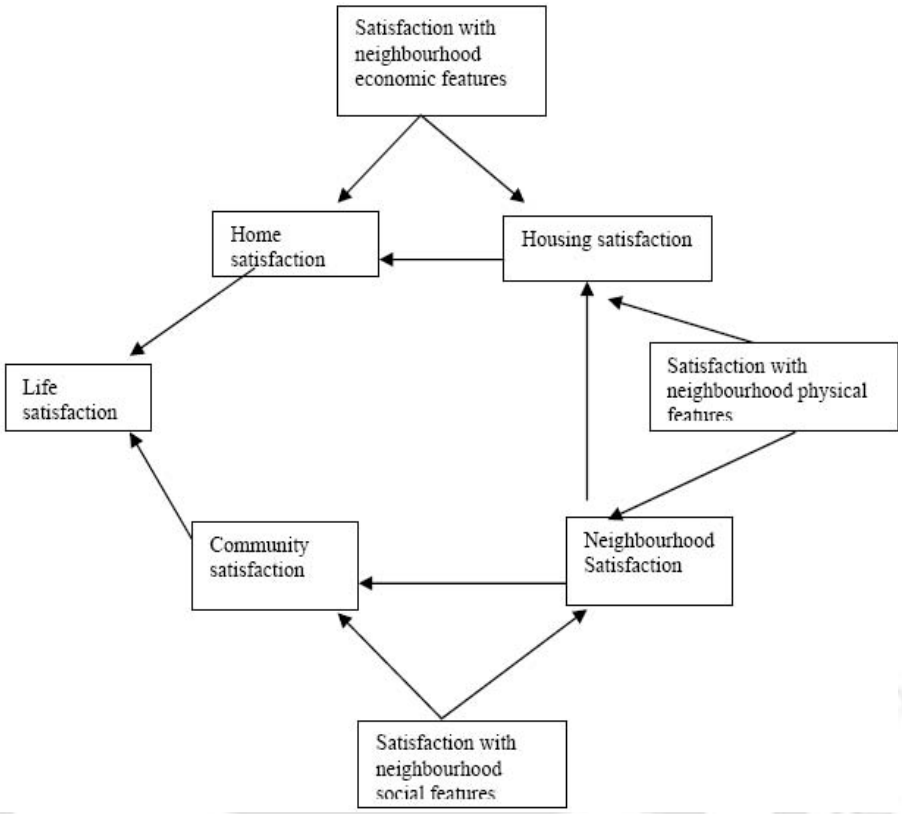
Model 2 as shown by Figure 2.9 explains how neighbourhood features affect life satisfaction through a satisfaction hierarchy that involves neighbourhood satisfaction as a primary mediator.



From Sirgy, 2002

Fig. 2.9: Neighbourhood features and its effects on life satisfaction having neighbourhood satisfaction as primary mediator (Model 2)

It has been found that satisfaction with neighbourhood's social, physical and economic factors affect overall neighbourhood satisfaction. Neighbourhood satisfaction, in turn, influences housing satisfaction, which, in turn influences home satisfaction. Finally, life satisfaction has been affected by home satisfaction. In other words, neighbourhood economic, social and physical features influence life satisfaction through the mediating effects of home satisfaction, housing satisfaction and neighbourhood satisfaction.



From Sirgy, 2002

Fig. 2.10: Neighbourhood features and its effects on life satisfaction through a satisfaction hierarchy where community satisfaction is a mediator (Model 3)

The author tries to relate how neighbour features affect life satisfaction through a satisfaction hierarchy that involves not only neighbourhood satisfaction but also housing satisfaction, home satisfaction, and community satisfaction as mediators with the help of Figure 2.10. Specifically, satisfaction with social features may affect not only neighbourhood satisfaction but also community satisfaction. Satisfaction with the physical aspects of the neighbourhood is likely to influence life satisfaction through a mediation effect of housing and home satisfaction. Sirgy has conducted a case study for empirical validation of these three models and the result is mostly supportive of the third model.

2.3.7 Capability approach

Sen (1993) has proposed a general model of wellbeing which conceptualizes QOL in terms of capability approach. The Capability Approach might be called the most acclaimed and most inspiring contribution of the author to human development literature. The capability of a person reflects the alternative combinations of functionings a person could achieve, and from which the person chose one collection. That capability is concerned with evaluating a person's actual ability to achieve various functioning as a part of living. Here functioning represents part of the state of a person-in particular the various things that an individual manages to do or be in leading a life. This approach is based on a view of living as a combination of various doings and beings.

The author distinguishes between resources (commodities), functioning and capabilities. It is inadequate to measure QOL only in terms of achieving some function or happiness. Rather it is equally important to measure whether a person has the capability to achieve which can distinguish between the achievements of a healthy person and a person with handicap, impairment or disease. The author emphasizes on the conversion of resources into achievements: a process which strongly depends on personal characteristics and social circumstances. The main reason for shift in attention from pure functionings to capabilities is justified by the argument that choosing might itself be a valuable part of living (Lercher, 2003).

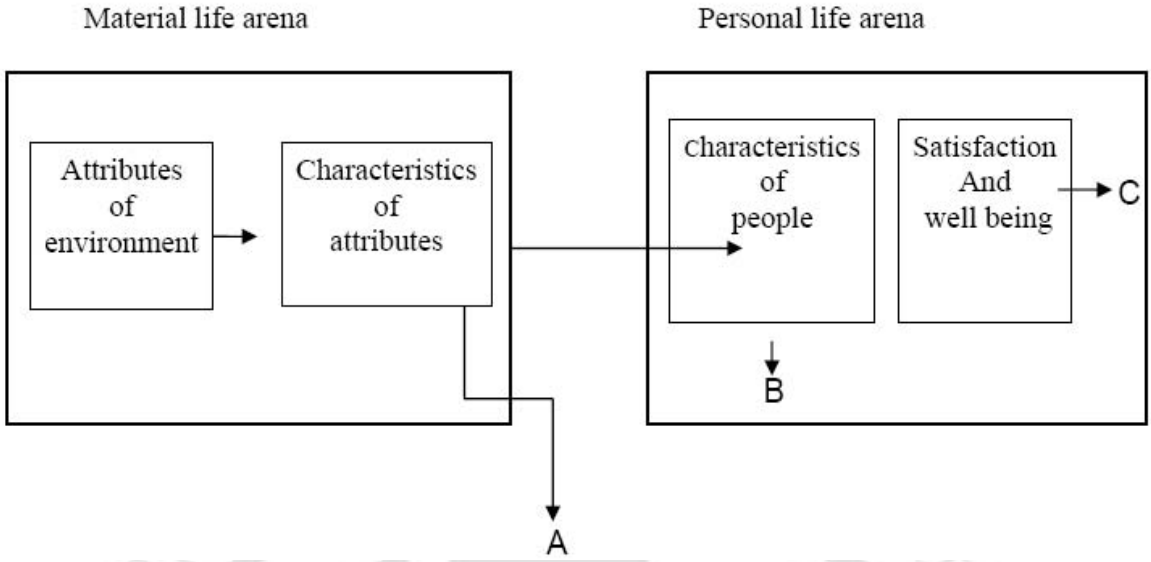
Capabilities have been defined derivatively from functioning. In the space of functioning, any point representing an n-tuple of functionings, reflects a combination of person's doing and beings, relevant to exercise. The capability is a set of such functionings n-tuples, representing the various alternative combinations of being and doings of which the person might be able to choose. If a functioning achievement is a point in that space, capability is a set of such points. Thus, capability contains information about the actual functioning n-tuples chosen, since it is too obviously among the feasible n-tuples.

Evaluation according to the achieved functioning is thus a special case of evaluation on the basis of capability as a whole.

In assessing wellbeing, evaluation is performed in terms of capabilities, rather than directly in terms of achieved or chosen maximal functioning n-tuple**.** Moreover, the informational base of capability is at least as adequate as that of achieved functionings. Capability gives information not only on well-being achievements but also on well-being freedom. Freedom might have intrinsic importance for the person's well-being achievements. Therefore, capability sets are used to identify environment and relationships that presented well-being freedom and choices made from these sets as well- being achievement.

2.3.8 Rogerson's environmental QOL

Rogerson (1995) has developed a conceptual model on Culyer's insightful expansion of Sen's division of things and people taken from an economic perspective. In order to examine things (commodities) and people, research should include more than the presence or absence of things and incorporate an analysis of the characteristics of both the commodities and people (Culyer, 1990; cited by Rogerson, 1995). In the case of things, which are consumed as a part of life, it is these characteristics, which often describe the quality of the goods or services and influence the utility value. Here, utility value is nothing but the outcome of consumption process that could be measured in terms of satisfaction or pleasure. Traditional welfare economic studies used to neglect the influence of characteristics of people in the assessment of utility of a commodity. But it is important for QOL assessment. The characteristics of people might be related to consumption of the commodity, to the inherent features of the people themselves or to relationships between groups of people. This inclusion of characteristics of people within the relationship between commodities and utilities has advantage of offering an alternative, non-utility focus for QOL.



From Rogerson, 1995

Fig. 2.11: A conceptual view of environmental quality of life

Rogerson conceptualized QOL by introducing a new phrase: environmental quality of life. The framing of this concept has been done by reducing the economic terminology used by Culyer as mentioned above and by relating the divisions between environment and people. Rogerson's environmental QOL is a combination of material and personal life arena. This scheme has been presented in Figure 2.11.

The relationship as shown in Figure 2.11 has utilized distinction between external conditions or things shown as material life arena and internal, personal factors of people shown as personal life arena. The material life arena comprises a series of goods, services and other characteristics such as social, physical and economic attributes of the living environment. These attributes resemble Culyer's concept of commodity. They include services such as health care, education facilities, leisure and recreation facilities, physical features such as landscape, climate, economic attributes of employment or labour market condition. These attributes have differing characteristics, which are the way for people to describe the quality of, or obtainable from the attributes. These characteristics included access, frequency or provision and efficacy.

This approach has conceived QOL as pertaining to the provision of necessary conditions for happiness and satisfaction to be achievable for individuals. These properties of environment work as stimulants for life satisfaction. Such QOL opportunities of a place or region can be assessed by the presence or absence of these necessary conditions and the characteristics of these features. These conditions are measured by objective indicators describing environment**.**

The personal life arena shows the characteristics of people in terms of satisfaction, pleasure, happiness or other preference ordering. These attributes can be called utility in a broader sense as individual's overall assessment of life satisfaction but not in the narrower analytical convention of what people want to maximize. The personal arena also includes the characteristics of people like age and gender, their life experiences and their relationship with other people.

Now two different sets of QOL definitions can be identified. One approach uses an evaluation of characteristics of people to identify variations in priorities and preferences of individuals and groups (B in Figure 2.11). The other approach is a subjective, experiential measure (C in Figure 2.11). QOL is also conceptualized as a measure of psychological well-being. This approach focuses on the level of satisfaction derived from an individual's evaluation of perception of an attribute or attributes against self-defined, personal standard or value system. Here, the main concern is with finding an appropriate measure of satisfaction with the person's life derived from the experience of living in a set of environmental condition. Such conceptualization of QOL provides subjective evaluation of consumption of environmental living conditions. The author tries to reconcile the subjective evaluation of QOL with people's objective situations whilst considering the impact of communities on individual QOL. This model has been applied in an urban project in Istanbul, Turkey (Govt. of Canada, 2002).

From literature survey, it is clear that QOL studies may be objective, subjective or combination of both in nature. It has been found that objective QOL studies have

association with directly measurable attributes of life, material condition of living or environment. Subjective QOL studies relate to individual's satisfaction or happiness associated with aspects of personal feelings or associated with appraisal of living condition. But it has been found that the association between objective and subjective dimensions is weak. Subjective well-being in the form of satisfaction or happiness has been used as an empirical approximation to "experienced utility" or subjective welfare. It has also been used as a strategy for a direct evaluation of environmental condition. Scores of happiness or satisfaction have been found to be treated as cardinal data without having appreciable effect on empirical result. Using such cardinal data, one can compute average values of satisfaction or happiness and estimate function taking such aggregate or average values as dependent variable (Welsh, 2006b).

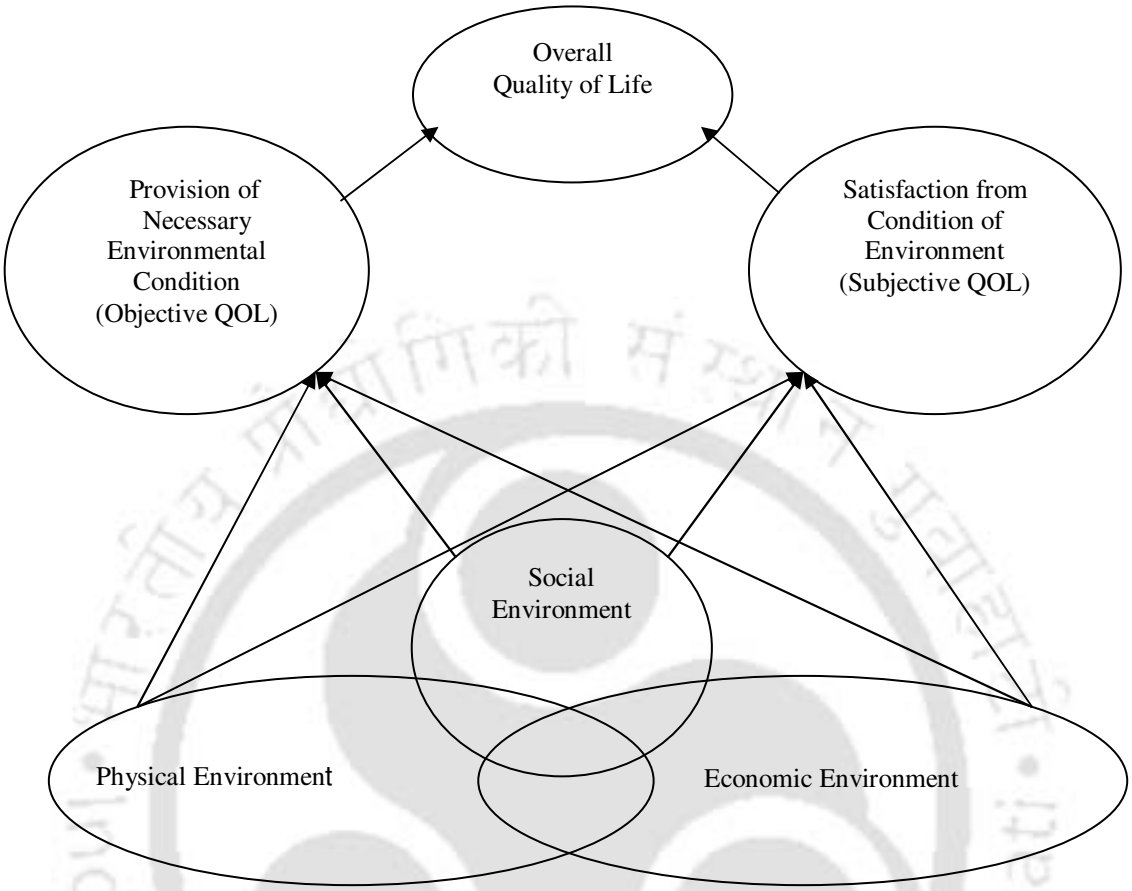
Although QOL studies have been found on variety of perspectives, studies on life quality in the context of urban environment have been found to be limited in number. Few studies have taken into account both subjective and objective aspects of environment together. But almost every study in this direction has been conducted in western context. As mentioned above, Rogerson (1995) has provided a model of environmental QOL to highlight the distinction between research which conceptualized QOL as related to living conditions and those which have emphasized on aspects of personal values and experiences. However the author does not conduct any empirical study to validate the model. Marans (2003) has mentioned about DAS 2001 study in the Detroit Region of Michigan to provide guidelines and information to improve life quality. But as far as the review of literature is concerned, no such works have been found in Indian perspective to provide guidelines to improve QOL. In a study conducted by Noronha et al. (2005), both objective and subjective QOL have been assessed by calculating relative score as has been applied for construction of human development index. The authors have assigned equal weights to all components which may not be suitable for practical purpose. The results could have been improved by applying multivariate statistical procedure. At the same time, it has been noticed that no comprehensive QOL study is available in the environment of Guwahati. Several studies have been found on Guwahati relating to socio

economic environment, industrialization and urbanization. But none of the studies have taken QOL into explicit account in the context of living environment. Therefore, taking into consideration the deterioration in environmental quality and its impact on human life, the study proposes to study QOL in the city of Guwahati.

2.4 Proposed framework for the present study

From the review of literature and discussion of conceptual frameworks it is clear that the central focus of QOL studies varies among a set of issues. It may be human ecology, human health and psychology, capability approach or features of neighbourhood satisfaction. Some of these concepts are primarily related to person, whilst others are related to environment. In spite of presence of numerous ways to conceptualize the relationship between QOL and environment, the theoretical and empirical underpinning of the relation is far from being established. In fact, conceptualization of QOL is itself a difficult process because of its multidimensionality. There is always confusion regarding the degree to which this multidimensionality needs to be reflected in the concept and measurement of life quality.

There appears to have agreement that in defining QOL, two fundamental sets of components and processes operate. The first one relates to an internal psychological-physiological mechanism producing a sense of satisfaction or gratification with life either at an individual level or collectively for communities and other social groups; and the second one relates to those external conditions which trigger the internal mechanism. If a study utilizes both objective and subjective indicators, it probably could arrive at more reliable and valid inferences about quality of living in that environment (Milbrath, 1979 and Rogerson, 1995). Thus, any comprehensive evaluation of QOL should include both subjective as well as objective aspects. Moreover, the least consensus that can be arrived from discussion of conceptual frameworks is that physical, economic and social environments form the core of studies related to life quality. These three environments



Source: self production

Fig. 2.12: Conceptual framework showing relation between environment and QOL

together provide the substance of a society. Any multidisciplinary conceptual framework of physical, social and other aspects of environment in relation to quality of life would allow for a more theory based choice of indicators (Kamp et al., 2003 and Garb et al., 2004). Considering all issues found in relevant QOL studies**,** a framework has been constructed for the present study. This conceptual framework as shown in Figure 2.12, places QOL as the central focus while taking into account the relation between men and environment.

In this study, environment refers to a local urban environment where people are living. Environment has been considered in a broader sense comprising physical, economic and

social attributes of urban areas. These three types of environments coexist in a city, each of them explaining in part or in combination the existence and continuity of a city. They deeply interact with each other and generate advantages and disadvantages for the city. Therefore, they have to be considered together (Camagni et al., 1998). The conceptual framework involves a synthesis of relevant local environmental attributes.

This framework combines objective circumstances of living condition and appraisal of people's satisfaction from such living condition. In other words, both objective and subjective dimensions have been considered together. External condition of physical, economic and social environment comprises objective QOL and satisfaction from such objective condition represents subjective QOL. Here, overall QOL has been measured in terms of life satisfaction obtained from living in that area. The term subjective urban QOL focuses on the notion of satisfaction with urban living (McCrea, 2006).In the context of the present study, subjective QOL has been defined as the sum of satisfaction with domains (Misajon, 2002) which is a simple additive model (Rojas, 2006).

This is a bottom up approach and assessment of QOL using this framework has been proposed to be conducted in the city of Guwahati at local scale and household level.

CHAPTER 3

Guwahati: Description of the Study Area

The conceptual framework adopted for this QOL research has been discussed in the previous chapter. A case study has been proposed in the city of Guwahati in order to carry out the research as proposed in the conceptual framework. The main objective of this chapter is to provide a brief description of the study area.

3.1 Guwahati: A preface

Guwahati is not only the main city in the state of Assam but also the city of strategic significance for the entire North East India. It is a leading city of the region and is the hub of commercial, business, educational, socio cultural, political and other activities. The capital of Assam, Dispur falls within the city. The head quarter of both Kamrup (rural) and Kamrup (metro) are situated here. Besides, Guwahati is a key spot of all communications between the North East India and rest of India. Therefore, it can also be called the gateway of North East India.

Throughout the 19th century and also during the first four decades of the 20th century, growth of Guwahati has been found to be very slow. Noteworthy developments during the British period were the establishment of the cantonment at Paltan Bazar, opening new lines of transport and communication and improvement of old ones within the town (Bhattacharyya, 2001). Even after the independence of India, no change has been noticed in the landscape of Guwahati except establishment of Guwahati High Court, North East Frontier Railway Headquarters, few educational institutions, construction of the Saraighat Bridge, oil refinery, military cantonment at Satgaon, Industrial Estate in Bamunimaidam and some government institutions. Changes began only in late 1980s.

It is difficult to say with certainty about the origin of the city. History says that Guwahati is a very ancient city. Archeological Survey[1] traces the city to the 6th century AD. It was the capital of the mythological kings Narakasur and Bhagadatta as has been found in the Mahabharata[2]. There are several opinions associated with the name 'Guwahati'. Some historians say that the present name 'Guwahati' originates from its association with the abundance of areca nut trees and betel vines. Another opinion tells that Guwahati comes from the term 'Guhar Haati' which means a place full of caves. It was called so for hills surrounded the place on all sides and it looked like a cave (Das, 2005).

3.2 Physical structure and climate

Geographically, the city of Guwahati is located at the intersection of 260 5'N to 260 12'N latitudes and 910 34'E to 910 51'E longitude. It is situated on the southern bank of the mighty river Brahmaputra. The city is situated on an undulating plain with varying altitudes of 49.5 meter to 55.5 meter above mean sea level. It is surrounded by hills on the eastern, southern and western sides. The shape of the city is just like a bowl with protrusion like Sarania Janardan hills having height of less than 200 meters. Of the 216 sq. km. of the city area, about 10 sq. km. area is under the water bodies such as Deepar beel, Numali Jalah[3], Silsako beel[4], Ghorajan, Silagrant beel, Barasapara, Tilingaon beel, Paschim Boragaon and other smaller water bodies (Sarma et al., 2001). Some of the major streams flowing through the city which work as natural, storm water drainage channel are Bharalu, Mara Bharalu, Basistha Bahini and Khanazan river. They finally join the Brahmaputra.

The climate of Guwahati is tropical in nature with four distinct seasons: summer, monsoon autumn and winter. The temperature varies between maximum 38^0 C and minimum of 20^0 C in summer and in winter it varies between maximum of 30^0 C and minimum of 10^0 C. Average annual rainfall of Guwahati is 1637.3 millimeter and 90 percent of this rainfall occurs between April to September and maximum rainfall period is July to August. Humidity is high in Guwahati which causes discomfort in the summer.

3.3 Governance

Besides the state administrative machinery there is a body of self governance called Guwahati Municipal Corporation (GMC). The GMC is a local body responsible for governing, developing and managing the city. At present it covers an area of 216 sq. km. covering 60 wards. The Corporation has 4 Revenue zones, 5 Public Works Department (PWD) divisions and 23 Public Works Zones. Conservancy is another important activity of the GMC. Another agency associated with planning and development of Guwahati is called Guwahati Metropolitan Development Authority (GMDA). It covers Guwahati Municipal Corporation Area, North Guwahati Town Committee area, Amingaon and some revenue villages of Silasundari Ghopa Mouza, Pub Barsar Mouza, Dakhin Rani Mouza, Ramcharani Mouza and Beltola Mouza[5]. The area is known as Guwahati Metropolitan Area (GMA). The Guwahati Development Department, a special department of the Government of Assam has been recently formed for overall development of Guwahati.

3.4 Economy

Guwahati is the main trade centre in the North Eastern Region of India. It is a major wholesale distribution centre, a marketing hub and also a retail hub in the region. The economy of the city is mainly based on tertiary sector. Industrial activities are also important but are conducted at small scale. During the last few years, real estate development and finance have grown up in Guwahati. Besides all these, business activities in the field of tourism and cultural activities are also practiced.

3.4.1 Industrialization

Establishment of Guwahati Refinery (1962) has been considered as the first major step towards industrialization in Guwahati. It is the most important manufacturing industry which mainly produces Liquefied Petroleum Gas (LPG), Light Diesel Oil, Superior Kerosene Oil, Aviation Tri fuel and Raw Petroleum Coke etc. During the last two

decades, the city has seen a steady growth in the industrial sector. India Carbon Products Limited is another major industry situated in Noonmati at the eastern end of Guwahati. India Carbon Products Limited produces carbon block from the raw petroleum coke of Guwahati Refinery. Other chemical industries are Assam Air Products Ltd. (Liquid Nitrogen), Assam Carbon Limited, The Industrial Gases Ltd. (Oxygen Gas) etc. There is a Liquefied Petroleum Gas bottling plant at North Guwahati. A large number of small scale industries have grown up in and around the city haphazardly. They include chemical based, iron based, cement based and agro based units engaged in the production of various consumers and plant needed goods. In the year 2001-02, 60 sheds have been constructed and there is allotment for another 60 sheds (Govt of Assam, 2002). There are Industrials Estates in Bamunimaidam, Industrial Area in Kalapahar, Mini Industrial Area in Kalapahar, and industrial area in Bamunimaidam within the GMC area.

3.4.2 Trade and commerce

The major steps towards expansion of business activities are the establishment of the Tea Auction Centre (1970) and the Guwahati Stock Exchange Limited (1983). The commercial establishment of Guwahati is divided into four categories namely wholesale, wholesale cum retail, retail shop and service shops. There is no centralized market complex owing to which, shops have been established in an unplanned manner across the city. The main wholesale market of Guwahati is located at Machkhowa and Fancy Bazar area. These areas occupy valuable space in the heart of the city which otherwise could have been more productively used. Importantly, these markets lack basic amenities like water supply and solid waste management, leading to unhealthy atmosphere for trading. These markets do not have adequate infrastructure facilities also. Building and construction businesses have started in Guwahati during the late 1980s. Hotel industry is also growing up with the expansion of the city. There are thousands of street food vendors, hawkers and petty traders in the city. Moreover, private sector hospitals and private educational institutions have grown up in large number. Shopping malls have also stood up. Running of Public Call Office and beauty parlours are some other business activities in the city.

3.5 Transport and communication

A network of road connects Guwahati with all the important cities in the neighbouring states and major cities in the country. Inside Guwahati, passengers can utilize city bus, share taxi, auto rickshaws and rickshaws for shorter distance. Moreover, people use personal vehicle on large scale. Guwahati is well connected by train also. The head quarter of North East Frontier Railway is also situated in the city. The Lokapriya Gopinath Bordoloi International Airport is situated in Borjhar in the outskirt of the city. There are regular flights to Delhi, Kolkata and Mumbai. It also connects the city with other towns of the North Eastern Region like Dibrugarh, Jorhat, Agartala, Imphal, Silchar, Aizwal, Tezpur, Dimapur and North Lakhimpur. Besides air route tremendous potential has been provided by the Brahmaputra River for developing a full fledged inland water ways system for smooth connectivity with rest of the country.

3.6 Educational infrastructure

Guwahati is the main center of all educational activities in the entire North East India. The educational institutes include one university, a large number of degree colleges, one medical college, one dental college, one ayurvedic college, one veterinary college and one homoeopathic college. One Indian Institute of Technology has also been established in Guwahati. There are 63 major private computer training institutes, two poly techniques, large number of junior colleges, several management institutes and many vocational training institutes. The city has a huge number of primary and high schools. Most of them are private schools. There are also schools are run by the government or by the GMC. Educational facilities for street children provided by Indian Council for Child Welfare and the World Vision of India are available at Kalibari near Railway Station, Arya Nagar, Sivanagar (Hengerabari), Bhetapara, and Birubari (Goswamee, 2001).

3.7 Health infrastructure

Guwahati has emerged as a major centre of health care facilities for the people of the North Eastern India. Health facilities are provided by both government and private hospitals. Some of the important health institutes in the government sector are Guwahati Medical College (GMC) Hospital, Mahendra Mohan Choudhury (MMC) Hospital, Regional Institute of Ophthalmology, B. Baruah Cancer Institute and Lokpriya G.N. Bordoloi T.B. Hospital at Kalapahar. Some prominent institutes in private sector are Guwahati Neurological Research Centre, Down Town Hospital, Sankardev Netralaya, International Hospital and Dispur polyclinic etc.

3.8 Social structure and demography

The society of Guwahati is cosmopolitan. With the expansion of the city, thousands of new people have settled at the centre and in the fringe area. The most significant feature of the society of Guwahati is the emergence of powerful middle class families. Joint family system has been declining gradually. Families are mostly nuclear now-a-days. It has been reported that the percentage of very small family (1-3 members) is 29.58 percent and percentage of medium size family (4-6 members) is 62.42 (Deka, 2001). The small families maintain kinship visiting their relations on holidays, during festival or family functions. Marriage system is more liberal because of spread of education. The culture is a blending of both rural and urban values.

There has been tremendous demographical change in Guwahati especially during the last three decades. When the Guwahati Municipal Board was formed in 1853, the population of Guwahati was only 3000. This meager size of population grew up to 818809 in 2001. Trend of population growth has been shown in Table 3.1. Tremendous increase in population has been seen from 1971 to 2001. The table shows that decadal growth of population suddenly grew in the year 1961. It might happen due to expansion of the GMC area in 1961 from a small area of 7.5 sq. km to 14.28 sq. km. During 1971, the decadal growth of population again fell down. But from 1971 to1991, the trend of growth

was as high as 117.27 percent which was much higher than the decadal growth of population for the state (18.85 percent) during the same period. It can be attributed to migration of population owing to shifting of the capital from Shillong to Guwahati and expansion of the GMC area in 1974 to 257.09 sq. km.

Table 3.1: Trend of demographic change in Guwahati

Year	Population	Decadal growth (%)	% share in urban population of Assam	Sex ratio
1853	3000	-	-	-
1901	11661	-	15.13	500
1911	12481	7.03	13.43	534
1921	16480	32.04	12.97	528
1931	21797	32.26	13.44	503
1941	29578	35.79	14.22	567
1951	430615	47.36	12.65	558
1961	100707	130.90	12.89	497
1971	123785	22.90	9.60	638
1981	Census was not conducted in 1981			
1991	548342	117.27	23.22	783
2001	818809	38.6	37.85	835

Source: Das, 2005, Census of India 1971, Series 3,
Census of India 2001, Primary Census Abstract, Assam

Sex ratio has been gradually increasing over the years except for the year 1961. But sex ratio in Guwahati is much lower than the sex ratio for the state of Assam (935). It may happen because migrated population mostly comprises male who come for employment opportunities. In this context, it should be mentioned that the highest percentage of population is less than six years of age followed by population in the age group 25-29 (Govt of India, 2001a).

3.9 Living conditions in Guwahati

Guwahati was unhygienic even when it was the head quarter of the Commissioner of Assam from 1826-71. In 1874, the head quarter of Assam was shifted to Shillong because

the British considered Guwahati unhygienic. But the head quarter of Assam was again shifted from Shillong to Guwahati in 1972. The decision of shifting the capital was influenced by political and administrative factors without taking into account environmental and other condition of the city. Since then, Guwahati has been growing in magnitude but not in terms of expansion of civic amenities. Besides being the largest city in the entire North East India, it stands at 44th position among 5230 urban centers in India (Govt. of Assam, 2006). At the same time, it is one of the most unplanned cities in India. Negligence and lack of farsightedness in planning, the capital has made civic life in Guwahati uncomfortable. City dwellers in Guwahati have to deal with a number of problems in daily life. They are mentioned below.

3.9.1 Drinking water facilities

The main source of natural water for the region is surface water drawn from the river Brahmaputra and its tributary Bahini, coming down from Khasi and Jayantia hills. A limited amount of water is also drawn from open water bodies like Deepar beel and other beels. The water supply to the city is provided by multiple organizations viz. Assam Urban Water Supply & Sewerage Board (AUWSSB), Guwahati Municipal Corporation (GMC) and Public Health Engineering Department (PHED). Apart from these, the Railways, the Refinery, the Defense Authorities and other Government agencies maintain their own facilities to supply water which do not cater to the requirements of common people. Almost 70 percent of the existing area does not have access to safe drinking water. Present per day requirement of the city exceeds 1600 lakh liter[6], but only 270 lakh liters per day has been supplied by public sector water supply sources. Others have to depend on tube well, ring well, deep tube well, private suppliers and natural water bodies. In case of supplied water, often leakages have been found in the old, unmanaged pipes. Transmission loss is reported to be as high as 40 percent. Due to low pressures in supply, the chance of polluted water entering the pipes by the leakages is very high. The duration of water supply is as low as 3 hours per day.

3.9.2 Sanitation

The city of Guwahati doesn't have any integrated sewerage system at present except for certain residential areas such as the Railway Colonies, the Indian Oil Corporation (I.O.C.), Refinery colonies and residential areas under defense establishments. These areas have their own sewerage facilities. Barring these few localities in the city, a large amount of the individual houses have septic tanks but without any collective disposal system for effluents. The sewage from septic tanks goes directly into the open drain. Also the garbage generated in the city is dumped just by the side of the drainage system causing loss of flowing capacity of the drains. This ultimately makes the surroundings unclean, unhygienic and conducive for growth of disease carrying organisms. The soak pits connected to septic tanks are becoming non-functional due to high sub soil water level within a short span of time. A good number of people use open space including the river bank of the Brahmaputra. These people should be provided with community toilet for defecation (Govt. of Assam, 2006).

3.9.3 Increase in the number of high rise buildings

Preferences of people for apartments basically due to scarcity of land, convenience enjoyed from the proximity to the center of the city and rising insecurity have led to rapid expansion of high rise buildings in and around the city. Such apartments can be raised anywhere by having simply a construction permission from the GMC or the GMDA. But residents of such apartments have not been provided with additional civic amenities. They have to share the same quantity of water, same congested road which are not sufficient even for the people who were there before the construction work of such apartment started. For water, most of the builders have installed deep tube wells ignoring the existing rules and regulation. Such construction ignores the ecology of the surrounding areas. The existing quality control measures and other norms set up are not followed while construction goes on. It is a matter of risk for the flat dwellers and neighbouring people.

3.9.4 Problem of traffic congestion

The volume of traffic is very high in Guwahati as it is the major centre of distribution of goods and services by both railways as well as by roadways to other districts and neighbouring states of Assam. But the pressure is more on roadways which carry 60 percent of the good traffic and 80 percent of the passengers' traffic (Bez, 2001). Besides the number of cars and motor bikes are increasing everyday in the city. It has been reported that the number of vehicles that move on the city streets is almost 300000 everyday (Chakravorty, 2007).

Apart from being the gateway to the North-East India, Guwahati is the most important commercial hub in the region. So, most vehicles going to any other places have to pass through the city. Owing to such heavy pressure, most of the roads remain congested during the peak hours. The notable roads which need immediate attention are G.S Road, GNB Road, A T Road and M. G. Road. Other roads or segments of roads suffering from traffic congestion are the Guwahati Club police point up to Silpukhuri, Paltan Bazar, Pan Bazar, Fancy Bazar, Ambari, Maligaon Chariali police point, Adabari city bus stand, Bamunimaidam, B Borooah Road up to Ulubari, Rehabari and Bhangagarh.

Besides increase in the number of vehicles, congestion is also due to the fact that there is no adequate parking at any of the above mentioned roads. Another major problem is the mixing of inter and intra city vehicles. It causes tremendous traffic congestions. Roads would be difficult to be widened for lack of free land along roadside. Wholesale markets are situated within the city (Machkhowa, Fancy Bazar and AT Road). Often it is seen that trade activities like loading and unloading, parking of trucks take place on the streets. Auto-Rickshaw stand and Taxi Terminal facilities are also on the same streets. As a consequence, traffic problem gets aggravated.

3.9.5 Problem of water logging

Water logging is a chronic problem in Guwahati. The frequently inundated areas in Guwahati are: Chandmari, Silpukhuri, Geeta Nagar, Hatigaon Chariali up to Narengi, G.N.B. Road from Guwahati club to Noonmati, R G Baruah Road, Maligaon, Naveen Nagar, Ambikagiri Nagar, Tarun Nagar up to Bhangagarh, Sundarpur, Rukmini Gaon, Mathura Nagar and some low lying areas in Beltola, Fatasil Ambari, some areas on the A T Road and Lamb Road.

As a city grows, there are more housing and construction activities leading to more rooftops, driveways, streets and other hard or impervious surfaces thereby decreasing the capacity of the land to soak up and carry excess water. The hills are indiscriminately cut for filling up low lying areas. Heavy rains wash away the mud-spattered run off from the naked hill and silt up the drains rapidly. Encroachment over low lying area by new settlers on either side of natural drains has blocked the natural flow of floods water during rain (Sarma, 2001). There are seven drainage basins through which all the waste and disposal are drained into the river Brahmaputra either directly or through various drainage channels and reservoirs indirectly. Out of these seven, Bharalu is the most significant. The original catchment of 123.5 sq.km of this river has been reduced to 45 sq km. A stretch of the river is dead and the rest has become narrow and shallow and for this, the river cannot carry the flood and rain water load. During monsoon and heavy rainfall, there is a back flow of water leading to overflow on to the catchment areas. Besides, most of the natural outlets of waster have been either destroyed or encroached. Therefore, they are unable to carry load and most of the catchment areas get submerged during heavy rain. It causes severe water logging. As the level of the river Brahmaputra is higher than the rest of the city at most places, it requires an integrated drainage system.

3.9.6 Emergence of slum area

Another significant crisis that has cropped up in Guwahati is the emergence of new slum and extension of existing slum area. When the capital of Assam was shifted from

Shillong to Guwahati there were only 10 slums as per the estimate of the Town Planning Board (Nayak, 2005). They were - (1) Rajbari (Uzan Bazar), (2) Aathgaon, (3) Manipuri basti, (4) Fatasil harizon Colony, (5) Tokoubari, (6) Bishnupur, (7) Solapara Harizon Basti, (8) Islampur (9) Lakhtokia and (10) Kachari Basti.

But at present there are 26 slums in the municipal areas of Guwahati. The number of people residing in these slums is 1.6 lakhs, which constitutes 20 percent of the population of Guwahati. Mainly, the economically backward people who migrate to the city for better employment opportunities are compelled to stay in such areas. The slums have expanded because of increasing pressure of population. It has been reported that another 163 slums equivalent to the status of these 26 government slums have been identified (Nayak, 2005). In the slums, 36.36 percent of the population is below 18 years of age. Of the remaining 63.64 percent adult population, 45.14 percent is women. Most of them work as daily wage earners, mechanics Rickshaw puller, coolie or street vendor. These slums require proper water supply, drains, disposal of solid wastes and garbage and sanitation facilities within the slum boundaries. There is absence of community life and recreational facilities in such slums.

3.10 Status of environment

Guwahati has been experiencing rapid changes. The speedy but unplanned urbanization and the phenomenal growth of population over the past three decades have resulted in continuous and large scale conversion of the existing land to urban use. Urbanization has also resulted in rampant encroachment in the hills and reduction of forest cover. Satellite imagery of the city's land use pattern shows that 73 percent of the land are under residential use, followed by 12.3 percent public and semi public use, 4.2 percent for industrial use, 1.5 percent for commercial use, 0.1 percent for recreational use and 0.6 percent for transpiration use (Thakur, 2005). Increasing population and their activities in relation to industrial, residential, commercial and transportation activities put pressure on the limited resources. These areas are affected by water, air and noise pollution along

with the problem of solid waste. Therefore, it is necessary to address these issues because they have potential to create disorder in life to a great extent.

3.10.1 Water pollution

Water pollution may be in the form of contamination of drinking water, surface water and ground water pollution. Leaking water pipe is a very common scene in the city. Pollutants enter the pipes through such leakages whenever they come into contact. Normally the drains remain filled with garbage because they are not maintained properly. Whenever it rains, the roadside drain substances run over the streets and contaminate surface water bodies directly. Vehicular pollution is another major contributor of surface water. Like the surface water, ground water is also polluted by several ways. In a municipal area ground water is often polluted by improper sanitary management, lack of suitable drainage management and hospital outflow (Barman, 2005). Bacteriologically, the water quality of the river Brahmaputra is very poor. The total coliform is very high in the water of the river (PCBA, 2007). It has been also found that the drainage system in the city is not well structured. Waste water drains coming from different areas located near the river stretch and also from hospitals and nursing homes are directly discharged to the river. Noonmati refinery affluent has been released through a channel which meets the river Bharalu on its way to the river Brahmaputra. Bharalu is loaded with waste from the entire city of Guwahati through the system of mutually independent drains and it joins the Brahmaputra. Such contamination can cause damage to aquatic life.

3.10.2 Air pollution

The intensity and nature of air pollution in the city has been increasing in recent years in Guwahati. The factors that contribute to this phenomenon are mainly industrial and transportation emission. There are several industries in and around Guwahati. Since air pollution cannot be restricted, the industries in the outskirt also increase pollution in Guwahati. Within the city also, several industries such as petroleum refinery, carbon industries, asbestos factory, iron works, leather industry, soap factory, chemical

industries, bakery and miscellaneous small scale industries have been found. Several coal depots have been established in Beltola –Basistha area. In Beltola itself, there are three coke industries whose coal charging capacity is 5-7 tones daily. They are severely affecting the area by emitting smoke and black particles. Besides, refuse burning, re-suspended road dust, construction activities, and naturally occurring dust are also contributing to air pollution. Vehicles emit pollutant like Poly Aromatic Hydrocarbon, Benzene, Carbon Monoxide, Suphar–Di-Oxide, Nitrogen-Di–Oxide and suspended particulate matter. In the case of older vehicle the quantity of emission is more. The quantum of pollutants on the road has been increased by the growing number of vehicles. Besides traffic congestion slows down the movement of vehicles and makes human beings more susceptible to pollution.

Among all types of air pollutants, Suspended Particulate Matters (SPM) and Respirable Suspended Particulate Matter (RSPM) have emerged as the most serious threat. High SPM concentrations are primarily irritants but do not have much relevance for direct health consequences if compared with its respirable fractions. The average values of RSPM lies above prescribed barring the rainy season. High level of RSPM may cause severe health problem. The values of SPM have also been found to be relatively high although it doesn't exceed the prescribed limit normally.

3.10.3 Noise pollution

The term 'Noise pollution' is used to signify the vast cacophony of sounds that is being produced in modern life, leading to health hazards. The main sources of noise in Guwahati are automobiles, construction equipments, loud speakers, bursting crackers, factories. Noise levels are particularly high near railway station, traffic round about and bus terminus. Uses of pressure horns and recreational noise during festivals are the sources of noise pollution. The domestic noises from radios, T.V sets –all add to the quantum of noise in daily life. Human ears do not respond to the real loudness but to the perceived intensity.

Normal conversation produces a noise level of 60-65 dBA and if daily exposure exceeds 85 dBA, there is substantial physiological and psychological damage to humans (Park, 1997). Acceptable noise levels may vary in different living environment. But rapid increase in urbanization, increase in traffic, growth of small industries, wide spread use of diesel generator and destruction of green cover has caused the level of noise pollution to exceed the minimum prescribed level. Noise level monitoring conducted by the PCBA in various locations of Guwahati has clearly shown the intensity of the problem. Noise level is far above the limit prescribed by medical science in all selected silence zones. Noise level should not exceed 20-35 dBA in such areas. But the minimum values are far above the prescribed level both the GMC Hospital and the MMC Hospital in the morning and evening. Similar is the case for other locations in the silence zone. Interestingly, there is not much difference between the noise level of silence zone and traffic transaction (PCBA, 2005). Besides the presence of such high and regular noise pollution, noise level increases during festivals. Exposure to high noise pollution can make workmen often irritated, short tempered and they are more likely to resort to agitation. Noise interferes with sleep also. It can cause high blood pressure, increase in heart rate and breathing and an increase in sweating. Escalation of noise level to such high level will adversely affect QOL.

3.10.4 Problems of solid waste

The management of waste is one of the important aspects of environmental management because it may affect human health. When waste is not removed from the streets, public places and any dumping sites in time, it poses severe public health and hygiene hazards. Especially in a city like Guwahati with warm and humid climatic, decomposition of garbage is fast and the condition may be aggravated if they are not disposed off properly. Problem of municipal solid waste (MSW) has been aggravated due to rapid increase in population, change in life style and consumption patterns.

Along with changes in habits and life style, the composition of solid waste has undergone change. There are changes in components and increase in quantum of solid waste. The

proportion of organic compound was 78 percent (Sharma and Rahman, 2001) but it is declining gradually which has been estimated to be 55 percent. Moreover, the GMC solid waste disposal system does not segregate the biodegradable and non bio degradable wastes before dumping. The highly infectious bio medical wastes are mixed up with MSW. Consequently the entire MSW become highly toxic and can spread disease very easily.

The institutional responsibility of solid waste disposal system is assigned to the GMC. Such conservancy services are under the supervision of the Corporation's PWD staff. The GMC is neither providing door to door solid waste collection services nor supplying adequate number of dustbin in the city. The situation is worse in those places where dustbins have been already placed. These dustbins are not cleared in time. As a result they spill over the sides and make the surroundings dirty. Sosol was the main dumping ground of the GMC. But it has been abandoned of late and dumping has been started now in a new ground spreading over size of 70 bighas which is hardly 1 km away from the National Highway no 37. The efficacy of MSW disposal system in the city has been noticed to be miserably poor. The GMC is disposing waste in an indiscriminate manner. They do not have systematic collection, efficient transportation and proper disposal systems.

The pattern of development, livability and environmental condition clearly shows that Guwahati has been experiencing unplanned growth during the last couple of years. Complexities of problems are increasing with expansion of the city. People suffer from inadequacy of basic amenities of urban life like water supply, traffic facilities, clean air, open space, scientific waste disposal method and proper sanitation system. There is a huge gap between demand and supply of such facilities. Such poor environmental condition of living has adverse effects on human well being. Because every individual's welfare depends not only on the individual's consumption of private goods and services produced by the government but also on the quantities and qualities each receives of non market goods and services from environment system like health, visual amenities and opportunities fro outdoor recreation (Freeman, 1993). In other words, environment may

be considered as a source of well being and QOL depends upon how assets of economic, social and physical environment.

After discussing the study area, the techniques of sampling and statistical procedures adopted for processing of data have been described in the next chapter.

Notes:

1. Excavations in Ambari locality
2. An epic
3. marshy area
4. Wetland
5. Mouza is an administrative block comprising several villages.
6. Information has been collected from interviews with the GMC authority.

CHAPTER 4

Methodology

Having discussed the conceptual framework and study area, the next issue addressed is measurability of QOL. The procedure adopted for empirical validation of the conceptual framework of QOL in the city of Guwahati has been discussed below.

4.1 The measurement of quality of life

Measurement of QOL has been considered as a conundrum by the policy makers and researchers. Researchers in this field are of the view that the concept of QOL might prove an important instrument for public policy making and above all, for social planning (Pacione, 2003a). But decision makers nourish the opposite view being affected by the fear of research bias. They believe that QOL is of direct relevance only to academic questions such as testing of conceptual models of life quality or to explore the association between QOL and various personal or environmental attributes. This controversy requires resolution of this problem and empirical testing of quality of life models can help to a great extent in this direction.

Very often, the idea of quantifying QOL is questioned. If society is considered as a whole and policy measures are taken to increase welfare, some numbers or grades must be assigned against such measures to assess its effectiveness (Parmeswaran, 1996). Many specialists agree that QOL has some meaning as grade and grade ranges from high to low. The most important fact to understand about QOL indicators is that all measures of quality are proxy i.e. indirect measures of the true condition which is sought to be judged. Since measures of QOL are not directly quantifiable, they are very often called indicators. The defined measure of QOL is related to the purpose to which it is put. But before all else, the purpose of evaluation should remain clear prior to undertaking it.

Measures of QOL are important for several purposes. First, one may wish to compare the states of affairs in different places or between different groups of people, at a given point in time. Secondly, one might wish to make welfare comparisons of people over time in the same place or members of a particular group. For example, one may ask if a country is doing better today than it did a decade ago, and so forth. The idea is to compare the present standard of living of a group of people at different point of time. The previous two reasons for the need of welfare indices focused on measures that reflect the current living standard. In contrast, the third reason stems from a desire to estimate the economic component of the standard of living an economy is capable of sustaining along alternative programs. Finally, quality-of-life index is necessary to evaluate alternative economic policies. Criterion functions for social cost-benefit analysis of investment projects, such as the present discounted value of flow of accounting profits are examples of such indicators (Dasgupta, 2001).

This work is an attempt to assess QOL in an urban environment. Usually, QOL refers to the degree to which a person's life is desirable versus undesirable, often with an emphasis on external components, such as environmental factors and income. But in this study, QOL is defined more broadly to include not only the quality of life circumstances, but also what respondents think about those circumstances (Diener, 2006 and Glatzer, 2006). As has been discussed in chapter 2, a conceptual framework has been prepared to carry out the study. The framework places QOL as the central focus while taking into account the relations between men and environment. In this study, environment refers to a local urban environment which comprises physical, economic and social attributes. This framework combines circumstance of external living condition (objective QOL) and appraisal of people's satisfaction from such living condition (subjective QOL). In the study, overall QOL has been measured to see the extent to which respondents are satisfied when thinking about their life as a whole (Moller, 2001 and Beukes et. al, 1997). Overall QOL has been measured in terms of satisfaction from life on a five point Likert Scale.

In this study, secondary information has been used to have a clear idea about the condition of living in the study area. Secondary information have been collected from a number of sources like Statistical Handbook of Assam, Economic Survey of Assam, Pollution Control Board of Assam, Census Report, Guwahati Municipal Corporation (GMC) Office and other published sources. But assessment of QOL is made by the respondent himself or herself. Such information cannot be furnished by secondary sources usually. Therefore, field survey has been conducted to collect self reported first hand information. The procedures of collecting primary data have been mentioned below.

4.2 The survey

4.2.1 Study area and sampling procedure

To collect primary information, sample survey has been conducted in Guwahati city at household level. The period of the study is from April 2006 to October 2006. The study has been conducted in area under the jurisdiction of the Guwahati Municipal Corporation (GMC) which comprises 60 wards. Two stage sampling has been applied for collecting primary information. In the first stage 10 percent of the total wards i.e. 6 wards have been selected purposively to represent heterogeneity of the city as far as possible. For selecting wards three distinct attributes have been taken into consideration such as traditional (old) area, commercial area and newly established area and two wards have been taken from each category for sampling. Habitation in the city mainly started in the traditional area and commercial areas grew up in the proximity of traditional area. In the last two decades habitation has started spreading towards the fringe of the city. Therefore, to take into account the variation in residential setting, these three types of residential patterns have been included in the study.

Settlements in the traditional areas started almost 100 years ago. These areas have several historical features and dominated by traditional morphological features established during the British rule. Although these are mainly residential areas, retail and commercial activities have also been found in these areas. Commercial area is hub of transportation and hotel activities, educational, administrative and wholesale or retail trade activities. It

is the busiest and most lively part of the city. Newly established areas refer to those fringe areas where people have started living in the last two decades or so. The main reason behind the expansion of the city towards fringe is migration of population. People from all the districts of Assam and neighbouring states have migrated on large scale to Guwahati during the last twenty years. While the central locations of the city have reached saturation level in terms of requisite vacant land for residential purposes, there has been a perceptible shift of such developments to the fringes of the city. Locations like Zoo-Narengi Road, Khanapara, Beltola and Basistha are developing as alternative residential destinations. But settlements in the fringe areas are not well planned.

Table 4.1: Distribution of wards with total number of household

Category	Ward number	Number of households
Traditional area	18	1453
	34	2481
Commercial area	29	1275
	31	1040
Newly established residential area	13	3558
	42	3013

Source: Census of India, 2001, Primary Census Abstract, Assam

Table 4.1 shows the wards selected to represent various categories of residential areas. Traditional area has been represented by ward number 18 and 34. While ward number 18 covers Santipur area, Bhutnath area and Kumar Para area, ward number 34 covers Uzanbazar area, Barowari area, Happy Villa area, Rajbari area, Latasil area, Jahaz Ghat area and Jorpukhuri area. To represent commercial area, ward number 29 and 31 have been taken into consideration. Ward number 29 includes Fancy Bazar locality where as ward number 31 includes Panbazar and Paltan Bazar area. Newly established residential area has been represented by ward number 13 and 42. Ward number 13 covers part of Fatasil, part of Jyotikuchi, Dakhingaon, Betkuchi, Pub and Pachim Boragaon, part of Tetelia, part of Gotanagar and part of Dakhin Jalukbari area. Ward number 42 includes

Japorigog area. It is impossible to calculate the number of household surveyed in each of the locality as mentioned above because there is no clear cut demarcation of boundary among the wards in the city.

In the second stage, after selection of wards to represent traditional, commercial and newly established residential areas, emphasis has been given on selecting some localities on the basis of observation and available secondary information to represent different income groups in each of the six wards. Then households have been randomly selected. In most of the cases, household head has been interviewed. But in absence of the family head any other available adult member has been interviewed. Keeping in view time and resource constraints, 3 percent of the total households from each ward have been interviewed (Fakhruddin, 1991). Thus, the number of households surveyed is 379. While sampling, emphasis has been given on picking up houses which are not close to each other in a locality. The required information has been collected with the help of a structured questionnaire.

4.2.2 The questionnaire

Before constructing the questionnaire, standard pattern prescribed by different authors have been reviewed. The WHOQOL Group (1995, 1998) has prepared 'WHOQOL Field Trial Form' to carry out QOL research collaboratively in different cultural settings. Individual's perception about position in life has been evaluated in the context of culture and value system while giving due consideration to their goals, expectations, standards and concerns. Grootaert (1986) has found that levels of living depended not only on individual characteristics, but also on living environment. The author presents a questionnaire called "Living Standard Measurement Survey" which is also accompanied by a community questionnaire for the living environment. Grosh et al. (2000) has forwarded one of the most comprehensive and informative documents to provide reliable information about economic, social and environmental condition. Similarly Christakopoulon et al. (2001) has prepared a community well-being questionnaire which could effectively provide valid and reliable profile of community well-being. Their

questionnaire assesses local area as physical, social, economic, political and psychological setting. Ulengin (2002) has taken into account physical, social, economic and transportation as dimension of QOL. Riseborough (2002) has developed a questionnaire to assess the impact of programmes to improve the local area and life opportunities of the residents. These questionnaires depict a clear idea about what variables should be included to assess human well being. Variables included in the questionnaire used in the present study have been selected through literature review, discussion with fellow residents and from personal experience of living in the city so that it can reflect the condition of life in the city.

4.2.3 Description of relevant variables and justification for their inclusion

The questionnaire mainly contains both objective and subjective measures of QOL. The first part of the questionnaire comprises questions on demographic information. Such demographic information includes questions on family composition, age, education, income and occupation. The questions on demographic information are followed by questions related to objective measures of physical, economic and social environment. This is followed by measures of subjective QOL. Life satisfaction has been handled as an ordinal variable with values between 1 and 5, where 1 corresponds to the very unsatisfied category and 5 corresponds to the very satisfied category (Rojas, 2006; Rojas, 2008; Smyth, 2008 and Rampichini et al., 1997). The subjective evaluation focuses on the notion of satisfaction with living circumstances (McCrea et al., 2006). Description of relevant variables included in the study has been given below.

4.2.3.1 Variables in the domain of physical environment

In the physical environment, the house is the first and foremost component. Respondents have been asked about ownership of the place he or she is living owing to the fact that having own house means a lot to a person. Besides ownership, the type of house is also important. For instance, living in a *pucca*[1] house is more comfortable than living in a

[1] With cemented floor

katcha[2] house. It provides better material condition of living besides creating positive impact on the inhabitant. Crowdedness in residential area can not be ignored while assessing quality of life in urban areas (Ng, 2005a). Therefore, it is important to take into consideration how many persons are living per room. Accordingly, respondents have been asked about total number of rooms, number of bed rooms, number of drawing rooms, number of dining rooms, number of kitchen and number of store rooms in their houses. To concretize the concept of crowdedness, first the number of children is considered. Any number of children below age ten years has been considered as one unit and couples are also considered as one unit. Then the ratio of total number of bed rooms and total adult units has been calculated to conceptualize the concept of crowdedness (Park, 1997).

Water is an indispensable element of life. Therefore, the source of water and its nearness to the household have been taken into account. Besides respondents have been also asked to report on the quality of water they have been using for household purpose including drinking. To maintain cleanliness it is important to see how solid and liquid wastes have been disposed off. There is lack of planned drainage system in the city of Guwahati. Moreover, solid waste disposal system has also created major problems in the city. Therefore, these two variables have also been taken into account. Another important aspect of living condition is sanitation. Guwahati is lacking an integrated sewerage system. Therefore, respondents have been asked about the type of toilet they have been using. A newly cropped up problem in Guwahati is water logging. In fact water logging is also attributed to unscientific drainage system as well as inefficient solid waste disposal system. Therefore, the extent of problem of water logging and its effect have been evaluated in the study. Due to various reasons noise level on an average is increasing which must be taken into account in assessing quality of life (Rehdanz et al., 2007). The air quality and its possible effect on health have also been assessed in the questionnaire (Welsch, 2006a; Welsch, 2006b and MacKerron, 2008).

[2] Without concreted floor and plinth.

4.2.3.2 Variables in the domain of economic environment

To assess the financial condition of the household, respondents have been asked about their monthly household income. Income has been captured in terms of some slabs because people are normally reluctant to disclose actual income. Initially five slabs have been constructed to measure income. The range of income for these groups have been taken as Rs. 2000 and less, Rs. 2001 to Rs.5000, Rs. 5001 to Rs.10000, Rs.10001 to Rs.15000 and Rs. 15001 and above respectively. Later on, very low and low income group have been clubbed into low income group. Thus, on the basis of monthly income, households have been classified into low, middle and high income groups and threshold level of income corresponding to these groups are Rs.5000 and less, Rs. 5001 and 15000 and Rs. 15001 and above respectively (Ngullie, 2002). It should be mentioned that the household income is the sum of total income of all earning member of the family in a month i.e. the monthly amount of money that a household receives. However the role of household income as the indicator of financial prosperity is limited because it does not take family size into consideration. But it is a common practice to use household income or household equivalent income as a proxy for the economic well-being of all members in the family (Fuentes et al., 2001 and Rojas, 2009). It is a tradition in the Indian society that capable members contribute to family expenditure which makes living easy. To have better picture about economic well being of the family, several additional questions have also been asked in the expectation that they could provide more reliable information on economic condition of the family. The respondents have been asked about additional income. Additional income is important to determine economic condition of the family (Takahashi, 1979). They have been asked about the possession of consumer durable goods like refrigerator /Television/ Phone/ Water filter (traditional/ sophisticated one)/ LPG / air conditioner / internet /news paper. At the same time, it is equally important to know the saving habit of the respondent. The respondents have also been asked about income security if suddenly the flow of main source of income is disrupted.

4.2.3.3 Variables in the domain of social environment

Absence of congenial social environment has been always considered to be deterrent in improving QOL. In a good society citizen should be in good health. They should be able to enjoy freedom and security. They should also be characterized by the presence of adequate provision of basic infrastructural facilities like efficient transportation services, recreational facilities, open space and parks and institutions for social services etc. Therefore, to assess health condition, respondents have been asked how many times they visited a doctor in the last three months. The reference period of three months has been justified on the ground that people may forget if longer period is taken into consideration. Usually urban societies are characterized by low level of interaction in a neighbourhood (Adriaanse, 2007 and Christakopoulon et al., 2001). Therefore, to have an idea about interpersonal communication, respondents have been asked how many families they interact in the neighbourhood. Moreover, there must be community involvement among residents for good community life. Hence, respondents have been asked whether they participate in social services, cultural activities, club activities, and occasional visit to other families. Sense of security is also important to enhance QOL. For that reason, respondents have been enquired whether they have been suffering from the fear of any such problem like theft, robbery, threat or something else. At the same time they have also been asked whether they had to go to police station. Availability of open and green space plays significant role in determining QOL (Shafer et al., 2000 and Marshall, 2004). To assess the accessibility of such urban amenities, respondents have been asked about availability of park, playground, public or private open space which they could easily reach. Besides parks and open space, availability of shopping facility including medical establishment is also important to community well-being. When the residents are forced to travel to neighbouring localities for shopping might feel unhappy. Conversely, communities with a variety of retail services and establishments contributed to a strong sense of consumer well-being (Sirgy, 2008). So, the respondents have been asked about availability of grocery shop, vegetable market, stationery and bakery and medical establishment in the locality. Leisure also play important role in determining QOL. Respondents are inquired whether they involve themselves in outdoor activities like

going to park, sports club, cinema, theatre etc (Lloyd et al., 2002). They are also inquired about their interest in gardening, watching TV or listening to radio or music system. Mode of travel and efficiency of transport system are also two important variables of the questionnaire. It is the transport facility which provides mobility in fast urban life. It facilitates connection between residences, working place, recreational site, shopping and so on. Being able to go shopping with relative ease and not struggling with traffic and parking make a difference in consumer well-being. Similarly, being able to give a ride to various community destinations with relative ease makes difference in one's sense of family well-being (Sirgy, 2008).

Thus, combining physical, economic and social dimensions altogether 28 variables have been included to measure objective QOL. The questions in the objective part deal with self reported objective living condition and variables in each dimension along with response items have been shown in Table 4.2.

Table 4.2: Variables with response options in objective measure of QOL

Domain	Variables	Options to answer from and scores for each answer
Physical environment	Ownership of residence (X_1)	Own independent *pucca* house=5, apartment=4, Rented *pucca* house/Quarter=3, own *katcha* house=2, rented *katcha* house=1
	Crowdedness (X_2)	One person: one room=5, two persons : one room=4, three persons: one room=3, four persons: one room=2, above four persons in one room=1
	Source of water (X_3)	Inside well=5, inside water supply=4,outside well=3, outside water supply=2 and others=1
	Water time (X_4)	24 hours=5, twice a day=4, once a day=3, Every alternate day=2, not even once a week=1
	Water cleanliness (X_5)	No problem=5 , pipe leakage=4, color and odor=3, not clear=2, suffering from more than one water related problem=1
	Drainage system (X_6)	*Pucca* drain =5, *katcha* drain=4, wastewater accumulates in a pit or tank= 3, stinking drains =2 , stinking pits=1,
	Solid waste disposal system (X_7)	Regularly cleaned bin=5, private agency=4, throw in the backyard or burn=3, irregularly cleaned bin=2, throw in the streets=1
	Sanitation (X_8)	Toilet with septic tank=5, common toilet with septic tank=4, toilet with tank of ring=3, toilet with a pit=2, no toilet=1
	Extent of the problems of water logging (X_9)	No water logging=5, maximum one day in street=4, maximum one day inside the premise=3, water logged for more than one day=2, loss of property=1
	Problems of noise (X_{10})	No noise=5, neighbourhood noise=4, loudspeaker noise=3,vehicular noise =2, industrial noise=1
	Air quality(X_{11})	No problem with air=5, foul smell=4, dust in air=3 , ash and smoke=2, more than one problem with air=1
	Air effect (X_{12})	No visible adverse effect=5, increasing cost of cleanliness=4, reduced visibility=3,watering eyes=2, increased breathing problem=1

Domain	Variables	Options to answer from and scores for each answer
Economic environment	Income (X_{13})	Rs. 15000 and above=5, Rs.10001 to 15000=4, Rs.5001 – 10000=3, Rs.2001-5000=2, Rs.2000 or less=1
	Additional source of income (X_{14})	Permanent asset=5, part time job=4, side business=3, others=2, no additional income=1
	Saving habit (X_{15})	Bank deposit as well as insurance=5, bank deposit=4, insurance policy=3, savings in society=2 and no saving =1
	Use of credit (X_{16})	Does not use credit =5, loans for consumer durable=4, housing loan=3, loan for medical treatment=2 and others=1
	Feelings of income security (X_{17})	Permanent asset=5, past saving=4, helps from relatives=3, borrowing=2 and no income security=1
	Use of consumer durables (X_{18})	Items: Refrigerator/ TV/ Phone/ Water filter (general/ aqua guard)/ LPG / air conditioner / internet /news paper All=5, any six=4, four to five items=3 ,one to three items=2, nothing=1
Social environment	Health problems (X_{19})	Never visited doctor in the last 3 months=5, once or twice in the last 3 months=4, once a month=3, twice a month=2 and more than two times a month=1
	Interaction with neighbourhoods (X_{20})	Interaction with almost all families in the locality=5, interaction with 5-10 families=4, interaction with 3-4 families=3, interaction with hardly 1-2 families=2, no interaction at all=1
	Involvement with the local society (X_{21})	Club and social activities=5, social service only=4, only club=3, cultural event=2, no involvement at all=1
	Sense of security at home (X_{22})	No insecurity=5, theft=4, threat=3, robbery=2 and others=1
	Visit to police station (X_{23})	Never visited police station=5, problem was solved by police=4, FIR lodged but nothing was done=3, ignored by police=2, complain against family=1
	Availability of open space (X_{24})	Park=5, playground=4, public open space=3, private open space=2 and no open space=1
	Availability of shops in the locality (X_{25})	Grocery shop, vegetable market ,stationary and bakery, medical establishment, no shops All kinds of shop=5, any four kinds of shops=4, any three kinds of shop=3, any two types of shop=2 and no shop=1
	Leisure activity (X_{26})	Go to park/visit people=5, go to sports/club/cinema/theater=4, gardening=3, watch/TV/radio/music=2, nothing specific /just stay at home=1
	Mode of travel (X_{27})	Own vehicle=5, walk=4, public transport at 5 minutes interval=3, public transport at 5-10 minutes gap=2, more than 10 minutes=1
	Efficiency of transport system (X_{28})	Reach destination on time=5, delay on your own part=4, can not board bus for heavy rush=3, inefficiency of public transport=2 and traffic jam=1

Source: Field work

4.2.3.4 Variables in the subjective domain

Overall QOL has been assessed in terms of overall life satisfaction with the help of a 5-point Likert scale (Seik, 2000; Westaway, 2006 and Ng, 2005). This scale is constructed by slightly modifying the survey questions applied in happiness survey in India to know how satisfied they are with life as a whole (Veenhoven, 2007). In the happiness survey,

the quantitative responses are rated as follows: (a) not at all satisfied, (b) not very satisfied, (c) satisfied, (d) very satisfied and (e) completely satisfied**.** This scale is restructured for the present study as follows: very satisfied, satisfied, neutral, dissatisfied, very dissatisfied. The response 'very satisfied' has been rated as 5, 'satisfied' as 4, 'neutral' as 3, 'dissatisfied' as 2 and 'very dissatisfied' as 1 (Beukes et al., 1997 and Sirgy, 2008). From the literature review it has been found that there are various means to assess subjective evaluation of QOL such as happiness, gladness, satisfaction and so on. But out of all these, satisfaction has been found to be more stable instrument of subjective evaluation of QOL (Crooker et al., 1998 and Wen-Tsou, 2001). Accordingly, level of satisfaction from living environment has been taken as a measure of subjective evaluation of QOL in the present study.

After asking the questions on objective dimension, respondents have been asked about their opinion on overall QOL. The specific question posed to them is "What do you feel about your overall quality of life?" The responses were captured in a five point Likert scale as mentioned above. Then a series of questions have been asked to assess the level of satisfaction with condition of housing, availability of parks and green areas, economic condition, cost of living, sense of personal security, health facilities, traffic, and welfare services rendered by local administration. Then the same question on overall QOL has been repeated, "What do you feel about your overall quality of life?" The second response has been assumed to be a more intuitive one, as the responses would be a more well-thought and rational one as it would be somewhat influenced by preceding questions on the respondent's level of satisfaction towards various aspects of life (Seik, 2000). The first question about overall QOL has been coded as QOL_1 and when the same question is repeated again, the response has been coded as QOL_2. The variables used to measure subjective QOL are shown in Table 4.3.

Table 4.3: List of variables included in subjective dimension

Domain	Questions and level of satisfaction
Overall quality of life(QOL_1)	What do you feel about your overall quality of life (X_{29}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1
Physical environment	Satisfaction from condition of housing (X_{30}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1 Satisfaction from availability Parks and Green areas (X_{31}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1
Economic environment	Satisfaction from one's own economic condition (X_{32}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1 Satisfaction from cost of living (X_{33}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1
Social environment	Satisfaction from sense of personal security (X_{34}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1 Satisfaction from health facilities (X_{35}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1 Satisfaction from condition of traffic (X_{36}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1 Satisfaction from local administration (X_{37}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1
Overall quality of life(QOL_2)	What do you feel about your overall quality of life (X_{38}): Very satisfied=5, satisfied=4, neutral=3, dissatisfied=2, very dissatisfied=1

Source: Field work

In order to examine the consistency in the responses to this question the internal consistency of the instrument has been computed by applying Cronbach's alpha method. Using Cronbach's alpha, the internal scale reliability of the items have been found to be as high as 0.87. After this some descriptive statistics have been provided below for the relevant variables.

4.3 Descriptive statistics

4.3.1 Demographic profile

The distribution of sample households according to various demographic features is presented in Table 4.4. About 85.6 percent of the household heads are male and 14.4 percent are female. Male-headed household is a common feature in most of the Indian societies except for a small number of regions only. Majority of the households, i.e. 36.7 percent are found to have 4 members in the family where as 27.8 percent are having 3 members, 10.2 percent are having 2 members, and rest of the families i.e. 25.3 percent are having 5 members or more. This clearly shows that most of the families in the city are nucleus in nature.

Table 4.4: Distribution of respondents: demographic features

Sex of the head of the household	**Percentage**	**Age group**	**Percentage**
Male	85.6	20-30	5.6
Female	14.4	31-40	32.5
		41-50	26.4
		51 and above	36.5
Number of family members	**Percentage**	**Education**	**Percentage**
2	10.2	Up to primary	16.9
3	27.8	Up to HSLC	10.0
4	36.7	Up to Degree	27.5
5 or more	25.3	Above Degree	45.6
Number of children below 10 years	**Percentage**	**Employment**	**Percentage**
No children below this age	49.4	Does nothing/housewife	7.2
1	41.7	Self employed in manual work	11.7
2	7.2	Retired	8.6
3	1.1	Business	25.6
Four or more	0.6	Service	46.9

Source: Field work

It has been found that, majority of the respondents i.e., 35.6 percent are more than 50 years old. But equally large number of respondents i.e. 32.5 percent belongs to the age group 31-40 years. 5.6 percent of the respondents are in the age group 20-30 years and 26.4 percent of the respondents belonged to the age group 41-50 years. In the sample,

41.7 percent of the respondents are having 1 child below 10 years age, 49.4 percent do not have children below 10 years in the family, 7.2 percent are having 2 children below ten years and only 1.7 percent is having more than 2 so young children. It clearly shows that the consciousness towards increasing population.

In the survey none of the respondents has been found to be illiterate where as 45.6 percent are graduate or more. 16.9 percent of the respondents have studied up to primary level, 10 percent has studied up to matriculation and 27.5 percent is under graduate. The survey reveals that 7.2 percent respondents have been found to be not associated with any kind of work to generate income (including housewife). The high percentage of educated persons in the survey is due to the fact that the literacy rate in Guwahati is higher at 77 percent (Govt. of Assam, 2006) compared to India average and most of the householders are also income earners. So, higher percentage of highly qualified people does not mean that the sample size is not representative of the population. To be precise if the survey provides representative information or not, therefore the frequencies of income groups have also been taken into consideration. This has been done in subsection 4.3.3. About 11.7 percent are self employed in low income earning activities like pulling rickshaw, street vendor etc. and 8.6 percent is retired servicemen. Among the sample, 25.6 percent are associated with business and 46.9 percent are in service. The level of education and pattern of employment shows that respondents are mostly qualified and their main occupation is service.

4.3.2 Attributes of residential area

The condition of housing and other features of physical environment has been shown in Table 4.5. The study of residential pattern shows that 38.8 percent of the respondents are residing in rented house either *pucca* or *katcha* whereas the remaining respondents are living in own house or flat. Almost 7 percent of the respondents are living in flats. That a large number of respondents live in rented house reveals the fact that there is rise in demand for houses. It has been found that 26.4 percent of the respondents are living in a

condition where room-person ratio is 1:2 or more. But interestingly, 65.5 percent of them are having individual rooms.

Table 4.5: Distribution of respondents: attributes of residential area

Ownership and type of houses	**Percentage**	**Solid waste disposal system**	**Percentage**
Rented *katcha* house	7.8	Streets and open space	8.9
Own *katcha* house	10.3	Irregularly cleaned bin	25.0
Rented *pucca* house	30.8	Backyard or burn	32.2
Own flat	4.7	Private agency	2.5
Own independent house	46.4	Regularly cleaned bin	31.4
Room per person	**Percentage**	**Sanitation**	**Percentage**
Above 4 person 1 room	0.6	No toilet	0.6
4 person 1 room	1.9	Pit	9.2
3 person 1 room	5.6	Toilet with a tank of ring	12.8
2 person 1 room	26.4	Toilet with a common septic	11.1
1 person 1 room	65.5	Individual family septic	66.3
Source of water	**Percentage**	**Area affected by water logging**	**Percentage**
Inside well	57.2	Loss of property	8.3
Out side water supply	21.1	More than 1 day	8.1
Outside well	5.0	Max 1 day inside the premise	2.5
Inside water supply	15.6	Max 1 day in street	20.0
Others	1.1	No water logging	61.1
Water supply duration	**Percentage**	**Respondent affected by noise**	**Percentage**
Not even once a week	1.7	Industrial noise	3.9
Every alternate day	0.8	Vehicular noise	39.2
Once a day	32.8	Loudspeaker noise	1.4
Twice a day	3.6	Neighbour's noise	2.2
24 hours	61.1	No noise	53.3
Water cleanliness	**Percentage**	**Air quality**	**Percentage**
No such problem	57.8	More than one problem with air	3.9
Not clear	13.3	Ash & smoke	4.7
Colour and odor	22.8	Dust in air	34.2
Pipe leakage	3.3	Foul smell	4.7
Combination of problems	2.8	No air problem	52.5
Drainage system	**Percentage**	**Air effect**	**Percentage**
Pucca drains	56.2	Increased breathing problem	15.0
Katcha drain	31.1	Watering eye	7.5
Pit	8.6	Reduced visibility	12.5
Drains stinks	1.9	Increased cost of cleanliness	9.4
Stinking pits	2.2	No problem with air	55.6

Source: Field work

It has been found that 42.8 percent of the respondents use supplied water and the rests have indigenously built water supply facilities like tube well or well inside the premises. Those who are using supply water reports that only 3.6 percent gets water twice a day.

Others i.e. 35.3 percent are having very erratic supply of water. Regarding water quality, 42.2 percent of the respondents report some or other kind of problems like leakages in the pipes, colour, odor, unclear water and combination of problems.

The questionnaire also includes questions on household wastes system and drainage system in the campus. From the secondary data it has been found that 37.32 percent of the respondents do not have any drainage system (Govt. of India, 2001a). But the survey reveals that about 10.8 percent of the respondents are without any drainage system either *pucca* or *katcha.* They use pit which often smells bad. In the city 31.1 percent respondents are using *katcha* drain and 56.2 percent are using *pucca* drain. For disposing solid waste people use different means like throwing in the lane or backyard, dustbins, etc. Of course, some people have been using services provided by private agencies for collecting wastes. Only 31.4 percent respondents are using regularly cleaned bin in their locality. 8.9 percent of the respondents have the habit of throwing household wastes in the streets. The percentage of respondents who reports irregularly cleaned bin is 25. People who throw garbage in the backyard and burn when garbage piles up are 32.2 percent. The statistics reveals that the number of respondents who are not using dustbin at all is even greater.

From secondary information it has been found that 81.61 percent of the residents are having septic tank in their household in Guwahati (Govt. of Assam, 2006). Against this, it has been found from the survey that respondents having septic tank are 66.3 percent which is much lower. Respondents using pit toilet is 9.2 percent, 11.1 percent are sharing common toilet and less than one percent do not have any kind of toilet. It has been also found that respondents using toilet with tank of ring is 12.8 percent. Using such tanks is not a healthy practice because the sewage often contaminates the ground water flow especially in the monsoon.

The percentage of respondents who are affected by water logging is 38.9 and out of them, 8.3 percent suffers from property loss. But interestingly, 61.1 percent of the respondents report no water logging problem at residence. It shows that although it is a severe

problem, majority of them reports no such problem. It might happen because of non occurrence of water logging problem during the survey period. Due to increase in number of vehicles, 39.2 percent of the respondents have reported to be affected by noise. Noise from industries affects 3.6 percent, loudspeaker noise affects 1.4 percent and 53.3 percent of the respondents have reported that they are not affected by any kind of noise.

It has been reported that 48 percent of the respondents are affected by air problem. The major problem is dust pollution which affects 34.8 percent of the respondents. 4.7 percent of the respondents are affected by ash and smoke in the air, 4.7 percent are affected by foul smell and 3.9 percent are affected by combination of problems. At the same time, it has been reported that such dust pollution causes increased breathing problem to 15 percent and problem of reduced visibility to 12.5 percent. Respondents who have complained of increased cost of cleanliness are 9.4 percent and 7.5 percent of the respondents have been suffering from watering eyes.

4.3.3 Economic condition

Table 4.6 illustrates the distribution of respondents according to household income, additional income, saving habit, material needs in the form of consumers' goods and income security. The result reveals that majority of the respondent i.e. 29.2 percent belongs to the income group Rs. 5,001-10,000. Respondents belonging to the lowest income group Rs. 2,000 or less is 5.8 percent and respondents who belonged to income group Rs. 2,001 -5000 is 13.9. When this very low income group has been clubbed with low income group it becomes 19.7 percent. At the same time respondents in the middle and high income group have been found to be 22.8 and 28.3 percent. This ensures that all the income groups have been represented in the sample size.

Regarding additional income, it has been found that only 29.7 percent of the respondents have access to additional source of income. For most of them i.e. for 20 percent of the respondents, the source of additional income is permanent asset like rent house. Part time

job and subsidiary business in free time is the source of additional income for 2.8 percent and 3.1 percent respondents where as 3.5 percent are engaged in any other activities.

Table 4.6: Distribution of respondents: financial condition

Monthly income of family	**Percentage**	**Use of credit by family**	**Percentage**
2000 or less	5.8	Do not use credit	68.9
2001 to 5000	13.9	Loan to maintain health cost	2.2
5001 to 10,000	29.2	Housing loan	13.6
10,001 to 15,000	22.8	For consumers durable	13.1
15,001 and above	28.3	Others	2.2
Additional Income of family	**Percentage**	**Consumer durable goods in household**	**Percentage**
No additional income	70.6	Nothing	10.0
Others	3.5	1 - 3 items	10.0
Subsidiary business	3.1	4 - 5 items	18.6
Part time job	2.8	Six items	52.5
Permanent asset	20.0	All goods	8.9
Saving of family	**Percentage**	**Income security at least for 45 days**	**Percentage**
No formal saving	20.0	No	25.0
Society saving	1.1	Borrowing	0.6
Insurance policy	2.5	Helps from relatives	5.2
Bank deposit	25.3	Past saving	57.5
Bank deposit and insurance	51.1	Permanent asset	11.7

Source: Field work

When the respondents have been asked about saving habit, it has been found that 80 percent have savings either in the form of society saving, insurance policy, bank deposits or in combination. At the same time 20 percent respondents do not have any kind of formal saving. Along with saving habit, it is also important to know the extent of loan burden to assess the economic status of the family. The survey reveals that 31.1 percent of the respondents have loan burden. Mostly they borrow for construction of house (13.6 percent) and to buy consumer's durables (13.1 percent). Respondents also borrow for health expenses (4.4 percent) and a meager 2.2 percent takes loan for any other purposes including family function or so. When they have been asked about income security for at least 45 days, 57.5 percent respondents have reported that there is no insecurity during the period owing to adequate past savings. At the same time 11.7 percent has reported that permanent asset can help them in absence of income during that period. It has been

found that 20 percent respondents possess permanent asset which generates additional income but it is adequate to meet unforeseen situation only in case of 11.7 percent. A marginal 5.2 percent have answered that they would take help from relatives and 0.6 percent would go for borrowing. This clearly reflects that credit is not so easily available in emergency which is a common characteristic in the society of developing countries. There is no income security for 25 percent of the respondents. Respondents have been asked about the possession of six minimum necessary consumer durable goods but a moderate 52.5 percent have access to all of them. The scenario depicted above clearly bears all the economic character of a society of a developing country.

4.3.4 Societal condition

A healthy society is represented by healthy respondents. Therefore, to have an idea about condition of health respondents have been asked how many times he or she had visited doctors in the last few months. Besides, frequency of visit to doctor gives an idea about severity of the problems. Table 4.7 reveals that 2.8 percent have visited doctors more than two times in a month, 3.1 percent twice a month, 14.1 percent once a month, 26.9 once or twice in the last three months and the remaining 53.1 percent have not visited doctor in the last three months. Regarding the level of interaction, it has been found that the society is characterized by low level of interaction. It is clear from the fact that 53.1 percent respondents have limited interaction covering only five to ten families and the remaining 46.9 percent interact with extended number of families in the neighbourhood.

Respondents have reported that they participate in different kinds of activities in social life. Almost 37.5 percent take part in cultural events, 12.8 percent visits clubs, and 21.4 percent participate in social service. Some of them, i.e., 20.8 percent are involved with more than one activity where as 7.5 percent is not involved with any kind of activities. Regarding insecurity, it has been reported that 33.3 percent of the respondents have been suffering from some kind of insecurity like robbery, theft, threat and so on. Against this it has been found that 91.1 percent of the respondents have never visited police station.

Table 4.7 Distribution of respondents: societal condition

No. of times respondent visits doctor	**Percentage**	**Availability of open space within 1 Km**	**Percentage**
More than 2 times a month	2.8	No open space	42.5
Twice a month	3.1	Private open space	12.8
Once a month	14.1	Public open space	8.3
Once of twice in the last three months	26.9	Playground	11.7
Never visit doctor in last 3 months	53.1	Park	24.7
Interaction with neighbours	**Percentage**	**Availability of shops**	**Percentage**
No interaction at all	1.9	No shop at all	4.4
Hardly 1family	4.3	Any one kind of shop	4.4
3 - 4 families	6.9	Any two types of shops	6.7
5 - 10 families	40.0	Any three types of shops	17.8
All most all families	46.9	All kinds of shops	66.7
Involvement with society	**Percentage**	**Frequently done leisure activity**	**Percentage**
No such involvement	7.5	Nothing specific/just stay at home	20.0
Cultural event	37.5	Watch TV/radio/music	6.1
Only club	12.8	Gardening	2.5
Social service only	21.4	Go to sports/club/cinema/theatre	11.7
Club and social activity	20.8	Go to parks/visit people	59.7
Insecurity at home	**Percentage**	**Efficiency of transport system**	**Percentage**
No insecurity	66.7	Traffic problems	59.4
Robbery	8.9	Inefficiency of public transport system	3.3
Threat	6.9	Can't board in the bus for rush	2.8
Theft	15.0	You get delayed	1.9
Others	2.5	Reach destination on time	32.5
Visit to police station	**Percentage**	**Mode of travel**	**Percentage**
Never visited police station	91.1	Public transport at an interval of 10 minutes and above	5.8
Complaint was ignored	2.2		
FIR was lodge but nothing was done	1.7	Public transport at an interval of 5 - 10 minutes	19.2
Problem was solved by police	3.1	Public transport at an interval of 5minutes	31.1
Complain was against the respondent's family	1.9	Walk	12.8
		Own vehicle	31.1

Source: Field work

The survey reveals that 42.5 percent respondents do not have access to open space. Only 24.7 percent have access to park and 21.1 percent have access to private or public vacant place which can not be called park. Only 11.7 percent have easy access to playground. But respondents are enjoying shopping facilities. Only 4.4 percent respondents did not have access to shops in neighbouring areas and the remaining respondents are having

different kinds of shops in the neighbourhood. Respondents having access to all kinds of shops are 66.7 percent. In the survey, majority of the respondents i.e. 67.5 percent have reported traffic problem.

4.3.5 Life satisfaction and domain satisfaction

While evaluating subjective QOL, the respondents have been asked twice about overall QOL. The results are shown in Table 4.8. When asked about overall QOL_1, 51.9 percent of the respondents have been found to be satisfied with life. Respondents who are neutral is 15 percent and very satisfied respondents is 8.7 percent. The percentages of very dissatisfied and dissatisfied respondents have been found to be only 2.2 and 22.2 respectively.

Table 4.8: Variation in satisfaction level with overall quality of life

Category	Respondents satisfied with QOL _1 (in percent)	Respondents satisfied with QOL _2 (in percent)
Very dissatisfied	2.2	3.3
Dissatisfied	22.2	28.6
Neutral	15.0	26.1
Satisfied	51.9	41.4
Very satisfied	8.7	0.6
Mean value	3.43	3.07
Standard deviation	0.999	0.923

Source: Field work

But when the same question has been repeated towards the end of the interview changes have been noticed in responses. Table 4.8 reveals that percentage of very dissatisfied respondents increases from 2.2 to 3.3 percent. Similarly, when the question is repeated, the percentage of dissatisfied and neutral respondents increases by 6.4 and 11.1 percent respectively. But percentage of satisfied and very dissatisfied people decreases by 10.5 and 8 respectively. It clearly shows that respondents have changed their opinion about satisfaction after going through a set of questions related to satisfaction and it has also been found that the variance is less in the second round. Besides assessing overall

satisfaction with life, satisfactions from other domains have also been assessed as shown in Table 4.9.

Table 4.9: Basic statistics of environmental satisfaction

Domain	Variable	Mean value	Standard deviation
Physical environment	Satisfaction from condition of housing	3.43	1.06
	Satisfaction from availability of parks and green areas	2.89	0.92
	Satisfaction from the level of environmental pollution in the city	2.25	0.75
Economic environment	Satisfaction from your own economic condition	3.12	1.17
	Satisfaction from cost of living	2.77	1.11
Social environment	Satisfaction from sense of personal security	3.03	0.86
	Satisfaction from condition of traffic	2.18	0.64
	Satisfaction from health facility in the locality	3.06	1.06
	Satisfaction from welfare services provided in the locality	2.91	1.07

Source: Field work

Mean value of satisfaction in descending order is as follows: condition of housing (3.43), economic condition (3.12), health facility (3.06), sense of personal security (3.03), welfare services (2.91), park and green areas (2.89), cost of living (2.77), environmental pollution (2.25) and condition of traffic (2.18). It is clear from Table 4.9 that satisfaction from condition of housing is the highest and satisfaction from condition of traffic is the lowest among all. Respondents have revealed that their level of satisfaction is not so high regarding pollution level in the city. It clearly reflects the existing poor traffic and environmental condition in Guwahati.

From the descriptive statistics it is clear that attributes of QOL are affecting people in different degrees. There are variations in these attributes from individual to individual and some of the characteristics are inclined to a particular dimension. Therefore, the situation demands an investigation into the factors determining QOL. For better understanding of the situation, it is necessary to represent this diverse large number of

variables by fewer new variables. That is, it is necessary to establish a pattern of variation among the variables for easy handing and interpretation. To identify the factors that have greatest influence in accounting for variation in QOL following statistical techniques has been used.

4.4 Statistical tools

The main objective of the study is to determine the underlying dimensions which affect QOL. It is obvious that the demarcation of the domains of life are somewhat determined by all the above mentioned variables. It is also possible that there are correlations among all variables. However, given the set of original questions, factor analysis allows not only for a reduction of dimensions, but also for a good demarcation of the domains on the basis of clustering together those questions with similar information and setting apart those questions with different information. For this reason, factor analysis can be used to identify group of questions which provide correlated attributes of environment and which can be labeled as non arbitrary demarcation of dimension of life. Factor analysis can explore the covariance relationships among many variables in terms of a few underlying but unobservable random quantities called factors (Hair et al., 2005). The justification behind use of factor analysis comes from the fact that large number of variables increases the possibility that the variables are not all uncorrelated and representative of distinct concepts. Instead, group of variables may be interrelated to the extent that they are all representative of more general concept. That is, variables within a particular group may be highly correlated among themselves but have relatively small correlation with variables in a different group. It is conceivable that each group of variables represented a single underlying construct, or factor, that is responsible for the observed correlation.

After identifying the dimensions it is practical to construct a single variable to represent the various dimensions of QOL. Principal components technique has been used to create the new variables and a regression method has been used to calculate the factor scores (Rojas, 2006 and Rojas, 2008). The main concept of principal component is summarization of information. Principal component is concerned with explaining variance covariance structure of a set of variables through a linear combination of these

variables. In principal component, a set of variables have been transformed into some linear combinations of the original variables so that the resulting composite variables as a set might have maximum variance under the restriction that different linear composites are orthogonal to each other.

Secondly to find the significant factors which affect QOL, ordered probit regression analysis has been applied. This type of regression has been used because the dependent variable is an ordinal variable. In ordered probit analysis, the probability of an outcome is calculated as a linear function of the independent variables plus a set of cut points.

Let us assume that our ordered responses are denoted by Y*. The objective is to model these ordered responses as functions of explanatory variables. Here, the latent scale corresponds to the observed responses Y_i which has five categories. The ordered response model in this case is motivated by an underlying continuous but latent process Y* together with the response mechanism of the given form-

$Y_i = 1$ if $Y_i^* < \gamma_1$

$Y_i = 2$ if $\gamma_1 < Y_i^* < \gamma_2$

$Y_i = 3$ if $\gamma_2 < Y_i^* < \gamma_3$

$Y_i = 4$ if $\gamma_3 < Y_i^* < \gamma_4$

$Y_i = 5$ if $\gamma_4 < Y_i^*$

The model is

$$Y_i^* = \beta' X_i + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Now β and γ parameters have to be estimated. The γs are cut points that indicate the discrete category that the latent variable falls into. The latent variable Y^* is related linearly to observable and unobservable factor and the latter have a fully specified distribution for f (μ) with zero mean and constant variance. Equation (1) gives the significant factors of QOL (Boes et al., 2006).

After obtaining the significant factors, it would be required to see if factors are explained by differential effect of area or income groups. Therefore, a regression model has been fitted with the help of dummy variables. Dummy variables can point out the difference if they exist. Here, the base categories are traditional residential area and low income group. The model can be expressed as follows-

$$Y_i = a + b_{1i}D_c + b_{2i}D_n + b_{3i}D_h + b_{4i}D_m + b_{5i}D_cD_h + b_{6i}D_cD_m + b_{7i}D_nD_h + b_{8i}D_nD_m + u_i$$

..... (4.2)

Where

Yi = factor score vector of the i^{th} factor.

D_c =1, if it is commercial area

= 0, otherwise

D_n=1, if newly established residential area

=0, otherwise

D_h=1, if high income group

=0, otherwise

D_m=1, if middle income group

=0, otherwise

D_cD_h=1, if high income group respondents in commercial area

=0, otherwise

D_cD_m=1, if middle income group in the commercial area

=0, otherwise

D_nD_h=1, if high income group in newly established residential area

=0, otherwise

D_nD_m=1, if middle income group in newly established residential area

=0, otherwise

U_i=error terms

Here, the number of equations would be equal to number of significant factors which affect QOL. Based on above mentioned techniques results have been derived and these results have been discussed in the next chapter.

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CHAPTER 5

Quality of life and environment

Literature review reveals that QOL in general intends to refer either to the condition of living environment or to some attribute of people themselves and sometimes to their psychological well-being or the extent to which needs are fulfilled. The quality of living environment in urban environment for the people of the world has emerged as an issue of fundamental concern for academic researchers, policy makers and citizens for the first time in the history of humanity. Therefore, in this study QOL has been appraised in urban living environment for the reason that the degraded living environments in cities of the developing countries may pose a serious threat to the very survival of mankind (Pacione, 2003b).

5.1 Relationship between QOL and environment

To explore the relation between QOL and environment a large number of variables have been taken into consideration. Therefore, the first important thing is to analyze the structure of the interrelationship among these large numbers of variables by defining common dimensions which may be called factors. It is a way of summarization and data reduction for facilitating the study. After this, factors have been used to explore the underlying dimension of QOL by using ordered probit regression analysis. Here, underlying dimension means explanatory factors of QOL which has been elicited by ordered probit regression analysis.

To get reduced number of dimensions from the data set, factor analysis has been applied. Factor analysis generates 11 factors whose eigenvalues are greater than 1. The factor

loading matrix has been shown in Table 5.1. The first factor explains the highest percentage of variance which is 21.8. The factors are labeled as given below-

First factor: The first factor comprises the following variables: consumers' durable goods in the household, satisfaction from own economic condition, savings of the family, satisfaction from condition of housing, sanitation, monthly income of the family, income security, ownership of residence, satisfaction from cost of living, frequently done leisure activities, drainage system and room per person. It represents the familial capability which is inherent in financial condition of the household.

Table 5.1: Factor loading matrix of QOL

Factors / Variables	1	2	3	4	5	6	7	8	9	10	11
Consumer durable goods in household	.858										
Satisfaction from own economic condition	.805										
Saving of family	.796										
Satisfaction from conditions of housing	.788										
Sanitation	.766										
Monthly income of family	.748										
Income security at least for 45 days	.745										
Ownership of residence	.718										
Satisfaction from cost of living	.690										
Frequently done leisure activity	.628										
Drainage system	.592										
Room per person	.575										
Satisfaction from level of Environmental Pollution in city		.788									
Satisfaction from condition of Traffic		.698									

Satisfaction from availability of Parks and Green areas		.668									
Air effect			.759								
Air quality			.745								
Respondent affected by noise			.733								
Source of water				.899							
Water supply duration				.897							
Interaction with neighbours					-.667						
Solid waste disposal system					.622						
Satisfaction from health facility in locality					.552						
satisfaction from local administration					.497						
Visit to police station						.727					
Involvement with society						-.477					
Use of credit by family						.456					
Additional Income of family						-.427					
Mode of travel							.729				
Satisfaction from sense of personal security								.782			
Insecurity at home								.442			
Availability of open space within 1 Km									.739		
Efficiency of transport system									.647		
Area affected by water logging										.705	
Water cleanliness										.578	
Availability of shops											.680
No. of times respondent visits doctor											.679
Eigenvalue	8.08	2.73	2.40	2.06	1.50	1.54	1.32	1.21	1.14	1.04	1.00
Percentage of Variance explained	21.8	7.37	6.49	5.57	4.30	4.15	3.58	3.26	3.09	2.82	2.71

Source: Field work
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Second factor: This factor is characterized by the presence of variables like satisfaction from level of environmental pollution in the city, satisfaction from condition of traffic and satisfaction from availability of parks and green areas. It represents satisfaction from environmental condition.

Third factor: It consists of variables like air effect, air quality and respondents affected by noise. This factor is related to quality of physical environment which signifies pollution.

Fourth factor: The fourth factor comprises variables such as source of water and water supply duration. It is a factor of water availability which shows that availability of clean water is an important dimension of QOL.

Fifth factor: This factor is explained in terms of variables like interaction with neighbours, solid waste disposal system, satisfaction from health facilities in the locality and satisfaction from local administration. It represents contentment from neighbourhood qualities.

Sixth factor: This factor comprises variables like visit to police station, involvement with society, use of credit by family and additional income of the family. The factor represents safe and affordable living.

Seventh factor: The seventh factor consists of only one variable, namely mode of travel. The variable has very high loading. This factor represents convenience with mode of transportation. This is an important factor because it represents costs in terms of hours and money.

Eighth factor: This factor consists of variables like satisfaction from sense of personal security and insecurity at home. The factor represents sense of security.

Ninth factor: Variables namely, availability of open space within 1 kilometer and efficiency of transport system have been correlated with the ninth factor. The factor represents urban amenities.

Tenth factor: This factor comprises variables like area affected by water logging and water cleanliness. It represents water related problem.

Eleventh factor: The eleventh factor is characterized by the presence of variables like availability of shops and numbers of times that a respondent visit doctor. It represents accessibility of services. A person normally visits a nearby doctor preferably with other shopping facilities where he or she can manage to get medicine and other necessary commodities.

Thus, it has been found that a variety of factors have been extracted which represent different dimensions of QOL. Now the important thing is to examine if the factors are statistically significant or not in explaining QOL. To do this, a general specification has been constructed where QOL has been expressed as a function of 11 factors that has been extracted. The relation between factors and QOL has been expressed as follows-

QOL = f{familial capability, satisfaction from environmental condition, pollution, availability of clean water, contentment from neighbourhood, safe and affordable living, convenient transportation, security concern, urban amenities, water related problem, accessibility of services}

It has been already mentioned in chapter 4 that the response variable is an ordinal variable having five points and it has been identified as QOL_2. Now, to find out the significant factors ordered probit regression is applied. The results have been shown in Table 5.2. The fitted model has a good explanatory power as revealed by the chi-square statistic. Since this is probit estimation, coefficients of the variables can not be interpreted directly in terms of their magnitudes. However, the sign and significance levels are worth

examination (Dasgupta, 2004). The signs of the coefficients are as expected. From Table 5.2 it is clear that capability of the family, satisfaction from environmental condition, safe and affordable living, pollution, convenient transportation system, security concern, and accessibility of services are the significant factors of QOL. Pollution has a negative impact on QOL. Water related problem is also negatively affecting QOL. But neither water availability nor water quality is a significant factor of QOL. At the same time urban amenities like availability of open space and efficiency of transportation system do not appear to be highly significant.

Table 5.2: Ordered probit estimates of QOL factors

Factors of QOL	**Coefficient**	**Significance level**
1. Familial capability	1.346*	0.000
2. Satisfaction from environmental condition	0.622*	0.000
3. Pollution	-0.184*	0.006
4. Availability of clean water	0.093	0.165
5. Contentment from neighbourhood qualities	0 .064	0.341
6. Safe and affordable living	0.161*	0.014
7. Mode of travel	0.515*	0.000
8. Sense of security	0.404*	0.000
9. Urban amenities	0.066	0.331
10. Water related problem	-0.073	0.262
11. Accessibility of services	0.176*	0.008
Cut1	-3.432	0.216
Cut2	-0.995	0.108
Cut3	0.505**	0.095
Cut4	4.32	0.350

Source: Field work

Dependent variable: QOL_2

* and **represent significance at 5 percent and 10 percent respectively

LR chi square (11) = 361.8 Prob > chi square = 0.000

Log likelihood = -256.840 Pseudo R^2 = 0.413

5.2 QOL and environment – inter income gap and inter area comparison

QOL is a personal expression of one's sense of well being. Human needs vary at different levels in society. It is not necessary that QOL is uniform among different environment and settings. Therefore, to examine if there is variation in the variables among different income groups and localities, descriptive statistics have been calculated. The results are given in Table 5.3.

Table 5.3: Descriptive statistics in different residential areas

Variables	**Commercial area (sample size=81) (figures are in percentage)**	**Traditional area (sample size=109) (figures are in percentage)**	**Newly established residential area(sample size=189) (figures are in percentage)**
Two person: one room	76 (where as one person :one room=nil)	7 (where as one person :one room=84)	16.9 (where as one person :one room=80.4)
Pucca drain	70.4	64	46.6
Dustbins are regularly cleared	57.7	24.9	18.5
Affected by noise	57.5(of which 45.1 percent is affected by vehicular noise)	50 (of which 48 percent is affected by vehicular noise)	40.7 (of which 36 percent is affected by vehicular noise)
Problem with air pollution	49.3	39	42
Respondents who have never visited doctor in the last six months	47.9	61	50.8
Interaction with almost all the families in the neighbourhood	23.9	42	58.2
Traffic problem.	47.9	78	54
No open space	50.7	50	35.4
Insecurity at home	31	34	33.9

Source: Field work

From the ratio between man and room as shown in Table 5.3 it has been found that there is over crowdedness in commercial area which is not so in traditional and newly established residential areas. But drainage system is better organized in commercial area. At the same time dustbins in the commercial area is better managed. But number of respondents affected by noise is higher in commercial area in comparison to traditional and newly established residential area. It may happen because vehicle creates more noise. The case is same for air effect. In comparison to traditional area, the number of respondents who did not visit doctors is lower in commercial area. Interpersonal communication is the lowest in commercial area which is obvious. But from general perception it appears that interpersonal communication should have been the highest in traditional area where people have been living for several decades. But it is not so. Rather interpersonal communication has been found to be high in newly established areas which may happen because the process of establishing a new society is going on in such area. Traffic problem is the highest in traditional area which is not an expected result. It may happen because traditional areas are old settlements where it is difficult to widen the roads. In case of open space, newly established areas are in better position where 35.4 percent reports that they do not have open space. Regarding insecurity, respondents are delivering more or less uniform pattern of response in terms of percentage.

Thus it has been found that there are differences in living condition in different areas. For this reason, it can be expected that factors of QOL that have been derived may not be uniform across different areas. The same may happen for different income groups also. Human needs may vary at different hierarchical levels. For the low income earner, a safe home is the ultimate end (Michelson, 1970) where as the rich are more concerned about the quality of environment. Therefore, it would be important to examine whether the factors of QOL are uniform across different individuals and different areas.

It has been found from ordered probit regression that out of 11 factors extracted, 7 factors are statistically significant. To find whether factors differ among different areas and among different income groups, a regression model is fitted in which dummies for different areas, different income groups and interaction effects have been considered as

explanatory variables. Altogether seven regression equations have been constructed with dummies and their interaction effects. In all these seven regression equations, the scores of the respective factor have been considered as dependent variable. Here, traditional area is the base category for different localities and low income group is the base category for different income groups. The fitted model as has been mentioned in equation 4.2 in chapter 4 is as follows-

$$Y_i = a + b_{1i}D_c + b_{2i}D_n + b_{3i}D_h + b_{4i}D_m + b_{5i}D_cD_h + b_{6i}D_cD_m + b_{7i}D_nD_h + b_{8i}D_nD_m + u_i$$

Where,

Yi = factor score vector of the i^{th} factor.

D_c =1, if it is commercial area

= 0, otherwise

D_n=1, if newly established residential area

=0, otherwise

D_h=1, if high income group

=0, otherwise

D_m=1, if middle income group

=0, otherwise

D_cD_h=1, if high income group respondents in commercial area

=0, otherwise

D_cD_m=1, if middle income group in the commercial area

=0, otherwise

D_nD_h=1, if high income group in newly established residential area

=0, otherwise

D_nD_m=1, if middle income group in newly established residential area

=0, otherwise

U_i=error terms

Results have been shown in Table 5.4 for all the seven equations. The table shows whether factors vary among different localities and for different income groups.

Table 5.4: Differential effect of areas and income groups on factors of QOL

Factors	Constant	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	R^2	F
Familial capability (Equation no.1)	-1.297 (.000)	-.398* (.006)	-.077 (.452)	2.243* (.000)	1.488* (.000)	.092 (.659)	.285** (.084)	-.105 (.555)	-.020 (.728)	.624	72.867 (.000)
Satisfaction from environmental condition (Equation no.2)	.136 (.436)	.256 (.276)	-.093 (.569)	.081 (.753)	-.110 (.504)	-.497 (.142)	-.243 (.361)	-.249 (.387)	-.049 (.606)	.024	1.080 (.376)
Pollution (Equation no.3)	.159 (.360)	-.365 (.118)	-.147 (0.18)	-.180 (.482)	.026 (.876)	-.125 (.709)	.002 (.993)	.132 (.643)	.059 (.533)	.031	1.590 (.126)
Safe and affordable living (Equation no.4)	-.311 (.069)	.094** (.083)	-.018** (.080)	.244 (.333)	.543 (.001)	.017* (.090)	.176 (.497)	-.324 (.249)	-.062 (.500)	.070	3.303 (.001)
Mode of travel (Equation no.5)	-.089 (.567)	.901* (.000)	.080 (.583)	.720* (.002)	-.409* (.005)	-.589* (.049)	-.659* (.005)	-.280 (.271)	.018 (.830)	.239	13.765 (.000)
Sense of security (Equation no.6)	-.403* (.020)	.727* (.002)	.300** (.063)	.221** (.083)	.130 (.420)	.127 (.702)	-.313 (.230)	-.017** (.051)	-.039 (.677)	.060	2.796 (.005)
Accessibility of services (Equation no.7)	.138 (.413)	-.248* (.027)	-.253 (.109)	.122 (.6240	-.029** (.057)	.655* (.045)	.461** (.072)	-.372 (.180)	-.029* (.049)	.094	4.556 (.000)

Source: Field work
Dependent variable: factor scores of the respective factor associated with the equation
* and ** represent significance at 5 percent and 10 percent respectively
Figures in the parentheses are significance level

For equation no. 1 the values of coefficients b_1, b_3, b_4 and b_6 have been found to be statistically significant. The value of b_1 shows that there is difference in the values of scores of factor 'familial capacity' for commercial area in comparison to traditional area. Similarly, b_3 shows that there is difference in the value of scores of the same factor for high income group in comparison to low income group. Differences can be found in the value of the factor score for middle income group in comparison to low income group as

shown by coefficient value of b_4. At the same time the value of b_6 shows that the interaction between middle income group and commercial area also makes difference in scores of the factor 'familial capacity'. Although all coefficient values are not statistically significant, it can be said that familial capacity as a factor of QOL varies among areas and among income groups.

But from the second equation regarding factor 'satisfaction from environmental condition', none of the coefficients have been found to be statistically significant. The model does not have satisfactory explanatory power at all. For further analysis, the likelihood ratio for a model without the interaction effects has also been computed. But F value does not change significantly even after dropping either of the area or income dummies or their interaction effects (Johnson et al., 2002). It clearly shows that variation in the value of scores of the factor is not dependent upon variation in either area or income groups. Therefore, it can be said that the variation in value of scores of factor 'satisfaction from environmental condition' can not be explained by area or income variation. This may happen because satisfaction is a psychological assessment of objective condition.

In case of the third equation where factor score for pollution has been taken as response variable, it has been found that F value is statistically insignificant. But when b_1 (having lowest't' value) has been dropped from the equation and a new regression is run; the adjusted R^2 increases marginally (from .015 to .017 and F=1.88, sig=.07). The new R^2 value is only .032. Now, it has been found that the coefficient value b_5 becomes significant (Dc=-.621, sig=0.023) which shows that there are differences in the score of the pollution factor for high income group living in commercial area in comparison to low income group in traditional area. The value of very low R^2 with only one significant coefficient values reflects low predictive power of the model. It means value of scores of the factor 'pollution' is not affected by area or income variation.

Although R^2 values are not so high, the overall fitting is good for the fourth, firth, sixth and seventh equations as shown by F values. Regarding these four remaining factors- safe and affordable living, mode of travel, sense of security and accessibility of services as a factor of QOL, it has been found that some of the coefficient values are statistically significant and some are not. Altogether, it can be said that variations in locality or income group may make difference in scores of these factors. But, it has been found that variation in area or income group can not affect the factor 'satisfaction from environmental condition'. Besides this factor, 'Pollution' is another factor on which area or income difference can generate hardly any effect.

In the previous discussion, QOL has been studied as a combination of both objective and subjective dimensions. However, it is important to know whether objective and subjective dimension comprises any useful construct of life when they are studied separately.

5.3 Comparison between subjective and objective QOL

In QOL literature, both objective and subjective dimensions have to be combined together to arrive at a reasonably valid assessment of life quality (Diener et al., 1997). But a comparative study between objective and subjective dimension is also important in the expectation that they can independently explore useful estimates of QOL construct. While objective and subjective indicators are generally fairly independent, their degree of dependence increases when objective condition of living is poor. That is, provided that environmental conditions allow for full adoption to occur, there will be little or no relationship between objective and subjective well being. The interaction between objective and subjective variables occur within a system that homeostatically maintains subjective QOL within a narrow range. The purpose of homeostasis is to keep people feeling positive about themselves and their lives, despite variations in their surrounding environment that could lead to negative states, such as depression, stress, and anxiety (Garretto, 2000). It is normally maintained within a quite narrowly defined range and the

processes of adaptation explain independence of objective and subjective QOL. But a very poor objective condition can defeat homeostasis and once this occurs, the objective and subjective QOL correlates strongly (Cummins, 2000). In this section it has been tried to find if there is correlation between objective and subjective dimension of QOL.

5.3.1 Satisfaction from overall QOL

To see if there is any variation in satisfaction from overall QOL, mean values of overall life satisfaction for low, middle and high income group have been derived and the results are presented in Table 5.5. The table shows that mean value of life satisfaction is the highest for rich, followed by middle and low income group. It may happen because one's own economic condition has a huge impact on the person's well being. The higher income groups may enjoy freedom of choice which may result in higher level of satisfaction. The result is similar to the findings of some other studies which have found that the relation between income and life satisfaction is strong (Inglehart et al., 2008). But it is important to mention that such relation may not be true in time series analysis (Veenhoven et al., 2006)

Table 5.5: Satisfaction from QOL for different income group

Variables	High income group		Middle income group		Low income group	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Overall QOL_1	4.06	.687	3.41	.889	2.56	.996
Overall QOL_2	3.73	.566	3.03	.864	2.25	.788

Source: Field work

Again from Table 5.6, it can be observed that satisfaction from condition of housing is the highest for high income group. It may happen because high income earners can afford a house with necessary household amenities.

Satisfaction from condition of traffic is the lowest for both high and middle income group; where as satisfaction from cost of living is the lowest for low income group. This may be so because consumer price index number for the working class population is the highest in Guwahati among all urban centers in Assam (Govt. of Assam, 2005).

Table 5.6: Satisfaction with domains of environment for different income groups

Variables	High income group		Middle income group		Low income group	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Satisfaction from conditions of housing	4.21	0.722	3.50	0.888	2.42	1.023
Satisfaction from availability Parks and Green areas	3.05	1.038	2.90	0.940	2.63	0.591
Satisfaction from level of environmental pollution in city	2.27	0.810	2.20	0.697	2.35	0.795
Satisfaction from own economic condition	4.08	0.740	3.07	0.956	1.89	0.979
Satisfaction from cost of living	3.58	0.959	2.70	0.932	1.80	0.935
Satisfaction from sense of personal security	3.35	0.940	2.99	0.786	2.68	0.770
Satisfaction from condition of Traffic	2.25	0.620	2.10	0.615	2.31	0.748
Satisfaction from health facility in locality	3.39	1.127	2.97	1.062	2.82	0.833
Satisfaction from welfare service by local administration	3.26	1.226	2.83	1.026	2.61	0.836

Source: Field work

It has been already mentioned that three types of residential areas have been considered for comparison of QOL. They are traditional area, commercial area and newly established residential area. Mean value of overall QOL satisfaction (namely QOL_1 and QOL_2) has been derived for each of these areas. Table 5.7 reveals that mean value of satisfaction with overall QOL is the highest in traditional residential area. But differences in mean values of overall QOL among these three types of residential areas are not high. This finding is similar to the findings that life satisfaction tends to remain stable. It has been found in a study in 1995 that the combinations of 16 normative populations mean scores in life satisfaction from six western countries are similar (Garretto, 2000).

Table 5.7: Satisfaction from overall QOL in different residential areas

Variables	Traditional area		Commercial area		Newly established residential area	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Overall QOL_1	3.62	.982	3.54	.998	3.34	.996
Overall QOL_2	3.14	.932	3.06	.939	3.05	.955

Source: Field work

Mean value of satisfaction from different variables of environment has also been derived for these three residential areas and they have been represented in Table 5.8.

Table 5.8: Satisfaction from domains of environment in different residential areas

Variables	Traditional area		Commercial area		Newly established residential area	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Satisfaction from conditions of housing	3.64	1.000	3.27	1.253	3.49	1.091
Satisfaction from availability Parks and Green areas	3.10	0.959	2.90	0.848	2.81	0.919
Satisfaction from level of Environmental Pollution in city	2.33	0.766	2.46	0.693	2.08	0.633
Satisfaction from own economic condition	3.28	1.207	3.18	1.234	3.07	1.154
Satisfaction from cost of living	2.76	1.138	2.92	1.156	2.87	1.107
Satisfaction from sense of personal security	2.87	0.800	3.17	0.756	3.09	0.810
Satisfaction from condition of Traffic	2.22	0.705	2.27	0.632	2.05	0.563
Satisfaction from health facility in locality	3.05	1.123	3.30	1.047	3.19	1.054
Satisfaction from welfare service by local administration	2.96	1.072	3.15	1.154	3.05	1.056

Source: Field work

It is clear from the table that satisfaction from condition of housing is the highest in traditional residential area followed by newly established residential and commercial area. Satisfaction from housing in the commercial area may be low because these areas are congested. It has been found that satisfaction from traffic is the lowest in all three locations. Satisfaction from level of environmental pollution in city is second least satisfied item.

From the foregoing discussions, it follows that satisfaction from condition of traffic is the lowest in all types of residential areas as well as for both middle and high income group. But in the case of low income group the least satisfied item is cost of living. Satisfaction from condition of traffic is ranked third. This mean value of satisfaction from condition of traffic for low income group is even smaller than the mean value of satisfaction from condition of traffic for middle and high income group. It clearly shows that poor condition of traffic is a common problem in the city.

5.3.2 Dimensions of subjective QOL

To explore the dimensions of subjective QOL, factor analysis has been carried out to reduce the data set and to get some new construct for the observed original set of variables which has been used in ordered probit regression. There are 3 factors whose eigenvalues are greater than 1. The factor loading matrix is shown in Table 5.9. The first factor is the most important factor which explains 39.91 percent common variance.

First factor: The first factor is characterized by the presence of variables like satisfaction from local administration, satisfaction from health facility in the locality, satisfaction from welfare service and satisfaction from availability of parks and green areas. This factor can be labeled as satisfaction from urban amenities and services available in the locality.

Second factor: It comprises satisfaction from cost of living, satisfaction from sense of personal security, satisfaction from own economic condition and satisfaction from condition of housing. The factor represents livability.

Third factor: The third factor includes variables like satisfaction from level of environmental pollution and satisfaction from condition of traffic. Both are directly related. This is a factor of environmental quality.

Table 5.9: Matrix of factor loading for subjective QOL

Variables \ Factors	1	2	3
Satisfaction from urban amenities and services	.849		
Satisfaction from health facility in locality	.845		
Satisfaction from availability of parks and green areas	.660		
Satisfaction from cost of living		.868	
Satisfaction from sense of personal security		.758	
Satisfaction from own economic condition		.737	
Satisfaction from conditions of housing		.662	
Satisfaction from level of environmental Pollution in city			.837
Satisfaction from condition of traffic			.822
Eigenvalue	3.59	1.69	1.20
Percentage of variance	39.92	18.88	13.45

Source: Field work
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

To examine whether these factors are significant or not, an ordered probit regression has been estimated. The results have been shown in Table 5.10. From the table it has been found that all three factors are statistically significant and the signs are also as expected.

Table 5.10: Results of ordered probit regression for subjective QOL

Variables	Coefficient	T statistics
1. Urban amenities and services	0.988*	.000
2. Livability	1.389*	.000
3. Environmental quality	0.199*	.004
Cut 1	-3.457	.209
Cut 2	-1.050	.111
Cut 3	0.519**	.096
Cut 4	4.441	.348

Source: Field work
Dependent variable: QOL_2
* and ** represent significance at 5 percent and 10 percent respectively
LR chi square (3) = 376.1, Prob > chi square = 0.0000, Log likelihood = -249.66646

It shows that satisfaction from urban amenities and services is a significant factor of QOL. But urban amenity has not been found to be significant factor while assessing overall QOL as a combination of both objective and subjective dimensions. It shows that instead of mere physical condition of urban amenities, the level of satisfaction from such amenities is more significant. The other two significant factors are livability and satisfaction from environmental quality.

5.3.3 Dimension of objective QOL

After having an idea about the dimensions of subjective QOL, factor analysis has been again applied to explore the dimensions of objective QOL from which the significant one has been explored with the help ordered probit analysis. The results are shown in Table 5.11. Eigenvalue criterion gives 8 factors having eigenvalues greater than 1. The first factor explains 20.51 percent of total common variance. Factors of objective QOL are mentioned below.

First factor: The first factor comprises variables like number of consumer durable goods in the household, savings of the family, sanitation, income security at least for 45 days, monthly income, ownership of residence, frequently done leisure activity, drainage

system and room per person. The first factor of objective QOL can be labeled as material condition of living which is inherent in financial condition of the family.

Table 5.11: Factor loading matrix for objective QOL variables

Factors / Variables	1	2	3	4	5	6	7	8
Consumer durable goods in household	.855							
Saving of family	.790							
Sanitation	.785							
Income security at least for 45 days	.749							
Monthly income of family	.711							
Ownership of residence	.699							
Frequently done leisure activity	.638							
Drainage system	.608							
Room per person	.590							
Air effect		.787						
Air quality		.763						
Respondent affected by noise		.707						
No. of times respondent visits doctor		.386						
Water supply duration			.879					
Source of water			.867					
Water cleanliness			.554					
Use of credit by family				-.595				
Involvement with society				.593				
Insecurity at home				-.566				
Visit to police station				-.561				
Additional Income of family				.517				
Availability of shops					.673			
Area affected by water logging					.667			
Mode of travel						.719		
Solid waste disposal system							.775	
Interaction with neighbours							-.578	
Availability of open space within 1 Km								.761
Efficiency of transport system								.634
Eigenvalues	5.74	2.37	2.02	1.59	1.47	1.19	1.12	1.10
Total Variance Explained	20.51	8.48	7.22	5.68	5.28	4.25	4.03	3.95

Source: Field work

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Second factor: It is consisted of air effect, air quality and respondents affected by noise, and number of times respondents visit doctor. The third factor may be labeled as environmental quality representing pollution.

Third factor: The variables that have been found in this factor are water time, source of water and water cleanliness. The factor reflects on availability of clean water.

Fourth factor: The fourth factor comprises variables like use of credit, involvement with society, insecurity at home, visit to police station and additional income of the family. This factor represents to what extent the family is capable of facing socio economic challenges. It may be labeled as socio economic status.

Fifth factor: It consists of variables like availability of shops and area affected by water logging. This factor represents susceptibility to water logging problem. As the number of shops increases there is more congestion. The quantum of wastes generated increases which are mostly thrown in open drains. All these attributes increases the chance of having water logging problem.

Sixth factor: This factor represents mode of travel.

Seventh factor: The seventh factor comprises variables like solid waste disposal system and interaction with neighbours. Solid waste is a problem which can be solved at community level with cooperation of each other. It represents community participation in waste management.

Eighth factor: The eighth factor consists of availability of open space within 1 km and efficiency of transport system. This factor represents urban amenity services.

From Table 5.12 it has been found that signs of the significant coefficient values are as expected except for the factor 'susceptibility to water logging problem'. The objective

QOL dimension clearly shows that material condition of living is an important factor of QOL.

Table 5.12: Ordered probit estimates of factors of objective QOL

Factors of QOL	coefficient	Significance level
1. Material condition of living	.879*	0.000
2. Pollution	-.112**	0.066
3. Availability of clean water	.019	0.754
4. Socio economic status	.168**	0.006
5. Susceptibility to water logging problem	.123*	0.042
6. Mode of travel	.333*	0.000
7. Community participation in waste management.	.121*	0.047
8. Urban amenity services	-.037	0.549
Cut1	-2.607	0.171
Cut2	-.653**	0.084
Cut3	.364**	0.078
Cut4	3.179	0.267

Source: Field work
Dependent variable: QOL_2
* and ** represent significance at 5 percent and 10 percent respectively
LR chi2(8) = 198.03 Prob > chi2 = 0.0000
Log likelihood = -338.740 Pseudo R2 = 0.2262

While studying QOL as a combination of both objective and subjective QOL, the factor 'water related factor' representing water logging and water cleanliness has not been found to be significant. But now it has been observed that susceptibility to water logging problem is a significant factor of QOL. It may happen because water logging and damage in water quality does not bother people so much. But some other aspects like severity of water logging in market place bother people. It clearly reflects that people either have difficulty is shopping due to water logging or water logging creates more damages in market areas. At the same time a new factor which is labeled as socio economic status has been found to be significant factor of QOL. As a person improves upon his or her socio economic situation, QOL also improves. Moreover a new significant factor which demands attention is community participation in waste management.

In the same way, one new factor has been found while exploring subjective dimension of QOL. It shows that satisfaction from urban amenities is a significant factor of QOL. But it has already been found in the study of QOL as a combination of objective and subjective QOL that urban amenity is not a significant factor. It shows that although physical condition of urban amenity is not a significant factor of QOL, satisfaction from urban amenity is important in life.

To examine the interrelationship between objective and subjective QOL, indices for objective and subjective QOL have been estimated for every individual household by applying principal component analysis. The first principal component score has been used to construct indices for every household separately for objective and subjective dimensions. After this, the correlation coefficient between indices of objective and subjective dimensions has been computed. The value of the correlation coefficient has been found to be 0.36 ($p<0.01$) which is not so high. The finding is similar with that of Chan et al. (2002) who has found the correlation between objective and subjective QOL to be 0.35. The author has commented that such lack of high correlation coefficient is consistent with other studies on this topic. Therefore, the relation between objective and subjective QOL can not be said to be so strong.

Depending on the findings of the study some strategies may be suggested to improve QOL in the city. They have been discussed in the subsequent chapter.

CHAPTER 6

Summary of findings, conclusions and policy suggestions

QOL is an issue of fundamental concern for both developing and developed countries. In recent times QOL has been used as a parameter to measure the effectiveness of public policy also. Yet no consensus has been arrived at regarding the definition of QOL because such studies are context dependent and can be studied from various perspectives. Studies related to QOL over decades have shown that QOL has been formed by both exogenous and endogenous forces and the effect of these forces have not been evaluated with equal importance. Now-a-days QOL studies in the context of quality of living environment have gained significant attention in public discourse owing to environmental degradation.

The present study is related to description and evaluation of nature or conditions of life in a particular region. In this study, QOL has been evaluated in the context of living environment in the city of Guwahati. The study has conceptualized QOL to be determined by objective condition of living environment together with individual's appraisal of such material condition of living. The term environment has been defined in broad sense comprising physical, economic and social environment. The study focuses on the relation between QOL and environment. Moreover, a comparison between objective and subjective QOL is also made in the study.

The study is mainly based on primary data. To collect primary information, a field study has been conducted in the GMC area at household level from April 2006 to October 2006. The GMC comprises 60 wards. Two stage sampling procedure has been used for collecting primary information. In the first stage, 10 percent of the total wards i.e. 6 wards have been selected to represent traditional (old) area, commercial area and newly established residential area. In the second stage, the households have been selected in such a way to represent different income groups in a random manner. The required

information has been collected from the household head or from any adult member with the help of a structured questionnaire. Keeping in view time and resource constraints, 3 percent of the total households from each ward is selected for collecting primary information. This questionnaire used for collecting information from households has been prepared in the context of Guwahati city.

Taking into consideration the objectives and nature of data, several statistical methods have been used. To explore the structure of the interrelationship among the variables factor analysis has been applied. After this factor scores have been used to explore the underlying dimension of QOL by using ordered probit regression analysis. Here, underlying dimension means underlying explanatory factors of QOL. To examine if the factors of QOL vary across areas and across income groups, a regression model has been constructed. In this regression analysis all the explanatory variables are dummies representing different localities and different income groups along with their interaction effects. To examine correlation between objective and subjective QOL, indices for each household have been derived by considering the scores of the first principal component.

6.1 Principal findings

The study mainly aims at finding the explanatory factors of QOL as well as to compare QOL for different income groups and for different areas. The main findings of the study are summarized below.

- From the study of QOL, 11 factors have been extracted and out of these 11 factors 7 factors have been found to be statistically significant. They are: familial capability, satisfaction from environmental condition, pollution, safe and affordable living, convenient transportation, security concern, and accessibility of services. It has been found that pollution is negatively affecting QOL.

- QOL is a personal expression of one's sense of well being. It is not necessary that QOL is uniform among different environment and settings. From descriptive

statistics differences have been noticed in QOL variables in different settings. By applying regression analysis having dummies for area, income and their interactions, it has been found that familial capability, safe and affordable living, convenient transportation, security concern, and accessibility of services are dependent on either area variation or income variation or both. But satisfaction from environmental condition does not depend upon either area or income groups or on their interaction. At the same time, the explanatory power of the model constructed for explaining variation in the factor 'pollution' is very weak.

- To see if there is any variation in satisfaction from overall QOL, mean values of overall life satisfaction for low, middle and high income group have been calculated. It has been found that mean value of life satisfaction is the highest for rich, followed by middle and low income group which may happen because income may enhance satisfaction through satisfaction of material wants. At the same time, mean value of satisfaction from overall QOL has been found to be the highest in traditional residential area. It shows that QOL is better in traditional residential area in comparison to commercial and newly established residential area.

- From the study of subjective QOL it has been found that satisfaction from condition of traffic is the lowest for all types of areas and for all income categories except for low income group. For low income group, the level of satisfaction is the lowest from the experience of cost of living in the city. The low income group has rated satisfaction from condition of traffic as the third least satisfied item with a very small mean value of satisfaction. Satisfaction with transportation in one's locality may reflect one's attitude toward road congestion, road conditions, and availability of public transportation. Low level of satisfaction from condition of traffic could be an indication of poor traffic and environmental condition in Guwahati.

- From the study of subjective dimension, it has been found that satisfaction from urban amenities and services, liveability and environmental quality are significant factor of QOL.

- The significant factors of objective QOL have been found to be material condition of living, pollution, socio economic status, susceptibility to water logging problem, mode of travel as well as community participation and waste management. While studying QOL as a combination of both objective and subjective QOL, water logging and related problem has not been found to be significant but now it has been observed that susceptibility to water logging problem is a significant factor of QOL. It may happen because people are not so bothered about deterioration in water quality caused by water logging. Rather, some other aspects like severity of water logging in market place bother people which may arise owing to difficulty in marketing. At the same time a new factor which is labeled as socio economic status has been found to be significant factor of QOL. As a person improves upon his or her condition to face socio economic challenge, QOL also improves. Besides all these, another significant factor which emerges in the analysis of objective dimension of QOL has been labeled as community participation and waste management.

- From the study of objective and subjective dimension separately, some new dimensions have come up. They are satisfaction from urban amenities, material condition of living, susceptibility to water logging, and community participation, waste management and socio economic status has been found to be significant factor of QOL. These factors could not emerge in the study of QOL by combining both objective and subjective dimensions. The correlation coefficient between objective and subjective QOL has been found to be .36 (p<0.01) which is not very strong.

Thus, it has been found that QOL is explained by factors of different dimensions. Some of them vary across areas and income groups and some of the factors do not vary.

Satisfaction from QOL has been found to be better in traditional and satisfaction from life has been found to be the lowest for low income group. It has also been found that irrespective of location or income level respondents are very dissatisfied with the condition of traffic.

6.2 Conclusions

Regarding the hypothesis -"Factors of QOL vary among different areas and among different income groups", it has been found that five factors namely, familial capacity, safe and affordable living, mode of travel, sense of security and accessibility of services are not uniform. It happens because variation in locality or income makes difference to the scores of these factors. But it has been found that variation in area or income group can not affect the factor 'satisfaction from environmental condition'. 'Pollution' is another factor on which area or income difference have hardly any effect. Thus, in case of the first hypothesis, it has been found that majority of the factors (seven) vary across area and income but at the same time some factors (two) are not affected by variation in locality or variation in income. Therefore, the hypothesis can not be accepted completely.

While exploring the underlying dimension of QOL, both objective and subjective factors appear to be significant. The correlation coefficient has not been found to be so strong between objective and subjective QOL. Therefore, the second hypothesis- "Objective condition and subjective satisfaction together comprise the dimensions of QOL but objective and subjective QOL correlate poorly", could be accepted.

6.3 Suggested policy measures

Since QOL is a multi faceted phenomenon, any step towards improvement of QOL requires integrated strategy covering every aspect of living environment. In this respect, keeping in view the findings of the empirical study, any necessary policy measures to be implemented may take into account the points mentioned below.

- Throughout the study, it has been found that economic aspect of life constitutes more dominant role because familial capacity and standard of living are two important dimension of QOL. They are intrinsic in financial strength of respondents. For low income group, the level of satisfaction is the least from cost of living in the city. Therefore, economic environment has to be improved. At least there should be guarantee of working opportunity as well as stable cost of living index.

- While formulating any policy measures, the planners should take into account to what extent respondents will be satisfied. Mere policy measures without taking into account such aspects may end up with failure. Therefore, it is important to see how satisfied people are so that the objective of economic growth and urbanization does not lead to wastage of resources. Otherwise, it may cause a threat for the survival of human being in the long run. It has been found that mean value of QOL of low income group is the lowest. Therefore, special care has to be taken of the urban low income group by providing the basic minimum facilities.

- Another factor of QOL has been found to be environmental pollution representing the variables air effect, air quality and effect of noise. To improve quality of environment, air and noise pollution have to be controlled. There should be better pollution control management. The situation can be improved by the use of the Compressed Natural Gas (CNG) in the vehicles. Of late, Liquefied Petroleum Gas (LPG) engines have been introduced in the city to counter the problem of pollution.

- Satisfaction from condition of traffic has been found to be the lowest but mode of transportation is a significant factor of QOL. Therefore, the chaotic traffic and transportation system needs to be improved. It requires scientific traffic management.

- Administration should guarantee safety against socio economic disturbances. Security should be ensured to every citizen. Besides, accessibility of urban amenities and services has to be improved. Improving QOL also requires controlling the menace of solid wastes. It has been found that there is correlation between community involvement and solid waste management. Controlling solid wastes can also reduce the intensity of water logging problem in the city.

The study finds that to ensure life quality, provision of basic minimum urban utility services and urban infrastructures have also to be upgraded simultaneously. Besides all these, emphasis should be given on the fact that measures to improve living condition are not ad hoc. Rather, measures should be taken in such a way that citizens are satisfied. Therefore, to improve QOL in Guwahati, all sections of the society have to provide helping hand to the administration to make Guwahati a livable city.

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1. "Urban Quality of Life: A Case Study of Guwahati", *Social Indicators Research,* DOI 10.1007/s11205-007-9191-6, 2007

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