Urban Quality of Life and Its Spatial Distribution in Addis Ababa: Kirkos sub-city

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By

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Dedicated to my late mother Tekea Gebru and my late sister Zufan Sereke

Abstract

Urban quality of life (QoL) is becoming the subject of urban research mainly in western and Asian countries. Such attention is due to an increasing awareness of the contribution of QoL studies in identifying problem areas and in monitoring urban planning policies. However, most studies are carried out at city or country level that commonly average out details at small scales. The result is that the variability of QoL at small scales is not well known. In addition, the relationship between subjective and objective QoL is not well known. In this study, the urban QoL in Kirkos sub-city of Addis Ababa, Ethiopia, is measured and its spatial distribution is evaluated at the smallest administrative level (Kebele level) using subjective and objective measures. One of the motivations for this study is the presence of only very few QoL studies for cities of African countries.

The study is based on a household survey in the sub-city and some secondary data. Statistical methods such as factor analysis and ANOVA are applied to establish and evaluate relations between some variables of QoL while coefficient of variation is applied to evaluate spatial variability. Geographic information system (GIS) is also applied to extract proximity information and visualize the spatial distribution of QoL.

The results of this study reveal that the subjective quality of life (QoL) scores show large variation in the sub-city. Using a six-point Likert scale, about 4% of the respondents in the sub-city are 'completely satisfied' and 15% are 'completely dissatisfied'. The remaining 81 % of the respondents expressed a feeling that ranges between the two extremes. In terms of the mean QoL score, most of the respondents in the sub-city expressed dissatisfaction. The QoL scores also show large variation from Kebele to Kebele and even within a specific Kebele indicating dissatisfaction in eight Kebeles and satisfaction in three Kebeles. The results reveal that the lower the QoL in the Kebele, the larger the variability of QoL within the Kebele. This indicates how aggregation at large scale can average out the variation of QoL at small scales.

The comparison between the subjective and the objective QoL at Kebele level indicated a state of dissonance, adaptation, deprivation or well-being. Such results suggest that the two measures do not always indicate the same level of QoL. In general, the findings of this study indicate the presence of QoL variability at small scales and the importance of studying both the subjective and the objective QoL instead of any one of these separately. The findings and approaches of this study can be used in designing future urban QoL studies in the region.

Keywords: Quality of life, Subjective quality of life, Objective quality of life, Addis Ababa, Kirkos sub-city

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1. Introduction

Quality of life (QoL) studies in urban areas have received an increasing research attention, see (Foo, 2000; Bonaiuto et al., 2003; Li and Weng, 2007; Møller, 2007; Brereton et al., 2008; Lee, 2008 and Moro et al., 2008). These studies vary in several aspects. For instance, the studies cover different regions and they consider different domains of life that affect QoL. Such domains of life for instance include housing, income, safety domains. The studies also vary in the scale of interest since some are applied at country level, some are at city level and very few are at local level. Quality of life is a broad term which encompasses notions of good life, a valued life, a satisfying life and a happy life (McCrea et al., 2006). For this study, a definition is adapted from Foo (2000) that defines urban QoL as individuals overall satisfaction with life.

Quality of life is often measured using either subjective or objective indicators. Subjective indicators are derived from surveys of resident's perception, evaluation and satisfaction with urban living. Objective indicators relate to observable facts that are often derived from secondary data. Depending on the level of QoL that is measured by subjective and objective indicators, there will be *well being, deprivation, adaptation, or dissonance.*

As stated by Zapf (1984) cited in Craglia et al. (2004), if an individuals subjective feeling and objective living conditions are good then we say there is *well being*. If both conditions are bad then there is *deprivation*. On the other hand, if the subjective condition is good and the objective condition is bad there is *adaptation.* However, if the subjective condition is bad and the objective condition is good then there is *dissonance*.

Several methods have been applied to study quality of life within an urban area. For instance, Moro et al. (2008) and Das (2008) showed that statistical methods can be applied to measure QoL in terms of selected attributes or domains of life. Remote sensing and census data can be used to develop and map urban quality of life index using a Geographic Information System (GIS), see Li and Weng (2007). However, Kamp et al.(2003) stated that science has not advanced a comprehensive framework to study quality of life in an integrated manner so that to assess physical, spatial and social indicators in a holistic manner.

In this study, quality of life is measured in the Kirkos sub-city, Addis Ababa – Ethiopia, using subjective and objective attributes of individuals' life. The spatial variability of QoL at Kebele level is also analyzed. A causal model of QoL that relate the subjective QoL of individuals', domain satisfaction and attributes of each domain is developed. The dimensions of subjective and objective QoL are identified. The subjective QoL is also related to the objective household categorical variables. Objective QoL index is developed using both household and spatial variables. The subjective and the objective QoL in the sub-city are also compared.

This thesis is structured in seven chapters. In the first chapter, the introduction and the research problems are presented. The research objectives, research questions, the conceptual framework and justifications of the study are also included in the first chapter. A description of the study area and the domains and attributes of life and the scope of the study are presented in the second chapter. In the third chapter, a review of relevant QoL literatures is presented while chapter four covers the research methods which are outlined in five sections. The first section presents a summary of the research

questions and methodology based on the research design. In the second section, pre-field work preparation is discussed. The third section summarizes the data collection techniques while the fourth section presents post-field work data preparation. The fifth section discusses data analysis for the six sub-objectives in separate sections. In chapter five, the results of this study are presented while the results are discussed in chapter Six. Finally, conclusions of the research are presented in chapter seven.

1.1. Research Problem

The theories and empirical studies of quality of life (QoL) have mostly originated from western society. Literature on quality of life in developing countries has been noticeably rare. As such, the main factors that affect the QoL of individuals' in cities of many developing countries are not clearly identified.

Commonly quality of life is studied at regional and country level. The purpose of studying QoL at regional and country level is mainly to compare variation across nations or regions. Such comparisons may benefit from knowledge on local variability in quality of life. However, studies that show the small scale variability of QoL are rare although it is often the case that interventions are implemented at smallest administrative levels.

There is no a universally applicable method for studying urban quality of life. Although it is possible to measure QoL using either subjective indicators or objective indicators, both have their own limitations. Very few studies have explored the relationship between spatial objective attributes and subjective QoL. The findings in the literature show contradictions on the presence of a relationship between these attributes. The literature does not show the combined effect of subjective and objective QoL in terms of the four states of QoL which are well-being, dissonance, deprivation and adaptation.

There are too many attributes and domains of both subjective and objective perspectives of life that may determine QoL. The type and number of attributes and domains that has been used in previous studies are not the same since such depends on the objective of the study and the study area.

The specific research problem for this study is summarized as lack of quality of life studies in developing countries, lack of knowledge on QoL variability at small scale and lack of knowledge on the relationship between the domains of life and subjective QoL. There is also lack of consensus on the relationship between individual, socio-economic and demographic characteristics and subjective QoL. There are no empirical studies that show the relation between subjective and objective QoL in terms of the four states of QoL.

1.2. Objectives of the Research

The main objective of this study is to measure and evaluate the spatial distribution of quality of life in the Kirkos sub-city of Addis Ababa, Ethiopia.

The sub-objectives are:

1. To measure subjective QoL and satisfaction with domains of life at sub-city and Kebele level
2. To evaluate the spatial variability of subjective quality of life in the sub-city
3. To develop a causal model for the subjective QoL
4. To identify the dimensions of subjective and objective QoL
5. To develop QoL index using objective attributes

6. To measure overall QoL as defined by the combined scores of the subjective and the objective QoL in Kirkos sub-city

1.3. Research Questions

Following the research objectives, the following research questions are identified:

Questions for sub-objective 1

o What is the level of subjective QoL at sub-city and Kebele level?
o What are the domains of life in urban context as defined by respondents?
o What is the level of individuals' satisfaction with each domain of life at sub-city and Kebele level?

Questions for sub-objective 2
o Is there variability in the subjective QoL between Kebeles?
o Is there variability in the subjective QoL within each Kebele of the sub-city?
o Is there clustering of Kebeles with high or low QoL scores?

Questions for sub-objective 3

o What are the dominant perceived attributes that affect specific domains of life in kirkos sub-city?
o What are the dominant perceived domains that affect the subjective QoL as defined by the residents of Kirkos sub-city?

Questions for sub-objective 4 and 5

o What are the dimensions of the subjective QoL in Kirkos?
o What are the dimensions of the objective QoL?
o Can QoL indices be developed from objective attributes?

Questions for sub-objective 6

o What individual and household characteristics explain the variation in QoL in Kirkos?
o What is the combined effect of the subjective and the objective QoL in the sub-city?

1.4. Justification of the Study

Policy makers are interested to know the most effective means of improving individuals' life. A literature review reveals that there is a general consensus by researchers, policy makers, and planners on the need to study quality of life in urban areas. The outcomes of quality of life studies may help city planners to understand and prioritize the problems that the community face. The outcomes facilitate identifying intervention areas for poorly ranked locations. As stated by Lee (2008), QoL information can be used to diagnose previous policy strategies and to draft future planning policies.

Research is necessary to identify appropriate indicators of QoL. Some quality of life studies are documented in the literature, see Rogerson et al.(1989) and Wong (2001) for England; Marans (2003) for Detroit metropolitan area in USA; Møller (2007) , Higgs (2007) and Richards et al. (2007) for South Africa; Moro et al. (2008) for Ireland; Lee (2008) for Taiwan. However, as discussed in the literature review section, there are contradictions with the results of these studies. Research in various regions of the world may help to clarify these contradictions.

Quality of life studies for the cities in East Africa region, particularly for Ethiopia, are noticeably absent. As such there is a need to evaluate and transfer the QoL concepts which were developed for the developed world and Asian countries to the East Africa region. This may contribute to advance the science and may also benefit urban planners and policy makers.

The quality of life of the residents of Addis Ababa is not well studied. Previous studies are mainly urban poverty studies that use objective variables and are often limited to country and regional level e.g. Bigsten et al. (2003) and Muzzini (2008). However, policy interventions or implementations are mostly carried out at a sub-city or Kebele level, which is the smallest administrative unit. Kedir (2005) recommends that poverty studies in the urban Ethiopia should explore ways that relate quantitative and qualitative attributes.

In this study, the focus is both subjective and objective aspects of quality of life at the smallest administration units which are sub-city and Kebele levels. As such this study will reveal local variation in quality of life. Such will provide information that can be used to improve the methodology for studying QoL. The findings from this study can be incorporated to the sub-city development plan (strategic plan) to improve the QoL of the residents. In addition, the simplified statistical model that is developed in this study can be used to predict QoL in other sub-cities of Addis Ababa.

1.5.   Conceptual Framework

The conceptual framework in Figure 1-1 shows the three ways of measuring urban quality of life using the two perspectives: subjective and objective perspectives. The three ways are the use of subjective domains and attributes, the objective domains and attributes, and the combination of subjective and objective attributes to measure QoL.

The physical and socio-economic dimensions of life have subjective domains and attributes that are perceived by individuals. These subjective domains and attributes are used to measure subjective QoL. A standard of comparison, in this case Likert scale, is required to quantify individual's perception. Statistical methods such as descriptive statistics, factor analysis, and multiple regression are applied to analyse the collected data for QoL studies. GIS operations such as map calculation, map overlay and others are applied to analyse the observations and display the results. GIS is also used to visualize results. The subjective QoL in this study is measured in terms of respondents' intuitive and rational response. The intuitive and rational response is evaluated using individual's perception of their life as a whole.

The physical and socio-economic dimensions of life have also objective domains and attributes. These objective domains and attributes are used to measure objective QoL. Statistical and GIS methods are also used to analyse these attributes. The main statistical methods that are applied are descriptive statistics, e.g. mean and standard deviation, and factor analysis. GIS operations such as map calculation, map overlay and others applied to analyse the observations and display the results. The objective QoL in this study is measured using both household and spatial variables.

The conceptual model also shows that subjective and objective QoL are compared. Statistical methods such as one way analysis of variance (ANOVA), and t-test are applied to evaluate the relationship between attributes of subjective and objective QoL. Mean and factor analysis are also used to find the scores of both subjective and objective QoL. A two-way matrix are developed for the subjective and the objective QoL and then GIS method are applied to display the combined effect of the two perspectives of QoL which are. well-being, deprivation, adaptation and dissonance.

The selected domains of life and attributes of this study are presented in chapter 2.

Objective   Subjective

Physical, social and economic dimensions

Objective domains and attributes	Two-way matrix, ANOVA, t-test, GIS	Perception
Factor analysis, GIS		Likert scale
Objective QoL	States: Well-being, Deprivation, Adaptation, Dissonance	Subjective domains and attributes
		Factor analysis, regression, GIS
		Subjective QoL
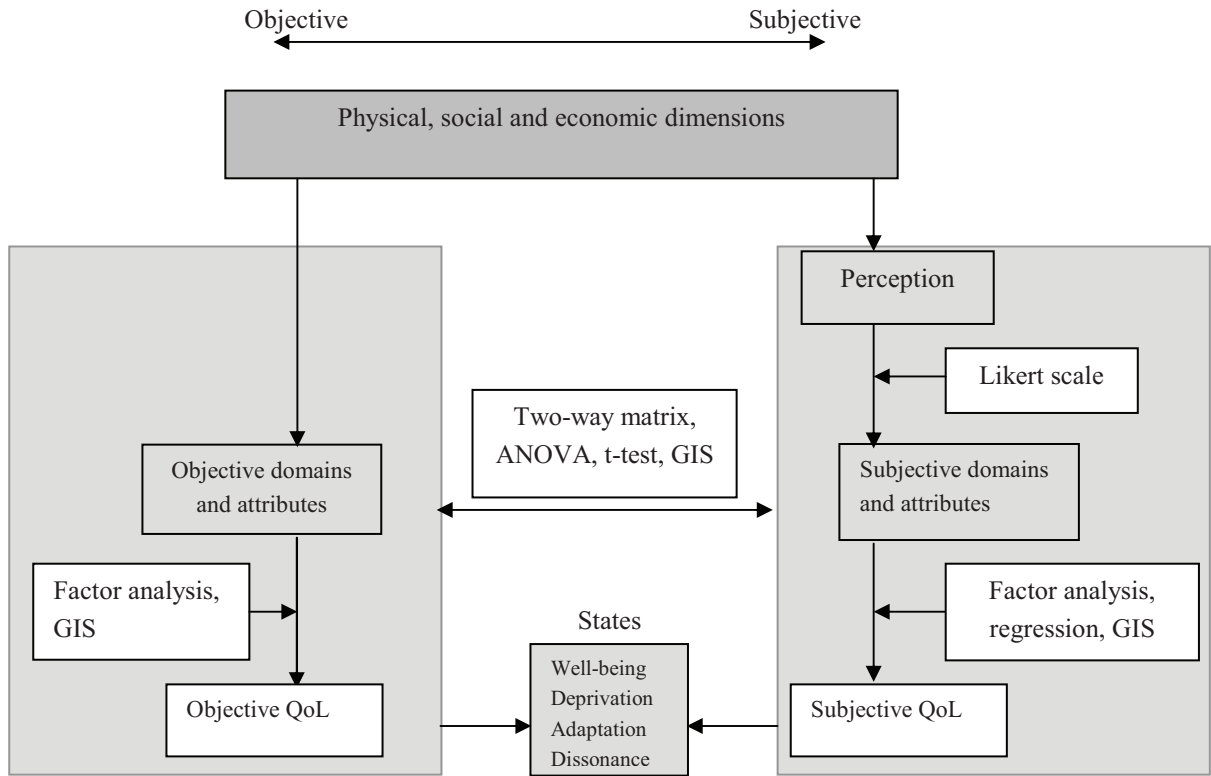
Figure 1-1 Conceptual framework

2. Study Area Description and Domains of Life

A brief description on the study area is presented in this chapter. The description includes the geographic location, surface area, population density and other characteristics of Kirkos sub-city. Also, in this chapter, the domains of life that affect QoL and the justification for selecting the domains of life and the attributes in this study are presented. The scope of the research is also defined in this chapter.

2.1. Study Area Description

Addis Ababa

Addis Ababa is the capital city of Ethiopia. Being the centre of the country it has a wider role in the economic, social, political and administrative issues. The centre of Addis Ababa is located approximately at 9^0 latitude and 38^0 east longitudes with a height of 2000 m to 2500 m above sea level. Its area is about 540 km^2. The total population of the city is estimated nearly 3 million (central statistical agency of Ethiopia, 2009). For administrative purpose, Addis Ababa is divided into 10 sub-cities.

Kirkos sub-city

Kirkos sub-city is one of the 10 sub-cities of Addis Ababa. As shown in Figure 2-1, Kirkos sub-city is located at the centre of Addis Ababa. National sport and cultural facilities such as Addis Ababa stadium and Meskel square are located in the sub-city. The sub-city hosts international offices such as the office for Organization for African Union (OAU) and the United Nations Economic Commission for Africa (ECA).
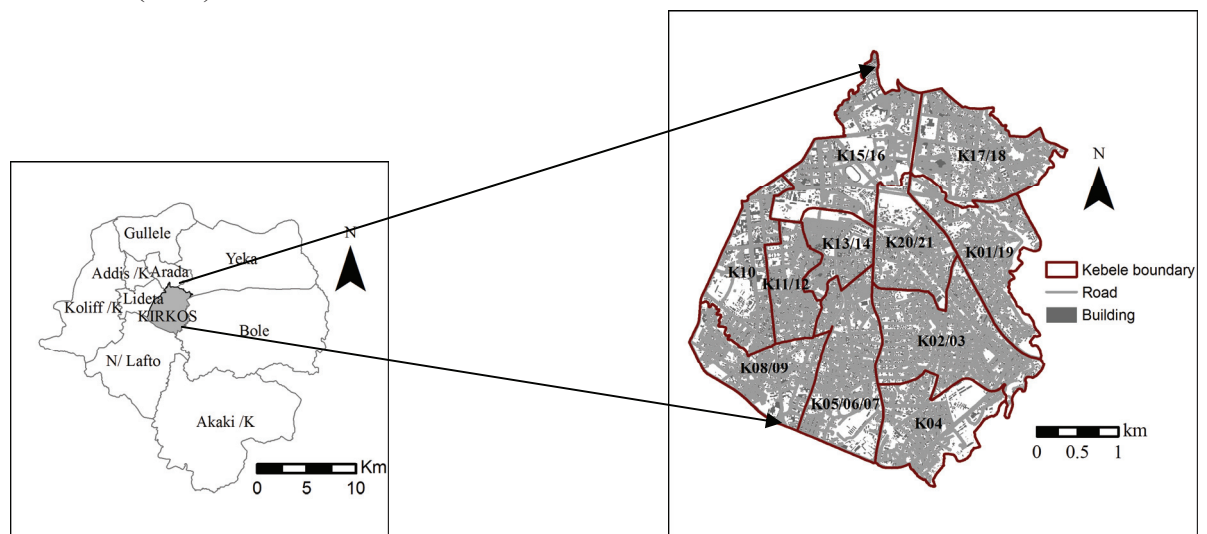
(a) Addis Ababa sub-city boundaries   (b) Map of existing building and road in Kirkos

Figure 2-1 Study area

As shown in Table 2-1, Kirkos sub-city covers an area of 1,472 hectare. Its total population is about 220,991 (central statistical agency of Ethiopia, 2009). The sub-city is among one of the densely populated sub-cities in Addis Ababa with a population density of 150 persons per hectare. The sub-city has 11 Kebeles, which are the smallest administrative levels in Ethiopia.

Table 2-1 Characteristics of the ten sub-cities of Addis Ababa

	Name of sub-city	Population (2007)[2]	Sub-city area (ha)[1]	# of Kebeles	Population density (pop/ha)
1	Arada	212,129	954	10	222
2	Addis Ketema	254,972	742	9	344
3	Lideta	201,613	1100	9	183
4	Kirkos	220,991	1472	11	150
5	Bole	308,714	11970	11	26
6	Nifas Silk-Lafto	315,134	5851	10	54
7	Yeka	345,807	8190	11	42
8	Akaki-Kaliti	183,288	12470	8	15
9	Kolfe-Keranio	428,219	6325	10	68
10	Gullele	267,381	3334	10	80

Source: [1]Addis Ababa city administration, 2008, [2] Central statistical agency of Ethiopia, 2009

Kirkos sub-city is characterised by a combination of modern buildings and old residential settlements. Some pictures of better off and worse off residential settlements in the sub-city are shown in Figure 2-2. Also as shown in Figure 2-1 the sub-city is characterized by dense built-up areas. Superficial observations of Kirkos's residential areas suggest that it is inhabited by residents with high difference in income.

Figure 2-2 Better off residential settlement in Kebele 02/03 (a) and worse off residential settlement in Kebele 13/14 (b)

The population distribution of 11 Kebeles in Kirkos sub-city is shown in Table 2-2. Kebele 05/06/07 has the largest population in the sub-city. In terms of surface area, Kebele 02/03 is the largest while Kebele13/14 is the smallest. However, Kebele 13/14 is the most densely populated while Kebele 10 is the least densely populated Kebele.

Table 2-2 Characteristics of the 11 Kebeles of Kirkos sub-city

	Name of Kebele	Population (2007)	Kebele area (ha)	Population density (pop/ha)
1	K01/19	18,226	140	130
2	K02/03	24,991	195	128
3	K04	12,784	133	96
4	K05/06/07	28,450	161	177
5	K08/09	20,925	122	172
6	K10	11,042	118	94
7	K11/12	22,842	72	317
8	K13/14	22,688	68	334
9	K15/16	17,002	188	90
10	K17/18	21,484	163	132
11	K20/21	20,557	105	196

Note: Kebeles mentioned in slash are the Kebele name of a single Kebele, for instance K05/06/07 is a single Kebele in the new administrative structure of the country.

2.2. Domains of Life and Attributes

The domains of life and attributes which may provide relevant information for urban planning was identified based on related literatures. Personal experience with the study area was also instrumental in this regard. Literatures on the domains of life states that life can be approached as an aggregate construct of many specific domains, and life satisfaction (QoL) can be understood as the result of satisfaction in the domains of life (Rojas, 2008). On the other hand, satisfaction in the domains of life can be understood as a result of satisfaction in attributes of the respective domains of life, see Lee (2008). For this study, eight domains of life were identified. These domains are housing, built environment, neighbourhood safety, neighbourhood sanitation, quality of public services, access to public services, social connectedness and family income. Table 2-3 shows the domains of life selected for this study. Justification for selecting each domain and attributes follows. Details are found in the literatures that are shown in Table 2-3.

Housing is a basic need and as such can affect the quality of life in urban areas. In the absence of appropriate shelter, people can not meet their basic needs. Appropriate shelter can be in terms housing condition, crowdedness in a house and housing ownership. Housing problems can affect health, education, community wellbeing and individual's feeling about life.

Built environment of urban areas can affect the way people feel about where they live which affects the quality of life. For instance, the more attractive, the less congested and the more suitable the built environment for raising children is the more satisfied individuals can be with their life.

Neighbourhood safety highly affects individual's view of their living environment and as such their sense of quality of life. Unsafe environment can be in terms of crime rate and traffic condition. With growth in urban areas, unsafe environment is becoming a major concern.

Neighbourhood sanitation is often a major concern in cities of developing countries. The status of neighbourhood sanitation can be evaluated through how well solid waste and liquid waste are managed, and the adequacy and quality of water supply.

Quality of public services such as education, health and recreation services can affect urban quality of life. It is expected that the better the quality and coverage of these services are the higher the quality

of life. Access to these services may also determine the QoL of individuals. It is also expected that the nearer the location of public services the better the QoL is.

Social connectedness in this study is defined as the degree of social interaction in the neighbourhood. Social connectedness can be an indication of the strength of interaction in a community. The strength of interaction within a community increases residents sense of belongingness in the community and as such can affect QoL. In Ethiopia, there are traditional ways by which people enhance interactions within their community; however, the situation might have been reversed with time in Addis Ababa partly because of factors related to modernization.

Family income is one of the domains of life that affect the QoL of residents. It is expected that the higher the family income, the better the quality of life.

Table 2-3 Selected domains of life to measure QoL

Domains of Life	Studies
Housing	Foo (2000), Turksever and Atalik (2001), Ibrahim and Chung (2003), McCrea et al.(2006), Santos et al. (2007), Li and Weng (2007), Das (2008), Apparicio et al.(2008), Zebardast (2009)
Built-environment	Turksever and Atalik (2001), Li and Weng (2007), Das (2008), Apparicio et al.(2008)
Neighbourhood safety	Foo (2000), Turksever and Atalik (2001), Ibrahim and Chung (2003), Santos et al. (2007), Das (2008), Apparicio et al.(2008)
Neighbourhood sanitation	Richards et al.(2007), Das (2008)
Quality of Public of service	Foo (2000), Ibrahim and Chung (2003), Santos et al.(2007), Rojas (2008), Das (2008)
Access to public services	McCrea et al.(2006), Brereton et al.(2008)
Social connectedness	Foo (2000), Turksever and Atalik,(2001), Ibrahim and Chung (2003), Bonaiuto et al. (2003), Richards et al. (2007), Lee (2008)
Family income	Foo (2000), Brereton et al. (2008), Rojas (2008),

Note: No distinction is made between the subjective and objective domains of life in the table

2.3.   Scope of the Research

One of the objectives in this research is to explore variability of QoL at the smallest administrative units (Kebele), which is often absent in several urban QoL researches. However, the variability of QoL at city and country level will not be addressed by this research.

In this study, emphasis is given on exploring resident's perception of their life (subjective domains and attribute). In the mean time, the relation between objective attributes including spatial factors and subjective QoL is also studied.

Domains of life and attributes were selected based on the socio-economic, cultural and geographic setting of Ethiopia. Besides domains applied for other developing countries, those recommended for urban planning by literatures, are included. However, including all domains of life and attributes is not feasible due to the time required for a single interview and since the study is expected to contribute mainly to urban planning. To evaluate whether the selected domains in this study are adequate, respondents were asked if they do have additional domains that they would like to see included in the questionnaire.

The fact that literature on QoL in the African continent is noticeably rare might introduce some limitation. This is due to the inability to compare the findings of this study with similar studies in the region.

3.   Review of Urban Quality of Life Studies

In this chapter, relevant literatures on the state-of-the-art of urban quality of life (QoL) studies are reviewed. The section starts with a review of various definitions and conceptual model of QoL. Next, measurements of QoL that are based on either subjective or objective are reviewed. Commonly, various domains of life affect QoL. As such an overview of the studies that reflect the effect of these domains is presented in this section. Also the relevance of quality of life studies for urban planning and management and the role of geo-information in QoL studies are discussed. The section ends with a brief summary on the reviewed literatures.

3.1.   Definition and Conceptual Models of Urban QoL

Definition

There is no a universally accepted definition of quality of life in the literature. Depending on the objective, several definitions of quality of life is documented in the literature. For example, Foo (2000) defines QoL as individuals overall satisfaction with life. Costanza et al.(2007) defines QoL as the extent to which objective human needs are fulfilled in relation to personal or group perceptions of subjective well-being. Das (2008) defines it as well being or ill being of people and the environment in which they live. Rogerson (1999) summarized other studies and identified key elements in defining QoL as physical environment, climate, pollution, crime and social facilities related to health and education. Other definitions of quality of life in the literature are compiled by Kamp et al. (2003) and Apparicio et al. (2008). Some of the key words which are included in these definitions are: satisfaction, objective facts, subjective perception, enjoyment, life satisfaction.

Conceptual model

The development of a multidisciplinary conceptual framework of QoL is important to advance the field of urban development, environmental quality and human well being (Kamp et al., 2003). Several examples of conceptual models on QoL and related concepts are also summarized in the same article. Some models are abstract and broad and others are more concrete and specific. The main differences in the models are caused by differences in scale, indicators, and domains of life that are of interest in studying QoL. For instance, in terms of scale, QoL can be studied either at aggregated level or at individual level, see Massam (2002). In terms of indicators, some conceptual models are developed for studies that are based on either subjective attributes or objective attributes while others are developed for studies that combine the two attributes. Domains of life that are studied also vary depending on the objective of the study, see Marans (2003) and Lee (2008). A brief discussion about domains of life is presented in other section of this chapter and examples are housing, safety, social services, etc.

Malkina-Pykh and Pykh (2007) proposed a conceptual model that is based on a concept of Pressure-State-Impact-Response. Pressure shows the external factors that affect residents QoL that can be measured with objective indicators. Health service and built environment are examples of pressure. State shows individuals response that can be measured also using objective indicators. Education level and personal health are examples of state. The impact is the result of the pressure and the stat and it is

the overall life satisfaction (QoL) that can be measured by subjective indicators. Examples of impact include satisfaction level of individuals with health service and built environment. The response shows socio-economic programmes that are developed to improve the individuals' development.

Das (2008) proposed a conceptual framework that shows the relation between environment and QoL. The model proposes a bottom up approach in which both objective and subjective indicators are considered to study overall QoL. The framework combines external living environment i.e. objective QoL and perception of individuals for such living environment i.e. subjective QoL.

Another conceptual model is the Detriot Area Study (DAS) model which is based on the relationship between individual's satisfaction with domains of life and their QoL. This model is first developed by Campbell et al. (1976) and applied for Detriot Area Study (DAS) by Marans (2003). Lee (2008) applied the DAS model for Taipei, Taiwan. DAS conceptual model can provide structural ideas for policy makers and planners to use information carefully and decide their action. Lee (2008) stated that the conceptual model can support the voice of the society to be heard by policy makers and planners by providing useful information. The quality of life in any geographic setting (i.e. cities, neighbourhoods, etc.) can not be analyzed with single attribute instead multiple attributes determine quality of life. As described by Campbell et al.(1976) cited in Marans (2003), domain satisfaction is a reflection of individuals' assessments and perceptions of domain attribute which in turn are influenced by the objective attributes (characteristics). Perceived attributes are subjective perceptions of residents regarding neighbourhood physical, socio-economic and personal attributes. The domains that are studied are often selected based on the objective of the study. The conceptual model developed for this study (Figure1-1) is modified from the commonly applied conceptual model developed in Das (2008) and in Campbell et al.(1976) cited in Marans (2003).

3.2. Measurement of Quality of Life

The need to measure quality of life in urban areas has been recognized in the literature although most of the studies are for developed countries. Examples of studies of QoL measurement in the cities of western countries are, for instance, Moro et al. (2008) for Ireland, Li and Weng (2007) for USA, and Bonaiuto et al. (2003) for Rome. However, very few studies of QoL are documented for Asian and African countries. For instance, Lee (2008) , have studied QoL for Taipei, and Møller (2007) studied it for South Africa. List of QoL studies for Asian countries is found in Foo (2000). However, as to the knowledge of the author, such scientific study for East African cities is absent. In this section, the reviewed literatures on the two perspectives of urban QoL i.e. subjective and objective QoL, the link between subjective and objective QoL and empirical studies on the two perspectives of QoL are presented.

3.2.1. Urban QoL perspectives

Urban quality of life has two perspectives that are subjective and objective perspectives Lee (2008). These perspectives are often applied separately or in combination to measure urban QoL. Details are presented in the subsequent paragraphs.

Subjective quality of life

Subjective QoL reflects people's perception of their life and can be measured using subjective indicators. Subjective indicators stand for individual's evaluation of objective conditions of life (Das, 2008). These indicators are derived from surveys of resident's perception, satisfaction and evaluation of their life. Subjective QoL is often measured using Likert scale although there is no commonly defined range. For instance, Foo (2000) applied a 5-point Likert scale ranging from a 'very dissatisfied' to a 'very satisfied' while Brereton et al. (2008) applied a 7-point Likert scale. Subjective QoL can be measured in terms of individual's overall life satisfaction with regard to their life as a whole. Overall life satisfaction is commonly measured either using the intuitive or the rational response, see Foo (2000), Ibrahim and Chung (2003) and Das (2008) and In the case of intuitive response, individuals are asked about their life as a whole. However, in the case of rational response, individuals are first asked about their feeling about several domains of life such as housing, living environment, safety, etc. Once the individuals respond to these questions, then they are asked about their feeling about their life as a whole so that they can give a rational response.

Das (2008) stated that measuring both the intuitive and the rational responses helps to check if there was change in individuals view about their feeling of their life after they realized how satisfied they are with several domains of life. However, Ibrahim and Chung (2003) states that the two responses helps to achieve a more accurate QoL measurement. In this study, both the intuitive and ration response is measured. However, the rational response is selected and applied for further analysis as a measurement of subjective QoL.

Lee (2008) stated that quality must be subjective and the most appropriate method of exploring QoL is by directly asking peoples perception of their life. Bramston et al. (2002), Ibrahim and Chung (2003), McCrea et al. (2006) and Lee (2008) used subjective indicators to measure quality of life. Subjective indicators are important when tackling community based issues through a bottom up approach. Ibrahim and Chung (2003) concluded that these indicators are preferred over objective indicators especially for planning and policy purpose since they provide valuable feedback.

However, as described by Foo (2000), subjective indicators have lower reliability and higher validity. One reason for the problem of reliability for subjective reporting as stated by Das (2008) is that subjective indicators cannot represent the environmental conditions in which people live. Resident's subjective perception of well being is often affected by expectations.

Objective quality of life

Objective quality of life represents the external conditions of life for instance, level of education and crime rate (Das, 2008). Objective QoL is measured using objective indicators which are related to observable facts that are derived from secondary data, see Li and Weng (2007) and Apparicio et al.(2008). Examples of secondary data include population density, crime rate, educational level and household characteristics. A very important fact is that quality can not be determined by objective conditions only and it is important to take into account subjective well-being of individuals. Foo (2000) stated that objective indicators themselves may not express the true quality of life since these indicators have high measurement reliability but low validity in assessing human wellbeing. Also Das (2008) stated that the objective indicators are very often imperfect and may suffer from either under reporting or over reporting.

3.2.2. The link between subjective and objective QoL

As stated by Turksever and Atalik (2001), measuring quality of life using both subjective and objective measures is necessary to provide an understanding of QoL. Measuring quality of life using both subjective and objective measures can benefit from the strengths of each of the perspectives, i.e. to arrive at more reliable and valid information about QoL. Such is also advocated by Rogerson et al.(1989), Marans (2003), Kamp et al. (2003) and Li and Weng (2007). However, there are contradictorily conclusions about the strength of the relationship between the subjective and objective QoL. For instance, Brereton et al. (2008) showed that there is a strong relationship. While McCrea et al. (2006) and Das (2008) showed that there is a weak relationship between subjective and objective QoL. For instance, the relationship developed using spatial variables as an objective attributes in Ireland is found to be highly correlated with subjective attributes Brereton et al.(2008). Although using different spatial variables in Australia, McCrea et al. (2006) showed, that there is a weak correlation between the two types of attributes. As such the relation between subjective and objective QoL is not well defined. The reason can be differences in domains of life studied or the fact that the domains can be location specific.

Foo (2000), Ibrahim and Chung (2003), Santos et al. (2007) and Apparicio et al. (2008) recommend the use of both subjective and objective indicators to complement the limitation of specific indicators. As stated by Apparicio et al. (2008) the challenges in using both indicators together are shortage in logistic and funding, different tools required to measure the two indicators and the difference in scale at which information is collected.

3.2.3. Empirical evidence on subjective and objective urban QoL

Several empirical studies using different variables to measure Qol are documented. For instance, Das (2008) used variables such as satisfaction from condition of housing and satisfaction from health facilities to study QoL. Demographic and socio-economic characteristics of an individual are also used in QoL studies. For example, Foo (2000) and Ibrahim and Chung (2003) used variables such as age, gender, marital status, education level, household income etc to study urban QoL. Other studies focused on the use of both socio-economic and spatial variables. For instance Brereton et al.(2008) and Moro et al. (2008) applied variables such as gender, employment status, household tenure etc and spatial variables such as population density, traffic congestion, crime rate, number of waste facilities, etc. In general, the empirical studies on QoL that are reviewed in this study varies in terms of the region the studies are carried out, the sample size, the Likert scale used and the indicators applied to measure QoL.

List of previous QoL studies that are reviewed are summarized in Table 3-1. The table shows that most of the empirical studies in urban QoL are for Western countries. Also, the sample size of these studies varies between 331 and 2400 without any defined relation with the population size. Thus in this study, a sample size of 607 respondents of Kirkos sub-city is conducted to measure both the subjective and the objective QoL using a 6 point Likert scale.It also shows that there is no defined Likert scale to measure QoL, i.e. it varies between Likert scale of 4 and 7. Most of the empirical studies that are reviewed in this study applied both subjective and objective attributes to study QoL.

Table 3-1 Summary of urban QoL studies

Author	Region	Study area extent (km^2)	Total population	Sample size	Likert scale	Measures
Foo (2000)	Asia	647.8	3.1 million	2200	5	Subjective
Turksever and Atali (2001)	Europe	NM	NM	384	4	Both subjective and objective
Bramston et al.(2002)	NM	NM	< 20,000	250	7	Subjective
Ibrahim and Chung, (2003)	Asia	14.7	173122	300	5	Subjective
Bonaiuto et al.(2003)	Europe	NM	NM	312	7	Both subjective and objective
Cramer et al. (2004)	Europe	NM	NM	2065		Both subjective and objective
Mccrea et al. (2005)	Europe	NM	2.35 million	1347	5	Both subjective and objective
McCrea et al.(2006)	Europe	20,000	2.35 million	1610	5	Both subjective and objective
Santos and Martins (2007)	Europe	NM	NM	2400	6	Subjective
Li & Weng (2007)	USA		860,454	NA		Objective
Higgs (2007)	South Africa	NM	NM	2000	5	Both subjective and objective
Moro et al.(2008)	Europe	NM	NM	1500	7	Both subjective and objective
Brereton et al. (2008)	Europe	NM	NM	1500	7	Both subjective and objective
Lee (2008)	Asia	154	2,618,298	331		Subjective
Rojas (2008)	Latin America	NM	NM	1540	7	Both subjective and objective
Das (2008)	Asia	NM	NM	379	5	Both subjective and objective

NM= Not mentioned

NA= Not applicable

Likert scale is a scale commonly used in questionnaires, and is the most widely used scale in survey research of subjective measures and respondents specify their level of agreement to a statement.

3.3.   Domains of Life that Affect QoL

Quality of life is an integrated effect of individuals' satisfaction with many domains of life. Such integrated effect has been studied by, for instance, Foo (2000), Lee (2008) and Rojas (2008). Marans (2003) describes that satisfaction implies a judgemental experience whereas happiness reflects a relatively short-term mood of delight. For policy makers and researchers, satisfaction is considered more relevant than happiness.

The domains of life that are relevant to study QoL are often determined based on the objective of the research. There is no consensus on which domains of life are relevant in studying QoL. However, it has been suggested by Rojas (2008) that the number of domains of life must be manageable. Rojas (2008) used seven domains of life that are health, economic, job, family, friends, self and community. While Lee (2008) used five domains of life such as civic service, neighbourhoods satisfaction, community status, neighbourhoods environmental assessment and local attachment.

One of the main research challenges is which domains of life affect subjective QoL. Lee (2008) showed that community status i.e. neighbourhood attractiveness and its suitability for raising children is best to predict QoL. While for Das (2008) satisfaction from condition of housing is best to predict QoL as compared to other domains that are availability of parks and green areas, environmental pollution, economic condition, cost of living, personal security, condition of traffic, health facility and welfare services.

The relationship between satisfaction with specific domains of life and objective characteristics of the respective domains are also an area of interest for urban QoL studies. For instance, Zebardas (2009) studied the relationship between objective characteristics of housing and satisfaction in housing and Rojas (2008) studied the relationship between objective income and satisfaction from it.

3.4.   Quality of Life for Urban Planning

As stated by McCrea et al. (2006), urban planners are responsible for managing the objective urban environment. As such they benefit from knowledge about how their decisions affect resident's satisfaction with urban living. Outcomes of urban QoL studies can provide information for developing planning and design strategies that will enhance the quality of life of the residents. The studies also provide information that help to identify the problem areas, causes of dissatisfactions, demographic influence and the citizen's priority in life Ibrahim and Chung (2003). QoL studies for urban areas are found in Rogerson (1999), Foo (2000), Wong (2001), Ibrahim and Chung (2003), Li and Weng (2007), Santos et al. (2007), and Lee (2008).

Lee (2008) advocated that studying satisfaction with domain of life such as housing and community domains is essential for urban areas. These domains of life are important to improve the understanding of urban QoL and methods of measuring it. Santos and Martins (2007) mentioned that the participation of the community in QoL studies provides an important support for policy definition and to establish long-term goals shared by the community.

3.5. Geo-information and Urban Quality of Life

The role of GIS in quality of life studies has not been well explored although spatial factors are expected to affect QoL. However, there are still few studies that explore the use of spatial variables and GIS in studying QoL. Brereton et al. (2008) used spatial variables including proximity measures to examine the influence of spatial dimensions on QoL. These spatial variables include population density, proximity to hazardous waste facilities, proximity to landfill and proximity to major roads. McCrea et al. (2006) studied how individuals perception of proximity to facilities is related to actual proximity to the facilities such as secondary school, sport facility and hospital. The above literatures applied Geographic Information System (GIS) to estimate proximity.

3.6. Summary

This chapter reviewed the state-of- the- art in urban QoL studies. Although there is no a universally accepted definition of QoL, the basic concept of the definitions provided by the studies is the same i.e. the notion of subjective and objective life satisfaction. Also there is no a single conceptual model that is commonly applied to study urban QoL.

Urban QoL has two perspectives that are subjective and objective QoL. These perspectives are measured using subjective and objective indicators respectively. It is possible to classify urban QoL studies in three depending on these indicators. The first class of studies are those that apply subjective indicators to measure QoL. The second class of studies use objective indicators. However, the third class apply both indicators i.e. subjective and objective to measure QoL.

There are several domains of life that affect quality of life. The types of domains of life that are assumed to affect QoL and hence are studied depend on the objective and the context of the study.

The review also showed the importance of QoL studies for urban planning and management. The out put from this study is expected to provide information for urban planners in the African context since such study is almost absent in the continent.

Geographic information system (GIS) plays a role in QoL study although it is not well explored. In this study, GIS is effectively used in estimating proximity to facilities, to explore the spatial variation of the subjective QoL and to visualize the spatial distribution of QoL in Kirkos sub-city.

4.   Research Methods

The research questions in this study are answered following a method that has four main stages. The first stage is pre-field work that includes preparation for the fieldwork. The second stage is field work during which relevant data was collected. Data is collected from two sources that are primary and secondary data sources. The third stage is post field work during which the collected data is processed and its consistency is checked. In the fourth stage, methods for data analysis are applied to study quality of life in Kirkos sub-city using subjective and objective attributes. First, an overview of the research design is first presented. Details of the four main stages of the research method are discussed in subsequent sections.

4.1.   Research Design

The research design of the thesis is shown in Table 4-1. The research design shows the research question that must be answered to achieve each sub-objective. In general, there is more than one research question per objective. The required data and its source are also shown in the Table. The method that is applied to answer a specific question is also specified.

4.2.   Field Work Preparation

In the pre-field stage, first, a base map of the study area was prepared. Second, the required data and proper domains of life were identified after an in-depth literature review. Eight domains of QoL and several attributes of the respective domains were identified. Thirdly, the household questionnaire was prepared in both English and translated to Amharic, which is the local language. The questionnaire consists of three sections that are general information that includes household characteristics, Quality of life as a whole and domain satisfaction, and satisfaction with the attributes of the selected domains of life.

The questionnaire includes questions that cover both the subjective and the objective attributes of QoL. Examples of objective attributes in the questionnaire are level of education, household tenure and household size. Examples of subjective attributes include perceptions of satisfaction with housing, income and built environment.

The questionnaire was structured in such a way that respondents can understand it easily. To prove this, the questionnaire was tested on an experimental group of individuals' priori to the actual household survey. The feedbacks from the experimental group were found very useful in improving the questionnaire in terms of clarity. Appendix A shows the questionnaire that was developed for this study.

During the last part of the pre-field stage, a sampling strategy was designed for the household survey. The main objective of designing the sampling strategy was to collect data that is representative of the residents of the sub-city. The sampling strategy is presented below.

Table 4-1 Research design

Sub-objectives	Research questions	Required data	Data source	Methods of data analysis
1	What is the level of subjective QoL at a sub-city and Kebele level?	IP	HS	- Descriptive statistics, such as mean, cumulative percentage and standard deviation
	What are the domains of life in urban context as defined by individuals?			
	What is the level of individuals' satisfaction with each domain of life?			
2	Is there variability in the subjective QoL between Kebeles?	IP	HS	- Coefficient of variation (CV) - Descriptive statistics, such as mean - Correlation coefficient
	Is there variability with in each Kebele of the sub-city?			
	Is there clustering of Kebeles with high or low QoL scores?			
3	What are the dominant perceived domains of life in the sub-city?	IP	HS	-Correlation matrix -Multiple regression
	What are the dominant perceived attributes that affect the domains of life in the sub-city?			
4	What are the dimensions of subjective QoL?	IP	HS	Factor analysis
	What are the dimensions of objective QoL?	-IC, SF	-HS, PS, S,GPS TO, AAM	-GIS ,Factor analysis
5	Can QoL indices be developed from objective attributes?	-Same as above	-Same as above	Factor analysis
6	What individuals and household characteristics explain the variation in subjective QoL in the sub-city?	-IP, IC, SF	-HS, PS, CS,GPS TO, AAM	ANOVA, t-test
	What is the combined effect of subjective and objective QoL in the sub-city?	-IP, SF	- Same as above	- Descriptive statistics, such as mean, GIS

HS: Household Survey, PS: Police stations, CS: Census data, TO: Traffic Office, AAM: Addis Ababa Municipality data, IP: Individuals' Perception, IC: Individuals' Characteristics, SF: Spatial Factors

Sampling strategy

First, an overview of the sampling scheme of related previous quality of life studies is briefly summarized. Das (2008) applied two stage purposive sampling for the study of urban quality of life in Guwahati. During the first stage of purposive sampling, 6 wards were selected out of the 60 wards based on some selected features, for instance traditional and new residential areas. Households from each ward are then picked purposively to ensure that various income strata are represented adequately. In total 379 households were interviewed. Lee (2008) applied stratified sampling to interview 331 households from the 12 districts of Taipei. However, the author did not provide details of the sampling.

Ibrahim and Chung (2003) applied a random stratified sampling method to interview 300 households that are evenly distributed around the study area. The same method was applied in QoL studies in Istanbul by Tulksilver and Atalik (2001). Foo (2000) applied stratified sampling method in such a way that the census boundaries are used to facilitate the selection of households. A stratified two-stage

sampling method can also be applied by designing the administrative unit as primary sampling unit and the households in the primary sampling unit as secondary sampling unit (Tsou and Liu, 2001). To study the QoL of urban poor in Thailand, Surit et al. (2008) applied a systematic sampling method and interviewed 523 households.

Based on their applicability in previous urban quality of life studies, a combination of three sampling methods are applied in this study. These methods are purposive, stratified and systematic sampling. Kirkos sub-city of Addis Ababa is selected purposively. Some factors that are considered in selecting the sub-city are that the sub-city is one of the densely populated sub-cities in Addis Ababa. The sub-city is located at the centre of Addis Ababa. I also had a lot of support from the sub-city administration since I had a research experience in the sub-city in the past.

Stratified sampling method is applied to classify the Kebeles into blocks or strata. First, Kebeles were classified into two to four large blocks mainly based on the old administrative boundary. Secondly, these large blocks or strata are classified into small strata based on residential structure which is mainly defined applying access roads as a boundary for the settlements since these were found effective. Prior knowledge of the study area supported by Google earth and QuickBird (2002) image was helpful in classifying areas for strata. The assumption is that residents that are grouped in same small stratum can share some common characteristics. For instance, residents in one stratum are expected to share social connectedness and have similar access to public services.

The rational behind classifying the Kebeles in to strata is to ensure spatial diversity of households from each block by avoiding selection of households from specific locations. This was also found necessary since many of the subjective and the objective variables that are studied are spatial variables. Stratification is also applied to have representative sample of households and represent the heterogeneity in the sub-city as much as possible.

Systematic sampling method is planned to identify households during filed work. The total number of samples, i.e. about 600, was determined based on information from similar studies (see Table 3-1). The total number of household in each Kebele is about 2,200 to 5,000. The interval for systematic sampling is calculated by dividing the total number of households by 55, which is the needed sample size from each Kebeles. Thus one household every 40 to 90 households were planned to be selected for interview. However, in some cases it was difficult to be too strict for instance, some individuals were not willing to fill the questionnaire or not available during the survey. In such cases, the nearby households were surveyed.

4.3. Field Work

In this study, the required data are collected from two main data sources that are primary and secondary sources. Details about the data are described below.

Primary data

Household survey was carried out to collect primary data from 11 Kebeles of Kirkos sub-city, Addis Ababa. The data was collected through interviews using a structured questionnaire during the period from 17 September 2008 to 17 October 2008. For the household survey, the main criterion was that the respondents must be head of the household. Moreover, the respondents must have lived in the sub-city for a minimum of 2 years.

First, twenty two data collectors and six supervisors were trained to facilitate the data collection. The data collectors were proposed by each Kebele administration while some were selected based on

previous experience with them. The quality of the data was guaranteed by working closely with the supervisors and the data collectors in a systematic way.

During field work, systematic sampling method is applied to identify and interview households from each second stratum. Although it is planned to select households at intervals of 40 to 90 households, the actual situation in the ground in some cases lead to apply less interval than the planned interval. In Addis Ababa, including Kirkos-sub-city, most of the residential areas have several households that live in a single compound. These settlements are commonly called small villages. The small villages commonly have homogeneous characteristics in terms of the life style. Thus, such small villages are considered as a single household. Sampling was started from one of the households that are located near the boundaries of each second stratum. Figure 4-1 shows location of the surveyed households in one of the Kebeles of Kirkos sub-city, i.e. Kebele 15/16.

The head of the households were selected as the respondents of the interview. However, in the absence of the head of the household any adult member is interviewed but such conditioned occurred rarely. Commonly, it is assumed that the head of the household or any adult member of the household reflects the feeling of all other members in a house. From each stratum or block 25 to 30 households that are evenly distributed were interviewed. The total number of respondents is 607 households with fifty five respondents from each Kebele. The time required to fill the questionnaire was about 15 to 20 minutes per questionnaire.

Spatial data was also collected in the sub-city using GPS. The data includes location of schools, health facilities, recreational facilities and police stations.
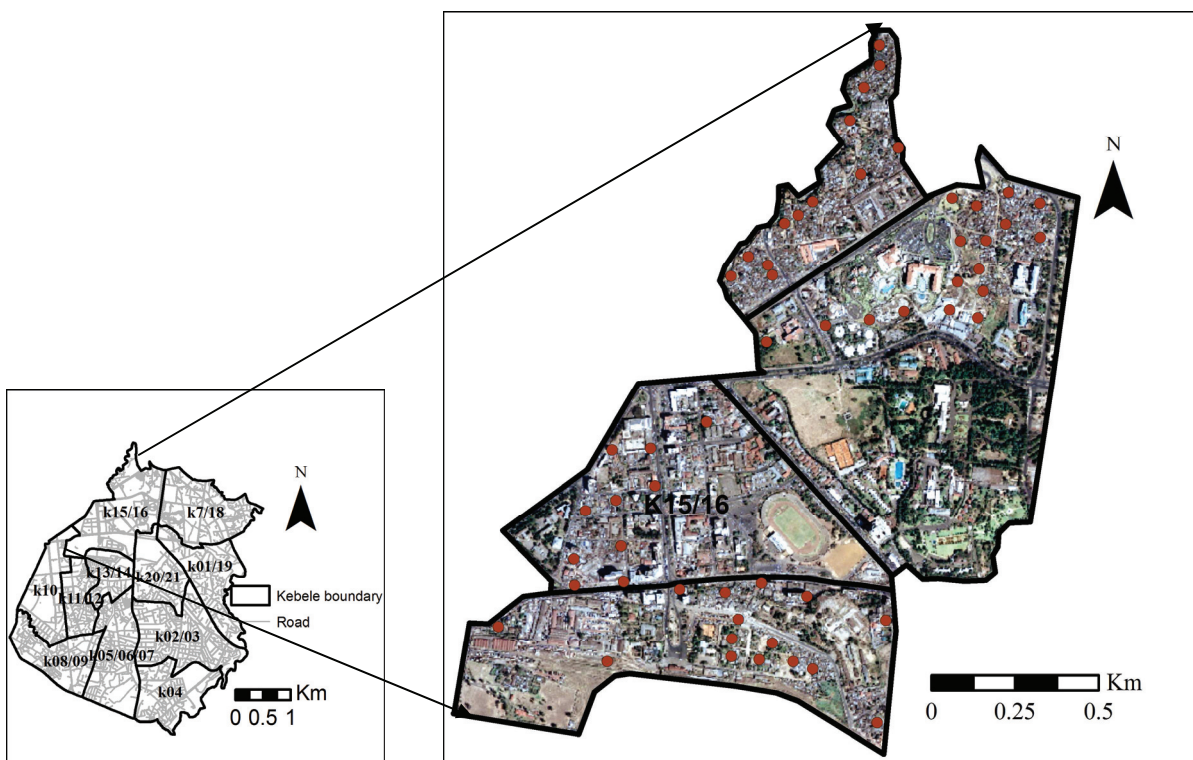
Figure 4-1 Location of the surveyed households in Kebele 15/16. Note: the boundaries of the small strata are shown. The image is obtained from QuickBird image that was acquired in 2002.

Secondary data

Crime data of the area is collected from Kirkos sub-city police department. The data includes one year crime data i.e. year 2007/8 for each Kebele of the sub-city. Traffic accident data is also collected from Addis Ababa traffic office. Some GIS data such as building map, land use, road map, home ownership and etc is collected from Addis Ababa Municipality. The population of each Kebele is accessed from the census data of 2007. List of the collected secondary data are shown in Table 4-2.

Table 4-2 Data collected from secondary sources

Data	Format	Source	Remark
Crime data	Excel	Kirkos sub-city police department	One year (2007/8) crime data per Kebele
Traffic accident data	Excel	Addis Ababa traffic office	
Digital maps of building, land use, road, ownership, administrative boundary, contour map, distribution of services i.e. health and education,	GIS	Addis Ababa municipality	
Population data 2007	Word	Central Statistical Agency, Ethiopia	Only Population per Kebele

4.4. Post Field Work Data Preparation

In this stage, the collected data is digitized, i.e. entered to a computer, checked for consistency and converted to proper format. Next the data is processed and analysed using statistical and spatial analysis techniques using standard statistical software packages and GIS such as SPSS (version11.5) and Arc-GIS, respectively.

4.5. Data Analysis

4.5.1. Subjective quality of life and domain satisfaction

Descriptive statistics is applied to measure subjective QoL and individuals' satisfaction with domains of life at sub-city and Kebele level. The subjective QoL is measured in terms of the rational QoL, the intuitive QoL and the QoL in 2006 which is two years before the household survey. The respondent's response is measured using 6 points Likert scale that ranges from 1 for completely dissatisfied to 6 for completely satisfied.

Descriptive statistics i.e. cumulative percentage of respondents is calculated to compare the rational and intuitive QoL, and to compare the QoL in 2006 and the QoL in 2008 at sub-city level. In this study, if it is not specified, the term subjective QoL is applied to refer the rational QoL.

Descriptive statistics is applied to measure the QoL and domain satisfactions at Kebele level. The mean score is used to aggregate the QoL for each Kebeles. Kebele's are also ranked based on the mean QoL score and based on the mean satisfaction score of each domain. Geographic information system (GIS) is applied to visualize the distribution of QoL in the sub-city.

4.5.2. The Spatial variability of subjective quality of life

Following Turksever and Atalik (2001), spatial statistics in terms of coefficient of variation (CV) is applied to study the variability of the subjective QoL at Kebele level. The CV is computed as standard deviation of the QoL scores divided by the mean of the scores and it indicates an absolute variability. To evaluate the relation between QoL scores and its spatial variability, the correlation coefficient is computed between mean QoL and CV. GIS is applied to visualize the variability and identify clustering of high and low Kebeles in terms of variability by mapping the calculated CV for each Kebele.

4.5.3. Causal model of subjective quality of life for Kirkos sub-city

The causal model is developed based on a commonly applied conceptual model as obtained through the literature review, see Lee (2008) and Marans (2003). The conceptual model in Figure 4-2 assumes that subjective quality of life is an integrated effect of satisfaction with several domains. The conceptual model also shows how to measure and compare individual's assessments of several domains that affect their lives as well as "life as a whole".
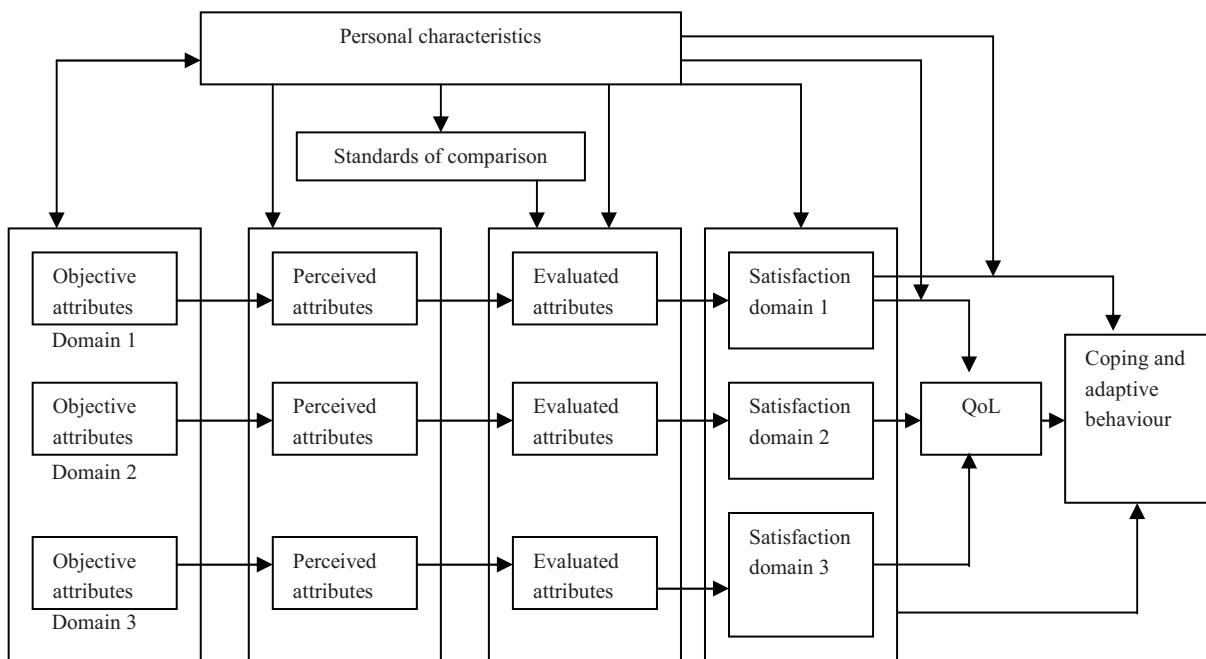
Figure 4-2 Model showing the relationship between domain satisfactions and QoL

Correlation matrix is computed for the raw data as preliminary assessment of the relationship between domains satisfaction. As suggested by Pacione (2003) and Richards et al.(2007) multiple regression is computed to identify the contribution of each domain to the subjective quality of life and to develop causal model that shows the interaction between domains and attributes. Assumptions of multiple regression for instances multicollinearity, non-Zero variance and independent errors are checked. The regression analysis is performed between domain satisfaction and subjective QoL scores, and between domain satisfaction scores and the respective attributes. The regression coefficients indicate the relative contribution of each domain and attributes on QoL.

4.5.4. Dimensions of subjective quality of life

Following Das (2008) and Zebardast (2009) factor analysis is carried out to identify dimensions of the subjective quality of life in the sub-city using 27 subjective attributes. Factor analysis is a statistical technique commonly used to extract a sub-set of uncorrelated attributes that explain the variance observed in the original data set. Priori to applying factor analysis, the suitability of the data was checked based on the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests. The requirement to apply factor analysis is that the KMO value must be great than 0.5 and the Bartleet's test value must be less than 0.1 (Li and Weng, 2007). To determine the number of factors extracted both the scree plot and the eigenvalue criterion are applied.

In this study, orthogonal varimax rotation method is applied to ensure that the attributes are maximally correlated with only one factor and for ease of interpreting the factors. To ensure that the factor scores are uncorrelated the Anderson-Rubine method is carried in identifying the factor score coefficients. The internal scale reliability of the attributes is checked using the Crohnbach's alpha test. The degree of reliability is acceptable if Crohnbach's alpha > 0.7 (Field, 2005).

The attributes that have the highest loading in the respective dimensions of the subjective QoL are selected to develop a simple model of QoL. Multiple regression is applied to develop a simplified model of QoL using the selected attributes.

4.5.5. Dimensions of objective quality of life

Factor analysis is applied to identify the dimensions of objective quality of life in the sub-city. Prior to the analysis, data preparation on the 13 selected objective attributes (variables) was performed. The variables include both individual characteristics and spatial variables. Some of the selected individual characteristics such as employment status, level of education and household tenure were categorical variables. These attributes are transformed into a score of 0 – 10 based on their contribution to quality of life. This method of data transformation is adopted after Zebardast (2009). For instance, the variable employment status has two classes that are employed and unemployed. The categories are transformed into a minimum score of 0 and a maximum score of 10. The assumption is that employed respondents have relatively high QoL than unemployed respondents. The transformed scores for the three variables are shown in Table 4-3. The variable Income is transformed in to natural logarithm. The remaining household characteristics such as household size, number of dependent children and number of rooms in a house are continuous and no transformation is computed on these variables.

Geographic information system (GIS) is used to derive proximity variables which are nearest distance to school and health facilities. Following Mccrea et al.(2005), the centroid of the block maps is used to identify the nearest distance to the facilities.

Population density is measured as total population (2007) divided by total area of each Kebeles. Building density is measured as total built-up area divided by total surface area of each Kebeles. Crime rate is measured based on the description applied in Moro et al.(2008). It is measured as a number of reported crimes in each Kebeles per 100,000 of the population. Number of traffic accident is measured as number of reported accidents in each Kebele. The spatial variables are assumed the same for all respondents in the specific Kebeles.

Factor analysis, which was applied for the subjective dimension, is also applied to identify the dimensions of objective QoL. Anderson-Rubine method is applied to avoid the influence of different measurement scale on the resulting score.

Table 4-3 Scaling of attributes of objective QoL

Attribute labels	Measures	Score
Employment status	employed	10
	unemployed	0
Education level	1-Illiterate	0
	2-Primary school	4
	3-Secondary school	7
	4-vocational school	9
	5-University degree	10
Housing ownership	1-Private	10
	2- Kebele	7
	3-Housing agency	5
	4-Private Rent	4
	5-Others	3

4.5.6. Index of objective quality of life

An index of objective quality of life is developed based on the method presented by Li & Weng (2007) . The QoL index is established using the score of the dimensions of objective QoL that was estimated by the factor analysis. The overall score of each respondent is obtained by weighting each factor score by the respective variance. As stated in Li and Weng (2007) there is lack of available criteria for weighting of indicators as such factors are considered as composite indicators and the percentage of variance that a factor explains is applied as a weight. Following, Li and Weng (2007), in this study, the objective QoL index for Kirkos is developed by weighing the dimensions with the variance of the respective factors.

A minimum-maximum standardization technique is applied to transform the objective QoL score to score of 1 to 6. Score of 1 represents lowest objective QoL and score of 6 represents highest objective QoL. The standardized score is aggregated using the mean value for each Kebele. GIS is applied to visualize the distribution of objective QoL in the sub-city.

4.5.7. Comparison between subjective and objective QoL

Subjective QoL variation with the characteristics of the respondents

One-way analysis of variance (ANOVA) and t-test is applied to compare the variation in mean subjective QoL score of respondents in different categories. This helps to find out the statistical significance of variation in the mean QoL scores with personal, socio-economic and demographic characteristics of the respondents.

The null hypothesis is that the mean score of respondents in different categories are equal and the alternative is the group means are not equal. The ANOVA F test is applied when the means of greater than two categories are compared. For the ANOVA, a significance level of 0.05, which corresponds to 95% confidence level, is selected. T-test is also applied to compare the mean of two categories, for instance, the two groups of gender are male and female respondents.

Relationship between subjective and objective QoL

Following Das (2008), the correlation coefficient is applied to compare the scores of the subjective QoL and the index of the objective QoL derived for every individual households. The comparison between the subjective and the objective QoL at Kebele level is assessed based on the theoretical concept that is described in Zapf (1984) cited in Craglia et al. (2004). First, the QoL score that is perceived by individuals is aggregated in terms of the mean score per Kebele. Next, the objective QoL score, which is established using factor analysis, is aggregated in terms of the mean score per Kebele. Finally, a two-way matrix is developed to assess the condition of both the subjective and the objective QoL for each Kebeles. The condition of QoL in each Kebele is identified as deprivation, well-being, dissonance or adaptation based on the average score. A score of 3.5 is applied to differentiate between 'good' and 'bad' QoL. If both the subjective and objective QoL are good then there is well-being while if both are bad then there is deprivation. If the objective is good but the subjective is bad then there is dissonance while if the objective is bad but the subjective is good then there is adaptation. Geographic Information System (GIS) is applied to visualize the four conditions of QoL in Kirkos sub-city.

5. Results

In this chapter, the results of this study are presented in four main sections. In the first section, the characteristics of the sampled households are presented. The result of the subjective QoL measurement is presented both at the sub-city and Kebele level in the second section. The results of the analysis of the domain satisfactions and the variability of subjective QoL are presented both for the sub-city and Kebele level. The second section also includes the causal model and the dimensions of the subjective QoL in the sub-city. In the third section, the result of the objective QoL measurement is presented. This section also includes the dimensions and an index of objective QoL. In the fourth section, the combined effect of the subjective and objective QoL is presented.

5.1. Household Characterstics

A sample survey of 607 respondents from 11 Kebeles of Kirkos sub-city is collected to achieve the main objectives of this study. A 6-point Likert scale ranged from 1 to 6 is used to measure individual's response on their quality of life (QoL), domains satisfaction and its attributes. A scale of 1 represents 'completely dissatisfied', 2 represents 'very dissatisfied', 3 represents 'dissatisfied', 4 represents 'satisfied', 5 represents 'very satisfied' and 6 represents 'completely satisfied' for subjective QoL and domains satisfaction. Close translation to the local language, i.e. Amharic, is given to the 6 point Likert scales. The objective variables include both individual characteristics and spatial factors.

First, for the purpose of brevity a distinction is made between the individual' and the household characteristics. The individuals' characteristics apply to the head of the respective household that are the respondents in this study. Individual's characteristics include age, sex, employment status and level of education. The characteristics of the household include household size, number of dependent children and monthly income. Table 5-1 shows the individuals' characteristics. The table shows that there are more male respondents (56.7 %) than female respondents (43.3 %). This is compared with the report of Ethiopia's plan for accelerated and sustained development to end poverty (PASDEP) MoFED, 2006 plan based on the 2004/05 welfare and monitoring survey for the country. The report mentioned that in urban Ethiopia there are more male headed households (61 %) than female headed household (39%).

The respondents' age that ranges from 18-86 is classified into 5 classes. Large number of respondents (33%) is in the age group of 41-50. In terms of the employment characteristics, the majority of the head of the households, i.e. 63.1 %, are employed while only 36.9 % are unemployed. Educational characteristics of the head of the households' shows that the majority, i.e.85 %, is literate while only 14.7% are illiterate. Some 32 % attained education up to primary level 53.0% attained secondary education or higher.

Table 5-1 Individuals' characteristics

Description	Category	Number	Percentage (%)
Sex	Male	344	56.7
	Female	263	43.3
Age	<20	8	1
	21-30	95	16
	31-40	146	24
	41-50	202	33
	>50	156	26
Employment status	Employed	383	63.1
	Unemployed	224	36.9
Education level	Illiterate	89	14.7
	Primary school	196	32.3
	Secondary school	174	28.7
	Vocational school	75	12.4
	University graduate	73	12.0

Table 5-2 Household characteristics

Description	Category	Number	Percentage (%)
Household size	1-2 persons	28	4.6
	3-4 persons	158	26.1
	5-6 persons	229	37.7
	>7 persons	192	31.6
Number of dependent children	No dependent child	79	13.0
	1 child	117	19.3
	2 children	151	24.9
	3 or more children	260	42.8
Family income (monthly)	< 500 Birr	281	46.3
	500-1500 Birr	219	36.1
	1500-2500 Birr	42	6.9
	2500-3500 Birr	27	4.4
	3500-4500 Birr	15	2.5
	>4500 Birr	23	3.8

Table 5-2 shows the household characteristics, i.e. household size, number of dependent children and family income. In terms of household size, out of the total respondents, only 4.6 % live in a household size of less than 3 persons per house. More than half of the respondents, i.e. 69.3%, live in a household size of larger than 4. In terms of dependent children, only 13 % of the households have no dependent children. The majority of the households have 3 or more dependent children. In terms of monthly income, 46.3% of the households have monthly income of less than 500 Birr, which is equivalent to 50 US dollars. Note that 1 US dollar is equivalent to 10 Ethiopian Birr. An income of

500 is equivalent to the annual income of 1200 Birr per person for an average household size of 5. This is comparable to the poverty line defined in PASDEP. The local poverty line as mentioned in MoFED, 2006 considered both food poverty line in Birr Per person per year and Kcal per person.

5.2.   Subjective Quality of Life

5.2.1.   Subjective quality of Life at sub-city level

The subjective quality of life (QoL) in the sub-city is measured in terms of the intuitive and rational response. During the household survey, both the intuitive and the rational quality of life were measured for two similar questions. The first question is *'what do you feel about your life as a whole?'* The response from this question is intuitive QoL. The intuitive QoL was measured by interviewing the respondents feeling about the quality of their life at the time of the household survey, i.e. 2008, and the quality of their life two years before the household survey, i.e. 2006.

The other question is *'Taking all the domains of life above into consideration, how satisfied are you with your life as a whole at present?'* The response from this question is considered as rational QoL. The rational QoL was measured after individuals were asked about their satisfaction with specific domains of life. This was done to check if there was a change in their views about the quality of their life after realizing how satisfied they are with several domains of life. Thus, the rational QoL would be influenced by preceding questions and is well thought than the intuitive one, which is instinctive.

Descriptive statistics for intuitive and rational QoL (2008)

Table 5-3 shows the percentage of respondents' in Kirkos sub-city that are categorized in each level of QoL based on their response. When respondents were asked about their intuitive QoL, the majority of the respondents, i.e. 26 %, expressed their dissatisfaction while only 3 % expressed complete satisfaction. About 74 % of the respondents said they are dissatisfied or feel worst.

When respondents were asked about their rational QoL, the majority of the respondents, i.e. 31 %, expressed their dissatisfaction while only 4 % expressed complete satisfaction. About 62 % of the respondents said they are dissatisfied or feel worst.

Comparing the intuitive and rationale response, the cumulative percentage of respondents that expressed dissatisfaction or worst feeling when their intuitive response was measured is 74 %. However, the cumulative percentage of respondents with a rational response of dissatisfaction or worst is 63 %. This implies that some respondents changed their response about their QoL after they were asked about their satisfaction with different domains of life.

The mean intuitive QoL score is 2.76 with standard deviation of 1.3 and the mean rational QoL score is 3.06 with standard deviation of 1.3. For both responses the mode is 3.

Table 5-3 Percentage of intuitive and rational QoL score

Level of QoL	Intuitive QoL in 2008		Rational QoL in 2008	
	Percentage (%)	Cumulative (%)	Percentage (%)	Cumulative (%)
Completely dissatisfied	24	24	15	15
Very dissatisfied	24	48	16	31
Dissatisfied	26	74	31	62
Satisfied	17	91	26	88
Very satisfied	6	97	8	96
Completely satisfied	3	100	4	100
Mean(Likert)	2.67		3.06	
Mode	3.00		3.00	
Standard deviation	1.3		1.3	

Descriptive statistics for QoL in 2006 and 2008

During household survey respondents were also asked about the quality of their life before two years i.e. 2006. Table 5-4 shows percentage of respondents in each level of QoL for the year 2006 and 2008. The cumulative percentage of respondents that expressed dissatisfaction or worst during the year 2006 is 51%. Also about the same cumulative percentage i.e. 49% of the respondents expressed they feel satisfied, very satisfied and completely satisfied for the same year.

However, the cumulative percentage of respondents that expressed their dissatisfaction or worst with their life during the year 2008 is 74%. While the cumulative percentage found from respondents who feel satisfied, very satisfied and completely satisfied for the same year is 26%.

Table 5-4 Percentage of intuitive QoL score for 2006 and 2008

Level of QoL	Intuitive QoL in 2006		Intuitive QoL in 2008	
	Percentage (%)	Cumulative (%)	Percentage (%)	Cumulative (%)
Completely dissatisfied	10	10	24	24
Very dissatisfied	18	28	24	48
Dissatisfied	23	51	26	74
Satisfied	33	84	17	91
Very satisfied	11	95	6	97
Completely satisfied	5	100	3	100
Mean (Likert)	3.30		2.67	
Standard deviation	1.3		1.3	

5.2.2. Subjective quality of life at Kebele Level

Measuring QoL at the sub-city level is expected to hide the QoL at small scale i.e. at Kebele level. Analyzing the QoL at Kebele level helps to identify Kebels that are low or high in terms of the QoL of the residents. The subjective quality of life at Kebele level is also analyzed in three ways that are, rational QoL in 2008, intuitive QoL in 2008 and intuitive QoL in 2006. The results are presented below.

Rational QoL in 2008

The map in Figure 5-1 shows the spatial distribution of the mean score of the rational QoL in Kirkos sub-city. Small values, which are represented by red, indicate low QoL while high values, which are represented by green, indicate high QoL. The map shows that rationally, the respondents' in the Kirkos sub-city feel either satisfied (i.e. a value of 4) or 'dissatisfied' or worst (i.e. a value of 3 and less) about their life at present time which is 2008. The map also shows some pattern of clustering of Kebeles with high or low values. For instance, Kebeles with low mean score are clustered in the south-western part of the sub-city.
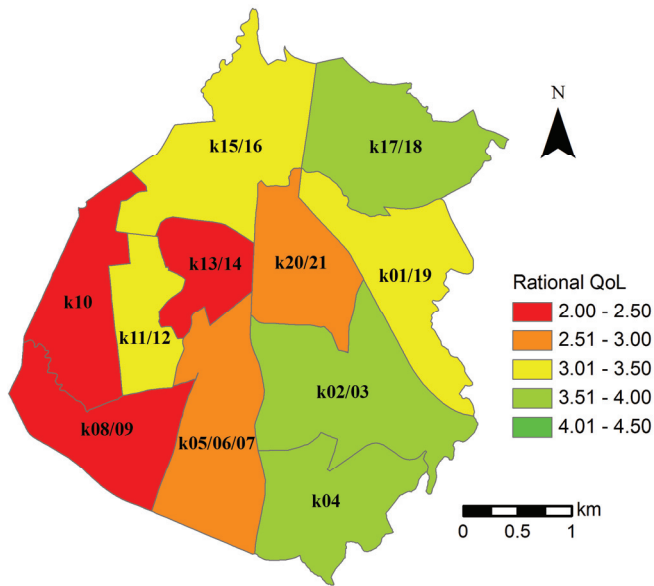
Figure 5-1 Spatial distribution of averaged rational QoL in Kirkos sub-city. Note that a Likert scale of 1 represents 'completely dissatisfied', 2 represents 'very dissatisfied', 3 represents 'dissatisfied', 4 represents 'satisfied', 5 represents 'very satisfied' and 6 represents 'completely satisfied'

Table 5-5 shows the statistic for the three top and the three bottom ranked Kebeles which were ranked based on their mean QoL score. The table shows that the mean rational QoL score varies between 2.0 and 4.0 with standard deviation of 1.33 and 1.34 respectively. In terms of ranking, K02/03 is the first ranked Kebele while K08/09 is the least ranked Kebele. The mode varies between 1 and 4.

Table 5-5 Statistic for the rational QoL in 2008. Note: the confidence intervals are shown

Kebele	Mean	Mode	Min	Max	Std. Dev.	Rank
K02/03	4.00(±0.39)	4	1	6	1.34	1
K17/18	3.65(±0.20)	3	2	6	0.97	2
K04	3.55(±0.20)	4	1	6	1.05	3
K10	2.35(±0.39)	1	1	6	1.32	9
K13/14	2.20(±0.20)	2	1	5	1.01	10
K08/09	2.00(±0.39)	1	1	6	1.33	11

Intuitive QoL in 2008

The map in Figure 5-2 shows the spatial distribution of the mean score of the intuitive QoL in the sub-city. The representation is chosen in such a way that red shows the respondents' are 'very dissatisfied' while green shows the respondents' are 'satisfied'. The minimum mean score is 2.00 and the maximum mean score is 3.33. The map shows that intuitively, on average respondents' in the Kirkos sub-city feels 'dissatisfied' (i.e. a value of 3) or worst about their life at present time, i.e. in 2008.
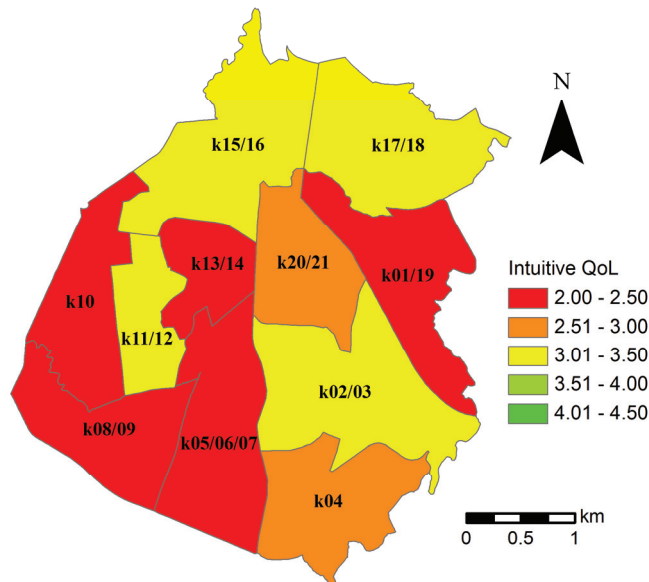
Figure 5-2 Spatial distribution of averaged intuitive QoL in Kirkos sub-city

Table 5-6 shows the statistics of the three top and the three bottom ranked Kebeles which were ranked based on the mean score of the intuitive QoL. The mean score varies between 2.00 and 3.33 with standard deviation of 0.95 and 1.23 respectively. A Likert scale of 2 implies the respondents' feel 'very dissatisfied' while 3 implies that respondents' feel 'dissatisfied'. Kebeles are also ranked based on the level of satisfaction. Although all the Kebeles have low intuitive QoL score, the ranking shows that there is a difference in the level of QoL among the Kebeles. The first ranked Kebele in terms of the intuitive QoL is K17/18 while the least ranked Kebele is K13/14. The mode varies between 1 and 3.

Table 5-6 Statistic for the intuitive QoL in 2008. Note: the confidence intervals are shown

Kebele	Mean	Mode	Min	Max	Std. dev.	Rank
K17/18	3.33(±0.33)	3	1	6	1.23	1
K02/03	3.16(±0.42)	3	1	6	1.58	2
K15/16	3.09(±0.37)	3	1	6	1.42	3
K05/06/07	2.29(±0.28)	2	1	5	1.07	9
K08/09	2.27(±0.32)	1	1	5	1.21	10
K13/14	2.00(±0.25)	1	1	4	0.95	11

Intuitive QoL in 2006

The map in Figure 5-3 shows the spatial distribution of the mean score of the intuitive QoL in Kirkos sub-city in 2006 which is two years before the household survey period. In the figure, small values, which are represented by red, indicate low QoL while high values, which are represented by green, indicate high QoL. On average, the respondents' in the majority of the Kebeles feel 'dissatisfied' (i.e. a Likert scale of less than 3.5) or worst about their life.
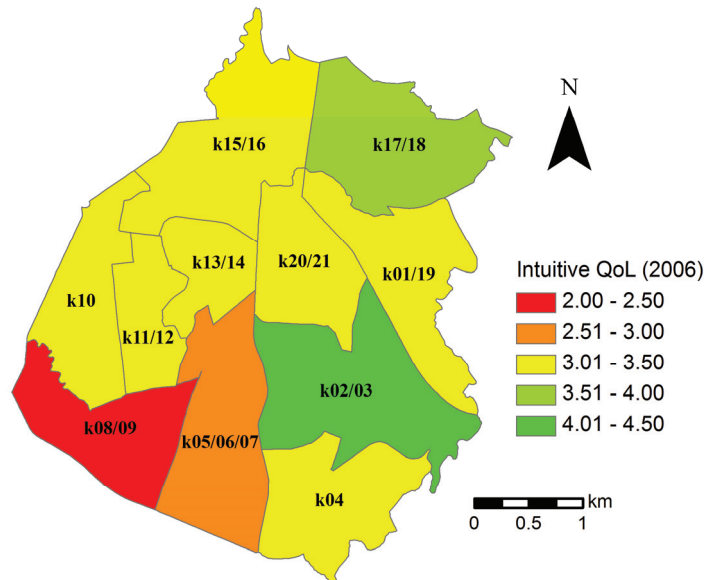
Figure 5-3 Spatial distribution of averaged intuitive QoL in 2006 in Kirkos sub-city

Table 5-7 shows the statistic for the three top and the three bottom ranked Kebeles in terms of the mean intuitive QoL in 2006. The mean score varies with in the Likert scale that ranges between 2.50 and 4.33 with standard deviation of 1.18 and 1.12 respectively. Likert scale of 2.5 represents dissatisfaction and a Likert scale of 4.33 represents satisfaction in QoL. Looking at the ranking of the Kebeles, K02/03 is the first ranked and K08/09 is the least ranked in terms of the mean intuitive QoL score. The mode varies between 2 and 4.

Table 5-7 Statistic for the intuitive QoL in 2006. Note: the confidence intervals are shown

Kebele	Mean	Mode	Minimum	Maximum	Std. dev.	Rank
K02/03	4.33(±0.29)	4	2	6	1.12	1
K01/19	3.71(±0.33)	3	1	6	1.23	2
K17/18	3.58(±0.31)	4	1	6	1.15	3
K10	3.05(±0.31)	4	1	6	1.21	9
K05/06/07	3.00(±0.35)	2	1	6	1.30	10
K08/09	2.50(±0.31)	2	1	5	1.18	11

Comparing intuitive QoL in 2006 and 2008, in all the Kebeles respondents expressed higher level of satisfaction in their life in 2006 than 2008. The result is similar to that for the sub-city level.

5.2.3. Satisfaction with domains of life

Quality of life is often determined by satisfaction with several domains of life. The domains of life identified for this study are housing, built-environment, neighbourhood safety, neighbourhood sanitation, quality of public services, access to public services, social connectedness and family income. In this section additional domain of life as defined by the respondents and the satisfaction level of respondents for the domains of life is presented.

Additional domains defined by respondents

The presence of several domains that affect quality of life in urban areas makes selection of domains for the study quite complex. As such one of the questions that included in the questionnaire was whether the respondents have additional domains of life other than the eight domains selected for this study. The response from this question helps to answer the research question *'what are the domains of life in urban context as defined by individuals?'*

The result in Table 5-8 shows 94% of the respondents replied that there are no additional domains of life that they would like to see in the questionnaire. Only very few i.e. 6% of the respondents recommended that they would like to see some domains of life included in the questionnaire. These domains are cost of living, governance, liquid waste facility and water supply.

Figure 5-4 shows the percentage of respondents that recommended the specific domains of life to be included in the questionnaire. The majority of the respondents, i.e. 67.65%, suggested cost of living as an additional domain of life. It is possible to argue that the need to include cost of living might be caused by the current economic crisis and as such may reflect the respondents' temporary feeling.

Very few respondents, i.e. 2.94%, responded liquid waste facility as an additional domain of life. The remaining respondents suggested governance (20.59%) and water supply (8.82%) as an additional domain of life. The reason may be due to the prevailing problem of liquid waste facility, governance and water supply in the city.

Table 5-8 Response for additional domains of life

Additional Domain of Life	Number	Percentage (%)
no	573	94
yes	34	6
Total	607	100

The additional domains of life as recommended by individuals are an indication that future studies in the region may include these domains of life to study urban QoL. The respondents were also asked about their satisfaction level with the additional domains. Almost all of the respondents said they are dissatisfied or feel worst with the additional domains they suggested.
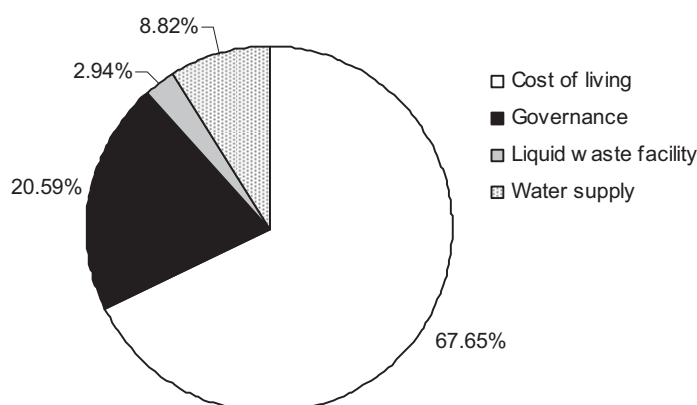
Figure 5-4 Additional domains of life

Domain satisfaction at sub-city level

The domain satisfaction score is measured as the percentage of respondents to the question *'What is your level of satisfaction with the following domains of life?'* A 6-point Likert scale is also applied to evaluate the result from each domain satisfaction. Percentage of respondents in each domain satisfaction level, the mean and standard deviation of domain at sub-city level are shown in table 5-9. More than half of the respondents felt dissatisfied or worst in five of the eight domains. These domains are housing, built-environment, neighbourhood sanitation, quality of public service and family income. Small percentages of respondents felt dissatisfied or worst in access to public services, neighbourhood safety and social connectedness domains. As shown in the table, the mean satisfaction score for each domain varies. The most favourably evaluated domain in terms of the mean score is social connectedness, followed by neighbourhood safety. The least favourably evaluated domain is family income, followed by neighbourhood sanitation.

Table 5-9 Statistics for domain satisfaction at sub-city level

Level of satisfaction	Domain of life (%)							
	HH	BE	SF	SN	PS	AC	SC	IN
Completely dissatisfied	18.0	5.5	3.8	18.1	4.3	2.3	2.5	23.4
Very dissatisfied	12.0	20.1	7.2	23.6	16.5	15.5	3.8	18.8
Dissatisfied	23.6	26.7	14.3	32.0	31.5	24.4	11.9	29.2
Satisfied	25.2	28.7	37.7	17.1	33.4	40.4	41.4	17.6
Very satisfied	10.7	10.5	20.1	4.9	9.6	12.0	22.7	7.2
Completely Satisfied	10.5	8.7	16.8	4.3	4.8	5.4	17.8	3.8
Mean (Likert)	3.30	3.45	4.10	2.80	3.40	3.60	4.31	2.78
Standard deviation	1.54	1.31	1.28	1.30	1.14	1.12	1.16	1.37

HH=Housing, BE=Built-environment, SF=Neighbourhood safety, SN=Neighbourhood sanitation, PS=quality of public service, AC=access to public service, SC= Social connectedness, IN=family Income

Domain satisfaction at Kebele level

The respondents' satisfaction with the domains of life at Kebele level is computed in terms of the mean score. Responses offered on 6 point Likert scale that ranged from 1, which represents 'complete dissatisfaction' to 6, which represents 'complete satisfaction' is also used to measure the level of domains satisfaction in the sub-city.

Table 5-10 shows the domain satisfaction at Kebele level. As shown in the table the mean of the satisfaction score varies from 1.67 to 4.75. The domain that scores the least is sanitation in Kebele 13/14 while the highest score is neighbourhood safety in K 02/03. Out of the eight domains, except family income, respondents' in Kebele 02/03 expressed satisfaction for all domains of life compared to respondents in the remaining Kebeles. Compared to the respondents in the other Kebeles, the respondents in Kebele 08/09 expressed the least satisfaction with all domains of life except social connectedness. Same as the sub-city level, in all the Kebeles, respondents expressed dissatisfaction or worst feeling for family income while respondents expressed satisfaction or better feeling for social connectedness.

At 95% confidence interval the population mean for the domains satisfaction varies between ±0.15 and ±0.54 from the sample mean. Both the highest and the lowest values are for Kebele 08/09.

Table 5-10 Mean satisfaction score of domains of life per Kebele

Kebeles	Domains of Life (Mean satisfaction score)							
	HH	BE	SF	SN	PS	AC	SC	IN
K01/19	3.13	3.75	4.45	3,25	3.73	3.69	4.05	2.84
K02/03	3.80	4.09	4.75	3.53	3.69	3.91	4.47	3.22
K04	3.51	3.73	4.49	4.35	3.65	3.49	4.73	2.95
K05/06/07	3.02	3.02	3.60	2.64	2.76	2.76	4.27	2.24
K08/09	2.44	2.55	3.35	2.38	2.22	2.42	4.45	1.89
K10	3.31	3.95	4.49	3.20	3.65	3.55	4.29	2.85
K11/12	3.87	3.53	4.04	3.04	3.49	4.04	4.25	3.05
K13/14	2.95	2.98	3.89	1.67	3.76	4.27	4.29	2.24
K15/16	3.31	3.62	4.24	2.75	3.75	3.73	3.82	2.95
K17/18	3.60	3.31	4.25	2.49	3.65	4.36	4.69	3.15
K20/21	3.40	3.47	3.95	2.53	3.25	3.46	4.14	3.19

Note: The 95% confidence intervals are ±0.29 - ±0.54 for HH, ±0.27 - ±0.41 for BE, ±0.25 - ±0.40 for SF, ±0.20 -±0.45 for SN, ±0.15 - ±0.37 for PS, ±0.16 - ±0.37 for AC, ±0.20 - ±0.37 for SC and ±0.27 - ±0.43 for IN

Kebeles are also ranked in terms of the mean domain satisfaction score. Figure 5-5 shows the ranking of the Kebeles. The section with green represents the top ranked Kebeles and red represents the bottom ranked Kebeles. For instance, for the housing domain the first ranked Kebele is K11/12 and the least ranked Kebele is K08/09.

Rank	HH	BE	SF	SN	PS	AC	SC	IN
11th	08/09	08/09	08/09	13/14	08/09	08/09	15/16	08/09
10th	13/14	13/14	05/06/07	08/09	05/06/07	05/06/07	01/19	05/06/07
9th	05/06/07	05/06/07	13/14	17/18	20/21	20/21	20/21	13/14
8th	01/19	17/18	20/21	20/21	11/12	04	11/12	01/19
7th	15/16	20/21	11/12	05/06/07	17/18	10	05/06/07	10
6th	10	11/12	15/16	15/16	10	01/19	13/14	04
5th	20/21	15/16	17/18	11/12	04	15/16	10	15/16
4th	04	04	01/19	10	02/03	02/03	08/09	11/12
3rd	17/18	01/19	10	01/19	01/19	11/12	02/03	17/18
2nd	02/03	10	04	04	15/16	13/14	17/18	20/21
1st	11/12	02/03	02/03	02/03	13/14	17/18	04	02/03

Domains of Life

HH=Housing, BE=Built-environment, SF=Neighbourhood safety, SN=Neighbourhood sanitation, PS= quality of public service, AC= Access to public service facility, SC= Social connectedness, IN=Income

Figure 5-5 Ranking of Kebeles in terms of satisfaction with specific domains of life

5.2.4. Variability of subjective quality of life at Kebele level

In Addis Ababa, although heterogeneity is expected in terms of quality of life, studies that quantify such variability are noticeably absent. As such, one of the objectives of this study is to explore the variability of QoL within each Kebeles of the Kirkos sub-city. This will help to evaluate if the Kebeles are heterogeneous or homogeneous in terms of the QoL of the residents. The out comes will indicate if studying QoL at lower level than the Kebele is needed or not.

Figure 5-6 shows the coefficient of variation (CV) of the mean rational QoL for each Kebeles. The CV is computed as standard deviation of the QoL scores divided by the mean of the scores and it shows an absolute variability. For the QoL, the CV range between0.25 to 0.63. Small CV values imply less variability while high CV implies high variability. The map shows high QoL variability for K08/09 and K10.
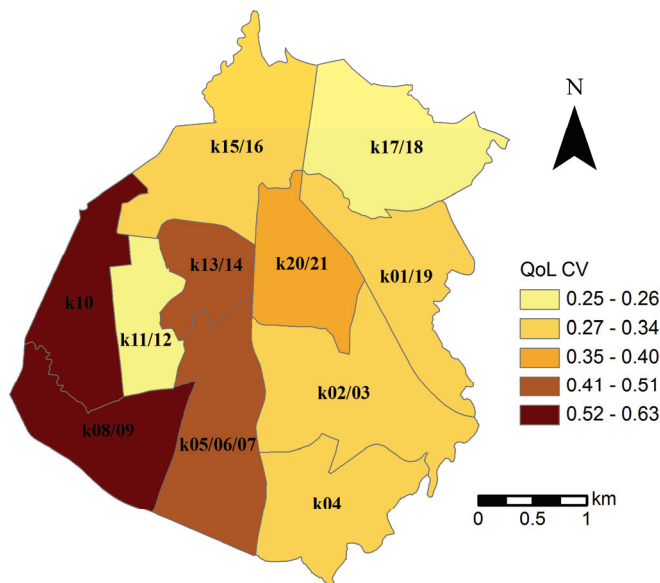
Figure 5-6 QoL variability in terms of coefficient variation (CV). Note that high value indicates high variability

The relationship between mean subjective QoL and CV is shown in Figure 5-7. Mean QoL scores correlates negatively with coefficient of variation (CV) that suggests the higher the QoL the less variable the QoL is. This implies that those Kebeles with high level of QoL are relatively homogeneous in terms of QoL. However, Kebeles with residents having low level of QoL are relatively heterogeneous in terms of QoL.

The exponential relationship between the mean subjective QoL and the CV value is defined in the following equation:

$$CV = 143.96e^{-0.4349M}$$

Where: CV is coefficient of variation, M is the mean score of the subjective QoL, and e is the base of natural logarithm which is equivalent to 2.718. The equation was fitted with $R^2 = 0.77$.
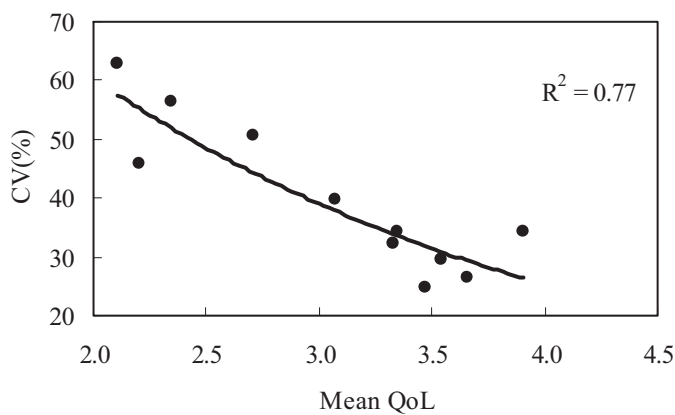
Figure 5-7 Relation between coefficients of variation and mean QoL

5.2.5. Causal model of subjective QoL

One of the objectives of this study is to develop a causal model by identifying the dominant domain satisfactions that affect the QoL in the sub-city. A relevant question is which domains of life have the highest causal impact in affecting the QoL in Kirkos sub-city? The answer to such questions can be used to prioritize intervention areas. Knowledge of the causal impact of the domains will also contribute to the design of future studies of urban QoL in the region.

As a preliminary analysis, Pearson's correlation is computed to examine relationship between the domains of life. Table 5-11 shows the correlation matrix between the domains. There is statistically significant correlation between the domains of life.

Table 5-11 Correlation matrix between domains of life

	HH	BE	SF	SN	PS	AC	SC	IN
HH	1							
BE	0.375**	1						
SF	0.220**	0.526**	1					
SN	0.217**	0.344**	0.259**	1				
PS	0.167**	0.262**	0.341**	0.162**	1			
AC	0.204**	0.228**	0.252**	0.052	0.459**	1		
SC	0.080*	0.208**	0.246**	0.103*	0.192**	0.198**	1	
IN	0.494**	0.284**	0.233**	0.277**	0.177**	0.175**	-0.057**	1

**Correlation is significant at the 0.01 level (2-tailed);

* Correlation is significant at the 0.05 level (2-tailed)

Following Richards et al. (2007), Multiple regression is applied to identify the dominant domains of life and the dominant attributes of domains of life. Multiple regression without an intercept is applied since the respondents expressed their rational QoL after considering their satisfaction with the specific domains of life. As such, the rational QoL is assumed to have a value in Likert scale of 1, which shows complete dissatisfaction, when all the domains have a value in Likert scale of 1. It means that complete dissatisfaction in all the domains results in complete dissatisfaction in QoL. Figure 5-8 shows the causal model of QoL for Kirkos sub-city. The causal relationship between QoL domains and rational QoL in the sub-city has the following form:

$$QoL = 0.12HH + 0.01BE + 0.09SF + 0.09SN + 0.10PS + 0.03AC + 0.06SC + 0.46IN \qquad (5\text{-}1)$$

where: The terms in equation 1 are as defined in previous sections.

The total variance of the subjective QoL that is explained by the model in Equation 5-1 is 93 %. The coefficients in the model indicate the relative impact of each domain on the QoL. All the domains are positively related to QoL. This is expected since the higher the satisfaction levels with these domains the better the quality of life of individuals. However, the contribution of each domain to the QoL is not equal. The domain that has the strongest causal impact is family income (0.46), and this is followed by housing domain (0.13). The domains neighbourhood safety, neighbourhood sanitation and public service quality have comparable impact on QoL. The domain that has the weakest causal impact on QoL is built environment (0.01).

This analysis shows that, the domains of life identified for this study have a direct effect on individuals' quality of life. Also, it shows that satisfaction from family income and housing are more important than satisfaction from the built-environment. The causal relationship between domain satisfactions and intuitive QoL is also assessed and the relationship has the following form.

$$QoL = 0.13HH + 0.01BE + 0.07SF + 0.03SN + 0.01PS + 0.06AC + 0.04SC + 0.49IN \qquad (5\text{-}2)$$

where: the terms are defined previously. 88 % of the variance is explained by the model which is comparable with the variance explained using the rational QoL i.e. 93%. Similar to the rational QoL, satisfaction with family income has the strongest causal impact. The differences in the coefficients in

equation 5-1 and 5-2 suggest some difference in the respondents' response of the rational and intuitive QoL.

The causal model in Figure 5-8 also shows the relationship between domain satisfactions and the respective perceived attributes that are also measured using a 6 point Likert scale. Housing ownership has the dominant impact on housing satisfaction followed by assessment of number of rooms in a house while crowding in a house and housing utility affordability have the least impact on housing satisfaction. The coefficient for housing affordability is small and negative and it is not considered in the analysis since this attribute did not have influence on the variance explained by the model.

Noise pollution is found to be the most important predictor of built environment than the other attributes of built environment. Crime rate in the neighbourhood is found to be a better predictor of neighbourhood safety than the other attributes of safety. It has been found that health service accessibility is a strong predicator of satisfaction with service accessibility. Quality of primary school has strong impact on satisfaction with quality of public services. The coefficient of road maintenance and quality of secondary school is small and negative and it is not consider in the analysis since these attributes did not influence the variance explained by the model.
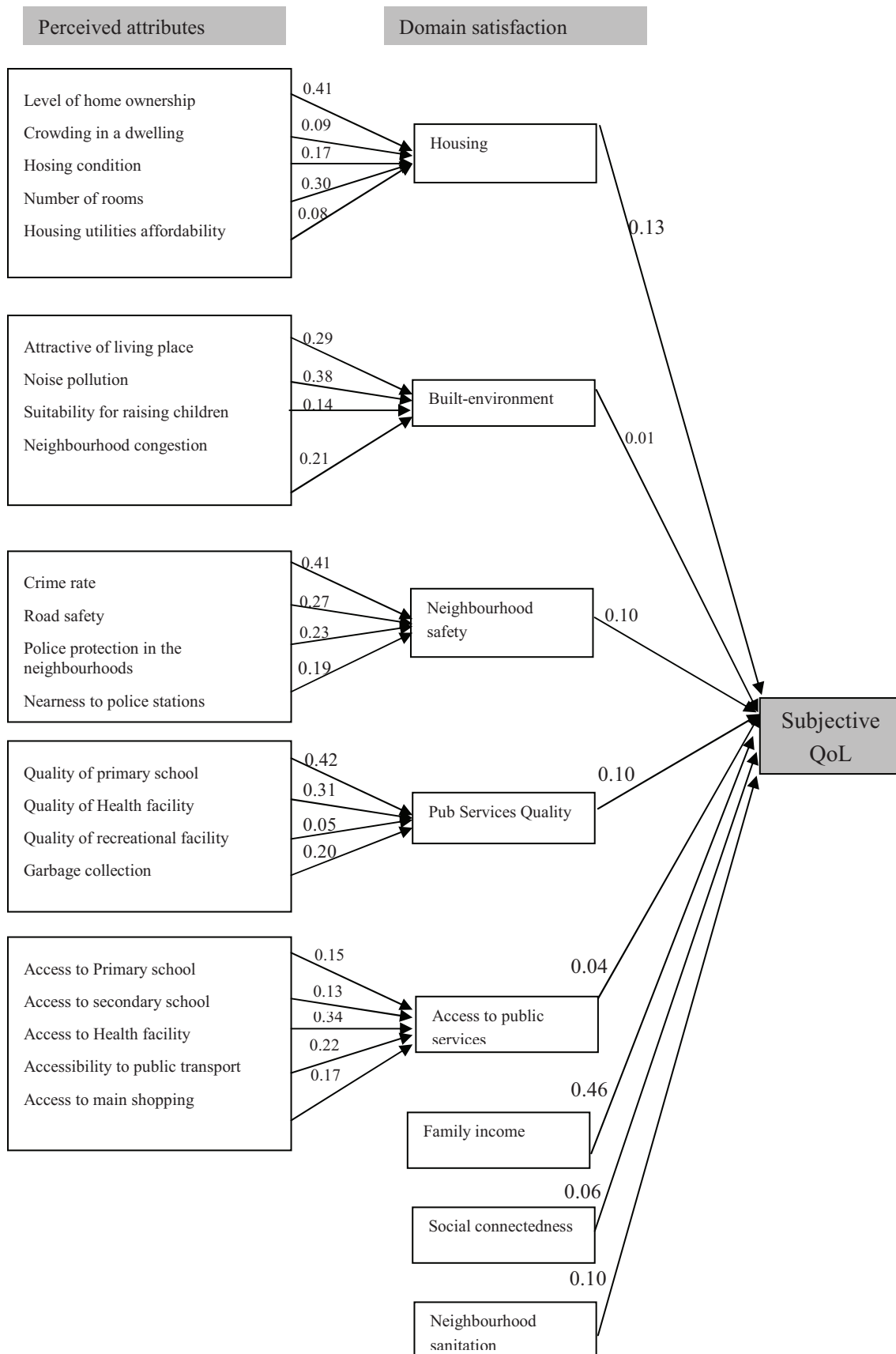
Figure 5-8 Causal model of subjective QoL for Kirkos sub-city

5.2.6. Factor analysis of the subjective QoL

Priori to the household survey, the perceived attributes of each domain of life were identified based on literature. Factor analysis helps to identify whether the classification of the attributes to the respective domains is correct or some modification is required for future work. It also helps to identify additional domains of subjective QoL and to assess if there is interaction across domains.

Factor analysis has been applied using 27 subjective attributes that were obtained from the household survey. The KMO value for this study is 0.67 and the Bartleet's test has a significant level of about 0.0 which suggests that the data is suitable for factor analysis.

One of the challenges in using factor analysis is how to interpret the loadings in each factor and to attach physical meaning to the factors. Comrey and Lee (1992) cited in Li and Weng (2007) recommended a loading of greater than or equal to 0.71 indicates an excellent strength of the relation between the factors and variables, 0.63 indicates very good relation, 0.55 indicates good relation, 0.45 indicates fair relation and 0.32 indicates poor relation.

The results of the factor analysis are shown in Table 5-12. The number of factors extracted by the eigenvalue criterion is 10. However, for ease of interpretation of the factors and considering the total number of attributes, seven factors are extracted using scree plot. The seven factors explained 57% of the total variance.

A comparison between the variables (attributes) of the seven factors and the attributes of the domains of life that are identified for the subjective part of the household survey is given below.

> ***First factor***: This factor mostly shows the highest loadings on attributes of the built-environment domain that were included in the questionnaire. The exception is the attribute garbage collection which was grouped under the quality of public service domain in the questionnaire.
>
> ***Second factor***: This factor mostly shows the highest loadings on attributes of the neighbourhood safety domain which were included in the questionnaire.
>
> ***Third factor***: This factor mostly shows the highest loadings on attributes of the housing domain that were included in the questionnaire. These attributes are related with 'physical dimension of housing'.
>
> ***Fourth factor***: This factor mostly shows the highest loadings on attributes of access to public services domain.
>
> ***Fifth factor***: This factor mostly shows the highest loadings on attributes of the housing domain. Exceptional is the accessibility of living place to public transport. Most of the attributes of this factor are related with the 'economic' dimension of the housing domain.
>
> ***Sixth factor***: This factor mostly shows the highest loadings on attributes of the domain-public service quality.
>
> ***Seventh factor***: This factor mostly shows the highest loadings on attributes that are related to sport and recreational facilities. This attributes were grouped in other domains of life in the questionnaire.

Table 5-12 Factor loading matrix for subjective QoL attributes

Perceived attributes	Factors						
	F1	F2	F3	F4	F5	F6	F7
Neighbourhood congestion	0.678						
Living place attractiveness	0.668						
Noise pollution	0.661						
garbage collection	0.559						
Suitable for raising children	0.516						
Police protection in the neighbourhood		0.724					
Crime rate		0.630					
Road safety		0.556					
Nearness to police stations		0.386					
Number of rooms			0.767				
Hosing condition			0.736				
Crowding in a dwelling			0.719				
Access to Primary school				0.818			
Access to secondary school				0.796			
Access to Health facility				0.563			
Access to main shopping area				0.407			
Accessibility to public transport					0.626		
Housing utilities affordability					0.544		
Level of home ownership					0.523		
Family income					0.410		
Housing affordability					0.341		
Quality of Health facility						0.779	
Quality of primary school						0.765	
Quality of secondary school						0.482	
Road maintenance						0.317	
Access to sport and recreational facilities							0.750
Quality of sport and recreational facility							0.674
Eigenvalue	4.08	3.15	2.05	1.84	1.51	1.38	1.34
Percentage of variance explained	9.45	9.17	9.06	8.51	7.45	6.92	6.33
% total explained variance	57						

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

The internal scale reliability of the attributes is checked using the Crohnbach's alpha test. The degree of reliability for subjective QoL attributes is 0.74. This implies that as a whole, the 27 subjective attributes measure the same construct; in this case, the construct is QoL.

5.2.7. Dimensions of subjective QoL

It is shown in section 5.2.6 that quality of life is multidimensional. It often facilitates interpretation if QoL can be summarised in few dimensions. Identifying the dimensions of the subjective QoL can help to compare it with the objective dimensions of QoL. The dimensions can also help to develop a simplified model of subjective QoL. In general, the seven factors that are identified in section 5.2.6 can be categorized in to four dimensions of subjective QoL. These dimensions are physical, economic, social and proximity. Factor one and three mostly explain physical dimension of QoL, factor five mostly explains economic dimension of QoL, factor two and six mostly explains social dimension of QoL, and factor four mostly explains proximity dimension of QoL. Factor seven is partly social and partly proximity. Some of the attributes of the factors are regrouped into the proper dimensions based on their physical interpretation. These attributes are nearness to police station, accessibility to public transport and road maintenance. The attributes of factor 7, which are access to sport and recreational facility and quality of sport and recreational facility, are grouped into two dimensions, see Table 5-13.

After regrouping the attributes into the appropriate dimension, a factor analysis is applied to the attributes of each dimension separately. Table 5-13 shows the attributes of the dimensions and the corresponding factor loadings.

Multiple regression analysis was performed to evaluate if QoL can be explained by a simplified model that requires few attributes instead of the 27 attributes that were included in the questionnaire. The attributes with the highest loading on the first factor of each dimension were considered as a predictor of QoL. These attributes are crowding in a dwelling, home ownership, quality of primary school and access to main shopping area. Equation 5-3 shows the simplified model in terms of the selected attributes. The model explains 88% of the variance in QoL. This model can be used in future studies of urban quality of life in the region.

$$QoL = 0.15CD + 0.25HO + 0.31QPS + 0.13AS \hspace{4cm} (5\text{-}3)$$

where: CD is crowding in a dwelling, HO is housing ownership, QPS is quality of primary school, and AS is access to main shopping area.

Table 5-13 Dimensions, attributes and loadings of subjective QoL

Dimension	Attributes	Loadings
Physical	Crowding in a dwelling	0.863(F1)
	Number of rooms	0.858(F1)
	Hosing condition	0.769(F1)
	Suitable for raising children	0.699(F2)
	Living place attractiveness	0.658(F2)
	garbage collection	0.635(F2)
	Noise pollution	0.625(F2)
	Neighbourhood congestion	0.529(F2)
	Road maintenance	0.384(F2)
Economic	Home ownership	0.761(F1)
	Family income	0.644(F1)
	Housing utilities affordability	0.633(F1)
	Housing affordability	0.492(F1)
Social	Quality of primary school	0.830(F1)
	Quality of health facility	0.820(F1)
	Quality of secondary school	0.729(F1)
	Crime rate	0.833(F2)
	Police protection in the neighbourhood	0.813(F2)
	Quality of sport and recreational facility	0.816(F3)
	Road safety	-0.705(F3)
Proximity (Access)	Access to main shopping area	0.772(F1)
	Nearness to police stations	0.669(F1)
	Accessibility to public transport	0.601(F1)
	Access to health facility	0.592(F1)
	Access to primary school	0.814(F2)
	Access to secondary school	0.793(F2)
	Access to sport and recreational facilities	0.895(F3)

Note: F1, F2 and F3 indicate that the loadings correspond to the either the first, the second or third factors of each dimension.

5.3. Objective Quality of Life

5.3.1. Factor analysis of the objective QoL

One of the objectives of this study is to identify the dimensions of objective quality of life in Kirkos sub-city. There are several objective attributes (variables) that may affect quality of life. The main challenge is how to develop indices from these attributes that can be used to predict QoL. Factor analysis is applied in this study to develop these indices using several objective attributes. Thirteen variables which reflect both household and spatial characteristics are studied.

The KMO value is 0.59 and the Bartlett's significance test is 0.0. This implies that the data is suitable for factor analysis. Five factors with eigenvalue of greater than 1 are extracted in this study.

The result of the factor analysis is shown in Table 5-14. Attributes with factor loading of greater than 0.5 are considered in identifying the dimensions. A physical meaning is attached to each factor in the next section.

Table 5-14 Factor loading matrix for objective QoL attributes

Attributes	Factors				
	1	2	3	4	5
Building density	.918				
Population density	.889				
Employment status		.823			
Education level		.754			
Ln family Income		.709			
Distant to health facility			-.715		
Number of traffic accident			.711		
Crime rate			.625		
Distance to school facilities			.609		
Number of rooms in a house				.828	
Household tenure				.810	
Number of dependent children					.888
Household size					.869
Eigenvalue	2.82	2.28	1.73	1.55	1.18
Percentage of variance explained	19.57	14.35	13.91	13.60	12.15
% total explained variance	73.57%				

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

5.3.2. Dimensions of objective quality of life

The factors that are shown in Table 5-14 can be considered as the dimensions of objective QoL in the Kirkos sub-city. The five factors explain 73.57% of the total variance in the data set. The first factor explains 19.57% of the variance while the remaining factors explain 12-14 % of the variance. This implies that the relative importance of the factors is almost equal and removing any one of the factors may result in loss of information.

The five factors are interpreted to define the dimensions of objective QoL in the Kirkos sub-city as follows:

First factor: This factor can be interpreted as crowdedness (CD) since it shows high loadings on building density and population density. The two variables are positively correlated with the factor. This suggests that the higher the score in this factor, the higher the crowdedness and the smaller the space for people to live.

Second factor: This factor can be interpreted as socio-economic status (SE) since it shows high loadings for instance on employment status and family income. All the attributes are positively correlated with the factor. The higher the score in this factor, the higher the economic aspects of quality of life.

Third factor: This factor is a combination of proximity and neighbourhood safety attributes. Crime rate, number of traffic accident and distance to school facilities are positively

correlated with the factor, while distance to health facilities is negatively correlated with the factor. This may be a result of a statistical interaction between the safety and proximity variables. The factor can be labelled as a combination of safety and proximity dimension (SP).

Fourth factor: This factor can be interpreted as housing dimension (HD) of QoL since it shows high loadings on the number of rooms per house and household tenure. The two attributes are positively correlated with the factor indicating the higher the score of these attributes the higher the score of the HD of QoL.

Fifth factor: This factor can be interpreted as demographic dimension (DM) of QoL. This factor shows high loading on number of dependent children and household size. The higher the score in this factor, the lower the number of people living in a house.

5.3.3. Objective quality of life index

One of the objectives of this study is to develop quality of life index using objective attributes which are commonly available than the subjective attributes. This will help for designing future studies of urban QoL in the region. The QoL index is developed by combining the scores of the five selected factors that relate to the objective dimensions of QoL. The overall score of each respondent is obtained by weighting each factor score by the respective variance as follows.

$$QoL_i = (-19.58 * CD_i + 14.35 * SE_i - 13.91 * SP_i + 13.60 * HD_i - 12.15 * DM_i)/100 \qquad (5\text{-}4)$$

where: QoL_i is quality of life score of respondent i, CD_i is crowdedness score, SE_i is socio-economic score, SP_i is safety and proximity score, HD_i is housing score and DM_i is demographic score of respondent i. The sign in the equation shows the direction of relationship between QoL and its dimensions. Socio-economic and housing dimensions have positive contribution to quality of life, while high values of crowdedness, safety-proximity and demographic dimensions have negative contribution to QoL in the sub-city.

The objective QoL score that is estimated by applying equation 5-4 varies between -1.49 and 1.42. Minimum-maximum standardization method is applied to transform the score to 1 to 6 which is similar to the scale range of the subjective QoL score in this study. This will help for ease of comparability of the index with subjective QoL score in the sub-city. A score of 1 represents low quality of life and a score of 6 represents high QoL.

The standardized scores of the respondents are aggregated for each Kebele to map the distribution of objective QoL in the sub-city. The map in Figure 5-9 shows the distribution of the objective QoL score in the sub-city. The mean score varies between 2.7 to 4.5. In terms of the objective QoL, Kebele 13/14 has the lowest score, i.e. 2.7, while Kebele 04 has the highest, i.e. 4.5, score.
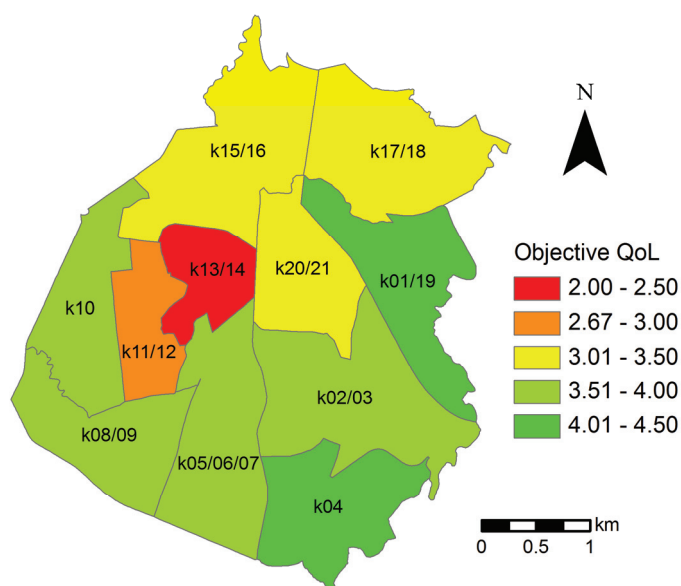
Figure 5-9 Objective QoL Index

5.4. Comparison between Subjective and Objective QoL

5.4.1. Influence of individual, socio-economic and demographic characteristics on QoL

The subjective quality of life (QoL) of individuals can be influenced by personal, socio-economic and demographic factors. It is important to know which of these factors significantly influence the QoL in the sub-city. One-way analysis of variance (ANOVA) and t-test are computed to compare the mean QoL score of respondents in different categories. A significance level of 0.05(95% confidence level) is chosen for defining differences in mean QoL scores.

The findings are shown in Table 5-15a and 5-15b. There is no statistically significant difference in the mean QoL score of female and male headed household in the sub-city. In terms of level of education, there is significant difference in the mean QoL score of respondents. In general, the mean QoL score is high for high educational qualifications.

In terms of family income, there is significance difference in the mean QoL score for different income categories. Generally, the mean score is higher for higher income groups than for lower income households. There is no unique and direct relation ship between the mean QoL score and household size. However, the number of dependent children seems to affect the mean QoL score significant. The mean QoL score decreases with an increase in the number of dependent children in a household.

The mean QoL score is significantly different for different categories of housing tenure. The mean QoL score is higher for respondents with private ownership and for those who rent from housing agency. In terms of number of rooms in a house, the mean QoL score differs significantly for different categories of number of rooms. The mean QoL score increases with an increase in number of rooms in a house.

In general, level of education, family income, the number of dependent children, housing tenure and number of rooms in a house influence the QoL in the sub-city significantly. However, gender has no significant influence on the QoL in the sub-city.

Table 5-15a Mean QoL scores for different categories of specific attributes

Attributes	N	Mean QoL score	F value	P
Gender			0.831	0.362
Male	344	3.10		
Female	263	3.01		
Level of education			8.718	0.000
Illiterate	89	2.87		
Primary school	196	2.98		
Secondary school	174	3.14		
Vocational school	75	2.71		
University degree	73	3.68		
Family income			14.749	0.000
Less than 500Birr	281	2.9		
500-1500Birr	219	2.9		
1500-2500Birr	42	3.3		
2500-3500Birr	27	4.0		
3500-4500Birr	15	4.0		
4500Birr and above	23	4.7		
Household size			14.749	0.000
<=3Person	83	3.1		
4Person	99	3.0		
5Person	100	3.0		
>=7Person	121	3.1		

Table 5-15b Mean QoL scores for different categories of specific attributes

Attributes	N	Mean QoL score	F value	P
Number of Dependent children			5.786	0.001
>=3children	272	2.91		
2children	148	3.05		
1child	111	3.08		
No dependent child	76	3.61		
Household tenure			19.733	0.000
Housing agency rent	34	3.74		
Private	168	3.68		
Private Rent	41	2.76		
Kebele	349	2.75		
Others	15	2.67		
Number of rooms			17.86	0.000
1Room	153	2.93		
2Rooms	162	2.65		
3Rooms	102	2.94		
>=4Rooms	190	3.58		

5.4.2. Combined subjective and objective quality of life

The mean score of objective QoL and the mean score of subjective quality of life is compared in terms of the subjective and the objective QoL. The map in Figure 5-10 shows the distribution of the QoL depending on whether the subjective and the objective QoL in Kirkos sub-city are good or bad. Although the objective living condition in Kebele 11/12 is bad, individual's perception of the living condition in the Kebele is good. In terms of QoL, we can say that there is adaptation in Kebele 11/12. On the other hand, with good objective living condition, individual's perceived QoL is bad in Kebeles 01/19, K10, K08/09 and K05/06/07. We can say that there is dissonance in these Kebeles.

Both subjective and objective living condition is bad in Kebele 13/14, K15/16 and K20/21. We can say that there is deprivation in these Kebeles. The opposite case, that is, both subjective and objective living condition is good in Kebeles 02/03, K04 and K17/18. We can say there is well-being in these Kebeles.
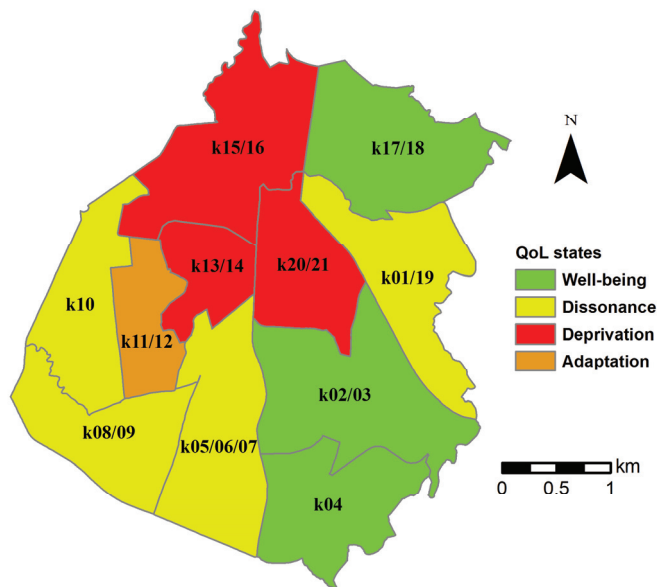

Figure 5-10 The combined effect of subjective and objective QoL in Kirkos sub-city

6. Discussion

In this chapter, the results of this study are discussed in three main sections. In the first section, the results of the subjective QoL measurement and domain satisfactions are discussed. Variability of the subjective QoL, and the causal model and the dimensions of the subjective QoL in Kirkos sub-city are also discussed in the first section. In the second section, the result of the objective QoL measurement is discussed. The dimensions and the index of the objective QoL are also discussed in the second section. In the third section, the relationship between the subjective and the objective QoL is discussed.

6.1. Subjective Quality of Life

6.1.1. Subjective QoL at sub-city level

Subjective QoL is commonly measured using either intuitive or rational response. The intuitive response reflects individuals' satisfaction with life without considering the integrated satisfaction with the domains of life. However the rational response reflects individuals' satisfaction with life after considering the integrated satisfaction with the domains of life. As stated by Ibrahim and Chung (2003) comparing the two responses can help to apply more accurate quality of life measurement.

In this study, a difference is observed in the level of QoL that is measured based on the intuitive and the rational responses. The rational response resulted in larger percentage of respondents that are satisfied in life than that of the intuitive response. For the rational response the mean QoL score is 3.06 with a standard deviation of 1.30 while for the intuitive the mean QoL score is 2.67 with a standard deviation of 1.30. The difference in the mean QoL between the intuitive and the rational QoL is 0.39 which is less than 1 point Likert scale. The difference is statistically significant at the 95 % confidence interval. The cause of the difference could be due to the reason that the intuitive response is instinctive and not well-thought. However, the rational response is well-thought and influenced by the domains satisfactions. The result agrees with the finding by Ibrahim and Chung (2003) that reported higher percentages of respondents that are satisfied and very satisfied in terms of the rational response than the intuitive response for selected settlements in Singapore. Also, they reported higher mean score, i.e. 3.71 and standard deviation of 0.63 for the rational response than for the intuitive response, i.e. mean score of 3.67 and standard deviation of 0.62. The difference in the mean score is 0.04 which is very much less than the difference in this study although such comparisons are affected by the difference in the study region. Das (2008) reported a different result that a lower percentage of respondents were satisfied in terms of the rational response than the intuitive response for Guwahati, India. The mean score of the rational QoL, i.e. 3.07 and standard deviation of 0.92 was less than the intuitive QoL, i.e. a score of 3.43 and standard deviation of 0.99. The mean difference is 0.36 Likert scale and their result is in contrary to the finding of this study for Kirkos sub-city. The above studies are carried out for Asian region and both studies applied a 5 point Likert scale. However, in this study a 6 point Likert scale is applied. Although the studies suggest that there could be some difference between the two responses, the difference in study area and the Likert scales make comparison of the findings difficult.

In this study, intuitive QoL is measured and compared for two years, i.e. 2006 and 2008. This helps to evaluate the progress in the QoL of respondents through years. There is a difference in the QoL for

two years in the sub-city. The percentage of respondents that feels dissatisfied or worst in their QoL is larger in 2008 than the QoL two years before, i.e. 2006. One of the reasons can be the economic crisis in 2008 which is expected to affect respondents feeling. The respondents were asked to express their feeling of their life in 2006 during the household survey. As such their response can be influenced by their current feeling of their life. Thus to compare QoL for two years it is better to relay on the actually collected data of the respective years, see Foo (2000).

6.1.2. Subjective QoL at Kebele level

The intuitive and the rational QoL are also applied to measure the subjective QoL at Kebele level. This helps to evaluate the variation in the QoL at small scale, i.e. at Keblel level. The mean QoL score in 2006 varies between 2.5 that indicate dissatisfaction and 4.33 that indicate satisfaction. The QoL score in 2008 varies between 2.0 that indicate very dissatisfaction and 3.0 that indicate dissatisfaction. This implies that in terms of the intuitive response, the respondents' in all Kebeles are dissatisfied with their QoL in 2008. Similar to the sub-city level, the QoL in 2008 is lower than the QoL in 2006. For the rational response the mean QoL score varies between 2.0 that indicate very dissatisfaction and 4.00 that indicate satisfaction. The rational response is more judgemental than the intuitive since respondents rational response can be influenced by their satisfaction with several domains of life. In this study, the subjective QoL that is measured in terms of the respondents' rational response is used for further analysis.

6.1.3. Satisfaction with domains of life

Additional domains of life

There are several domains of life that affect the QoL of individuals. In this study, the domains of life are housing, built-environment, neighbourhood safety, neighbourhood sanitation, quality of public service, access to public service, social connectedness and family income. The majority of the respondents, i.e. 94%, did not recommend for additional domains of life. Very few respondents recommended for cost of living, governance, liquid waste facility and water supply. The need to include cost of living might be caused by the current economic crisis and as such may reflect the respondents' temporary feeling. It is not surprising that cost of living is named as additional domain since most of the respondents expressed dissatisfaction and worst feeling with family income in the sub-city. The need to include governance, liquid waste facility and water supply may be due to some problems of these domains of life in the city. Das (2008) and Turksever and Atalik (2001) reported that cost of living is one of the domains that affect individual's QoL. Drainage system and water supply are also included in Das (2008) . This implies that future urban QoL studies in the region can include the additional domains of life. However, the absence of these domains did not affect the result of this study as explained by the performance of the regression model that is developed between the domains and the QoL.

Domain satisfaction at sub-city level

Respondents were asked to rate their level of satisfaction with domains of life identified for this study. This helps to evaluate the level of satisfaction of respondents with each of the domains. In general, respondents were most satisfied with social connectedness that has the highest mean score of 4.31 and standard deviation of 1.16. This could be due to the presence of local organizations such as Idir that enhances social interaction among neighbours, in Ethiopia see Ellis and Woldehanna (2005). However, respondents were least satisfied with family income that has the lowest mean score of 2.78 and standard deviation of 1.37. This could be due to the presence of many respondents in the low income category as described in section 5.2.

The coefficient of variation (CV) can be calculated by dividing the standard deviation by the mean of the scores to compare the level of variability of the satisfaction scores of social connectedness and family income. The calculated CV is 0.27 and 0.49 for satisfaction with social connectedness and with family income, respectively, indicating that there is high variability in satisfaction with family income than that with social connectedness. At the sub-city level, the respondent's response for satisfaction with social connectedness is more homogenous than the family income.

Ibrahim and Chung (2003) reported that respondents were most satisfied with public safety and least satisfied with the environment in Industrial area in Singapore. Das (2008) reported that respondents in Guwahati city, India were most satisfied with condition of housing and least satisfied with condition of traffic. Richards et al.(2007) reported that there is higher level of satisfaction with social connectivity in informal settlements of Buffalo and Durban cities of South Africa.

The reason for the difference in the results of the studies that are mentioned in the previous paragraph can be attributed to the different domains of life included in the studies, the context of the studies and also to the difference in the region in which the studies were carried out.

Domain satisfaction at Kebele level

The domain satisfactions are also studied at Kebele level to rank the Kebeles based on the respondents' satisfaction with each domain of life. Similar to the sub-city level, the respondents in all Kebeles are most satisfied with social connectedness while the respondents in all Kebeles are least satisfied with family income. Only the respondents of Kebele 02/03 and Kebele 04 expressed satisfaction with their neighbourhood sanitation and only the respondents of Kebele 08/09 expressed dissatisfied with their neighbourhood safety.

The Kebels are ranked based on the mean satisfaction score of respondents for each domain of life. In terms of satisfaction with domains of life, the ranking of the Kebeles shows some pattern. For instance, Kebele 02/03 is ranked the highest, i.e. in the top three, in terms of satisfaction with almost all the domains of life. Kebele 08/09 is ranked the least in terms of satisfaction with seven domains while it is ranked fourth in terms of satisfaction with social connectedness. This may be interpreted that although the respondents of Kebele 08/09 are dissatisfied with several of the domains of life, they expressed satisfaction with the social connectedness. Kebele 13/14 is ranked the least for all the domains except the domains public service quality and access to public services. This also is interpreted that compared to respondents in other Kebeles, respondents in Kebele 13/14 are more satisfied with the quality and access to public services in the neighbourhood than the other domains of life. Findings on the level of satisfaction with domains of life can be used by urban planners in improving the QoL of the residents.

6.1.4. Subjective QoL variability

Studying QoL at large scales such as country and city level can average out the variability at small scales. In this study, the variability in the subjective QoL is evaluated at small scale that is at the smallest administrative unit of a sub-city, i.e. Kebele level.

It is shown that there is a variation in the mean QoL of the Kebeles of Kirkos sub-city. When aggregated at the sub-city level, the mean QoL indicates a level of 'dissatisfaction' with the quality of life of the respondents'. However, the mean QoL in some Kebeles indicates 'satisfaction' while in other Kebeles, it indicates 'dissatisfaction' or worst. This implies that aggregating the score at sub-city level averages out the variability of QoL at small scale, i.e. Kebele level.

The coefficient of variation (CV) is computed to evaluate the variability with in a specific Kebele. In Kirkos sub-city, variability in QoL at Kebele level relates to the mean QoL in an exponentially decreasing manner. As such, there is low variability of QoL in Kebeles with high QoL. After reviewing similar studies, the variability in the QoL at different scales that are country, city, district and census division levels are summarized in Table 6-1 which shows the CV at different level. The reviewed studies did not report the CV except Turksever and Atalik (2001). As such the CV of the remaining studies was calculated from the reported mean and standard deviations.

As shown in Table 6-1, the standard deviation in this study is much larger than that reported by other studies. However, standard deviation is affected by the mean score and such coefficient of variation (CV) provides a much better explanation of the variability since it is the ratio of standard deviation and mean. The effect is that the measure of variability is not much dependent on the mean score. In terms of CV, QoL variability is mostly smaller at country level than at city, district or census division level. This shows how large scale studies averaged out the variability at small scale. In general, variability of QoL at the scale of Kirkos sub-city and its Kebele level is relatively large compared to other studies that are summarised in the Table. The QoL of Kebeles with high variability can be further studied at sub-Kebele levels if there is a desire to prioritize intervention areas within a specific Kebele.

Table 6-1 Variability of subjective QoL at different scale

Literatures	Description	Scale	Standard deviation	Mean	CV	Likert
Foo (2000)	Singapore	Country	0.63	3.55	0.18	5
Turksever and Atalik (2001)	Istanbul	City	0.50	1.48	0.34	4
Das (2008)	Gwhati, India	City	0.92	3.43	0.27	5
Turksever and Atalik (2001)	Istanbul	District			0.22-0.37	4
Foo (2000)	Singapore	Census division			0.09-0.21	5
Tesfazghi (2009)	Addis Ababa	Kirkos Sub-city	1.30	3.06	0.43	6
		Kebele			0.25-0.63	6

6.1.5. Causal model of subjective QoL for Kirkos sub-city

The subjective quality of life (QoL) of individuals is an integrated effect of their satisfaction with several domains of life. The domain satisfactions are also an integrated effect of satisfaction with the respective attributes of the domains. The causal model of Kirkos is developed based on the commonly applied Detroit Area Study (DAS) conceptual model. DAS model shows the causal relation between QoL and domain satisfactions, and between domain satisfactions and the respective perceived attributes. The established causal model of Kirkos explains 93 % of the variance in the subjective QoL of the residents. However, the impact of the eight domains on QoL is not the same.

In Kirkos, satisfaction with family income has the strongest causal impact on the QoL of the respondents'. To check whether this finding is influenced by large number of respondents with low income, the analysis is carried out by excluding respondents that earn low income, i.e. <500 Birr per month. The result showed that family income has the strongest causal impact on the subjective QoL of all income groups. This implies that compared to each of the domains of life, family income is the highest contributor to the level of QoL in the sub-city. The domain that has the second strongest causal impact on QoL is satisfaction with housing. The causal model also shows satisfactions with neighbourhood safety, quality of public services and neighbourhood sanitation have comparable impact on the QoL in the sub-city while satisfactions with built-environment have the least impact on the QoL. This finding implies that any effort to improve the QoL in the area can give prior focus on the domains that have the highest impact such as family income and housing.

Lee (2008) that reported community status, which is equivalent to the domain built-environment in this study, has the strongest causal impact in determining QoL for Taiwan Taipei. However, Lee (2008) did not use family income as a domain of life and such comparison can not be made with the findings of this study. However, the difference indicates the possibility that ignoring any of the domains of life may change the structure of the causal model.

Housing ownership is the most important predictor of housing satisfaction in the sub-city. The low level of satisfaction with housing is probably due to the fact that most of the respondents live in a house owned by the Kebele administration and few respondents live in private owned house. Satisfaction with built-environment is mostly predicted by noise pollution. Crime rate in the neighbourhood is the most important predictor of satisfaction with neighbourhood safety. Richards et al.(2007) reported that crime rate is one of the most important predictor of QoL in South Africa. Satisfaction with quality of primary school is the most important predictor of satisfaction with quality of public service in the sub-city while access to public service is mostly relates to access to health facility.

6.1.6. Dimensions of subjective QoL

The dimensions of subjective QoL in Kirkos sub-city are identified. Since QoL is multidimensional identifying the dimensions facilitates its interpretation. Factor analysis reduced 27 subjective attributes into seven factors. Based on their physical meaning and the results of the factor analysis, the attributes are grouped into four separate classes which are considered as the dimensions of subjective QoL. For instance, the attributes of the domain built-environment and physical aspect of housing are grouped in to the physical dimension of subjective QoL. The four dimensions represent the physical, economic, social, and proximity (access) dimension of subjective QoL in the sub-city.

Das (2008) identified three dimensions of subjective QoL for the city of Guwahati, India using nine variables. These dimensions are public service, general and liveability. The number and type of

variables applied to identify the dimensions of subjective QoL in Das (2008) is different from that applied in this study. This implies that the type and number of the dimensions is partly determined by the type and the number of variables applied.

A simplified model of subjective QoL is also developed using only four attributes, one attribute from each dimension. The selected attributes have the highest loading in the factor analysis. These attributes are satisfactions with level of crowding in a dwelling, housing ownership, quality of primary school and access to main shopping area. The model explains 88% of the variance in the subjective QoL. The simplified model can be used for future urban subjective QoL studies in the region since applying the 27 attributes is costly in terms of time and resource.

6.2. Objective Quality of Life

6.2.1. Dimensions of objective QoL

The dimensions of objective QoL in Kirkos sub-city is identified using 13 objective attributes. The dimensions are identified through factor analysis that groups attributes into a single factor based on their strength of relation. The dimensions are used to measure the objective QoL in the sub-city. The five dimensions of objective QoL are crowdedness, socio-economic, safety and proximity, housing and demographic. The five dimensions explain 74% of the total variance.

Li and Weng (2007) identified three dimensions of objective QoL for Indianapolis using 10 variables. These dimensions are economic, environment and crowdedness. The crowdedness dimension in Li and Weng (2007) is comparable to the crowdedness dimension in this study since population density and housing density are used to construct the crowdedness dimension in both studies. Das (2008) identified seven dimensions of objective QoL for the city of Guwahati using 27 attributes. Some of these dimensions are standard of living, water, environmental pollution and social. The difference in the type and number of dimensions reported in the literature is partly due to the difference in the type and the number of attributes applied in the studies.

6.2.2. Objective QoL index

Following Li and Weng (2007), an objective QoL index is developed multiplying the factor scores, which were interpreted as dimensions of objective QoL, with the respective variances. The index helps to evaluate the objective QoL in the sub-city. It also helps to compare objective QoL with the subjective QoL.

The dimensions of objective QoL as mentioned above are crowdedness, socio-economic, safety and proximity, housing and demographic. Economic and housing dimensions have positive impact on the objective QoL. This implies that the higher the score in the socio-economic and housing dimension, the better the QoL. Crowdedness, safety and proximity and demographic dimensions have negative contribution to the QoL. This implies that the higher the score in these dimensions, the lower is the QoL. For instance, the higher the score of crowdedness, the smaller the space for people to live.

Based on the developed index, there is a variation in the objective QoL in the sub-city. There is some pattern of clustering of Kebeles with high and low objective QoL. Kebeles with high QoL are clustered in the south and eastern part of the sub-city and Kebeles with low QoL are clustered in the northern part of the sub-city.

6.3. Comparison between Subjective and Objective Quality of Life

6.3.1. Influence of personal, socio-economic and demographic characteristics on QoL

In this study, the influence of personal, socio-economic and demographic characteristics on the subjective QoL in Kirkos is studied. Factors such as level of education, family income, number of dependent children, housing tenure, number of rooms in a house and household size influence the QoL in the sub-city significantly. However, gender of the head of the household has no statistically significance influence in the QoL in the sub-city.

Although household size has statistically significant influence on the QoL, it does not have a unique and direct relationship. The subjective QoL in the sub-city does not necessarily decrease with an increase in the household size. However, it decreases with an increase in the number of dependent children in a house.

6.3.2. Combined subjective and objective QoL

The subjective QoL score and the index of the objective QoL in the Kebeles of Kirkos sub-city were compared in terms of correlation coefficient. The correlation between the subjective and the objective QoL in the sub-city is poor i.e. 0.24 (significant at 0.01 level of significance). Such weak relation somewhat suggests that improving the objective QoL does not necessarily improve the subjective QoL. This finding is comparable with Das (2008) and McCrea et al.(2006) but it is in contrast to Brereton et al. (2008) who found high relation between subjective and objective QoL. However, comparisons cannot be conclusive due to the difference in the domains of life that are applied in the studies and due to the reason that the scores of the domains of life are location specific.

Based on the theoretical explanation given by Zapf (1984) cited in Craglia et al. (2004), the combined effect of subjective and objective QoL results in deprivation, well-being, adaptation or dissonance. Deprivation is the condition in which both conditions are bad. The opposite is well-being that represents the situation in which both conditions are good. As such deprivation and well-being exist when both the subjective and objective QoL measurements indicate the same levels of QoL. Dissonance is the condition in which the objective QoL is 'good' but the subjective is 'bad'. Adaptation is the condition in which the objective living condition is bad but the subjective is good. As such dissonance and adaptation exist when both the subjective and objective QoL measurements indicate the contrasting levels of QoL.

To evaluate the presence of the four possible conditions that are define by Zapf (1984) cited in Craglia et al.(2004), the subjective and the objective QoL in each Kebeles of the sub-city is evaluated in a two-way matrix. Deprivation and well-being are observed in three Kebeles of Kirkos. These deprived Kebeles in terms of QoL are clustered in the Northern part of the sub-city.

Dissonance is observed in four Kebeles of which three are located in the southwest part of the sub-city while one is located in the east part of the sub-city. The objective living conditions in these Kebeles are high mainly due to the fact that these Kebeles are less crowded and have respondents with high economic condition compared to other Kebeles. The subjective QoL of the four Kebeles is low compared to the objective QoL probably due to the fact that the respondents are dissatisfied with some of the domains of life. For instance, the respondents in the four Kebeles, which has low subjective QoL, expressed dissatisfaction with housing, income and sanitation.

Adaptation is observed only in Kebele 11/12. The objective QoL in this Kebele is low mainly due to the fact that the Kebele is overcrowded and low level of housing condition compared to other Kebeles. The subjective QoL of this Kebele is high compared to the objective QoL probably due to the fact that the respondents are satisfied with some of the domains of life. For instance, the respondents in this Kebele, expressed satisfaction with housing, built-environment, neighbourhood safety, access to public services and social connectedness.

7. Conclusion

In this study, the subjective QoL is measured and its spatial distribution is evaluated in Kirkos sub-city of Addis Ababa. For 2008, the subjective QoL is measured in terms of the rational and the intuitive response of individuals. At the sub-city level, the mean score of both the intuitive and the rational response of the respondents indicate that the respondents are dissatisfied with the quality of their life. However, there is large variation between the QoL of the respondents in the sub-city. For instance, in terms of the rational response, about 4 % of the respondents in the sub-city are 'completely satisfied' and 15% are 'completely dissatisfied'. The remaining 81 % of the respondents expressed a satisfaction level that ranges between the two extremes.

At smaller scale than the sub-city, i.e. at Kebele level, respondents of all Kebeles expressed dissatisfaction in terms of the intuitive mean QoL score. However, there is large variation in terms of the rational response at Kebele level with the respondents in three Kebeles expressing satisfaction while respondents in eight Kebeles expressing dissatisfaction or worst feeling about the quality of their life. The results indicate that aggregation at large scale, i.e. the sub-city level, can average out the variability of QoL that exists at small scales, i.e. at Kebele level in this study. Also, the results suggest that the outcome of a QoL study may vary depending on either the intuitive or the rational response is applied to measure the subjective QoL.

The intuitive response in 2008 and the intuitive response in 2006 were also compared. At the sub-city level, respondents expressed dissatisfaction in both years. However, there is a temporal variation in the level of intuitive QoL at Kebele level. In 2008, the QoL score shows dissatisfaction or worst (lowest) feeling in all the Kebeles. In 2006, the QoL score shows satisfaction in three Kebeles while the QoL score shows dissatisfaction or worst in eight Kebeles. However, the responses of the 2006 QoL can be biased by the current living condition of the respondents since the QoL in both years was measured based on the household survey of 2008. Thus, a better comparison can be made if the comparison is based on data that is collected in the specific years for which QoL is measured.

In this study, the subjective QoL that was measured in terms of the rational response was selected for further analysis since it showed high correlation with the domain satisfactions and since it is better-thought than the intuitive response.

Eight domains of life are identified based on literature and experience. The majority, i.e. 94 %, of the respondents did not recommend any additional domain of life that they would like to see included in the questionnaire. At the sub-city level, the respondents expressed satisfaction with only three domains of life. These domains of life are social connectedness, neighbourhood safety and access to public service facilities. However, at the Kebele level, the situation is somewhat different. For instance, the respondents in Kebele 02/03 expressed satisfaction with seven domains of life while the respondents in Kebele 08/09 expressed satisfaction with one domain of life i.e. social connectedness. This indicates how aggregation at large scale, in this case at sub-city level, can average out the variability of domain satisfaction at small scale.

The variability in the subjective QoL in the sub-city is evaluated using coefficient of variation (CV). The result indicated that the variability of QoL in each Kebele decreases exponentially as the QoL in the Kebele increases. Such result suggests that Kebeles with high QoL are relatively homogeneous in terms of QoL while Kebeles with low QoL are relatively heterogeneous.

A causal model was developed for the subjective QoL in the sub-city. The model indicated the domain that has the strongest causal impact on the subjective QoL is family income while the domain that has the weakest causal impact on the subjective QoL is built-environment. The attributes that have the strongest causal impact on the housing domain, built environment domain and neighbourhood safety domain are satisfaction with home ownership, noise pollution and crime rate, respectively. The attributes that have the strongest causal impact on the domains quality of public service and access to public service are quality of primary school and access to health facility, respectively.

In Kirkos sub-city, four dimensions of subjective QoL are identified which are physical, economic, social and proximity factors. Also, a simplified model of subjective QoL is developed using four perceived attributes instead of twenty-seven attributes. The simplified model can be used in future studies that predict QoL in the sub-city. However, its applicability for the other sub-cities of Addis Ababa should be evaluated in future studies.

The dimensions of the objective QoL in Kirkos are crowdedness, socio-economic status, safety and proximity, housing and demographic. Using these dimensions of objective QoL, an index of objective QoL is developed. The combined effect of subjective and objective QoL in the sub-city is studied using the subjective QoL score and the index that is developed for the objective QoL. The combined effect of the subjective and the objective QoL in each Kebele indicated dissonance, adaptation, deprivation or well-being. In the Kebeles with well-being and deprivation, the subjective and the objective perspectives could measure the same level of QoL. However, in the Kebeles with dissonance and adaptation the subjective and the objective perspectives do not necessary measure the same level of QoL. One reason can be some of the domains of life that are included to measure the subjective QoL are not included to measure the objective QoL. For instance, social connectedness is not included in the objective measure. However, it is difficult to conclude that the two perspectives will measure the same level of QoL after including all the domains of life since the subjective QoL is based on individual's perception that is an integrated effect of several factors that relate in a complex manner. Also relative to the subjective perspective, the objective perspective lacks validity since most of the formulation of the index is determined by the researchers' judgment or existing formulations that may not accurately reflect residents' satisfaction. The result in this study also indicates the need to study the combined effect of both subjective and objective QoL.

Subjective QoL score is compared against characteristics of respondents through ANOVA. It is found that there is a statistically significant difference in the QoL of respondents of different level of education, family income, the number of dependent children, household tenure and number of room in a house. In general, QoL increases with an increase in the level of education, family income, level of household tenure and number of room in a house while it decreases with an increase in the number of dependent children. However, QoL does not have a statistically significant relation with gender. Although there is significant relation between QoL and household size, the relation is not unique and direct as it is commonly expected.

In general, the findings of this study indicate that large scale study can hide the variability of QoL at small scales. The findings also reveal the importance of studying both subjective and objective QoL instead of any one of these separately. It is expected that the results and finding of this study will be useful in designing future urban QoL studies in the region. Studying QoL at the city level, i.e. Addis Ababa, was not the focus in this study and such can be considered in future studies.

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Appendix A: Questionnaire for Household Survey

This interview is for study purpose and completely voluntary. The answers you give will be kept confidential. This survey is about the people living in Kirkos sub-city (Addis Ababa) how they feel about their life. Data will be collected from residents (head of the household) two years over living in the sub-city.

Sub-city: _____   New Kebele: _____

Old Kebele: _____   House number: _____

Name of interviewer _____   Block no: _____

Code: _____

Section A: General Information

	choices				
Age					
Gender	1=Male		2=Female		
Employment status	1=Employed		2=Unemployed		
Education level	1= Not educated	2= Primary education	3= Secondary education	4= Vocational	5= University degree
Household size					
Number of dependent children					
Household tenure	1= Privately owned	2= Kebele	3= Rent from private	4= Housing agency	5= Others
Number of rooms					
Health facilities the family often uses	1= Government health facility		2= Private health facility		
Educational facilities Children attend	1= Government	2= Public	3= Private	4= No school going children	
Family income (monthly)	< 500 Birr	500-1500 Birr	1500-2500 Birr	2500-3500 Birr	3500-4500 Birr	>4500 Birr

Section B: Overall life satisfaction and domain satisfaction

1= completely dissatisfied 2= very dissatisfied 3= dissatisfied

4= satisfied 5= very satisfied 6= completely satisfied

No	Questions	Level of satisfaction					
		1	2	3	4	5	6
1	At this present moment, what do you feel about your life as a whole?						
2	What was your feeling about your life before two years?						
3	What is your level of satisfaction with the following domains of life? Housing Built environment Neighbourhood safety Social connectedness Quality of public service Access to public service Neighbourhoods sanitation Family income						
4	Taking all the domains of life above into consideration, how satisfied are you with your life as a whole at present?						
5	Are there other domains of life you want to include?	1= No 2= Yes If yes what?					
6	What is the level of satisfaction with the additional (this) domain						
7	What do you feel about neighbourhoods upgrading effect on your life?						
8	What do you feel about the future upgrading plan in the neighbourhoods if there is any?						

Section C: Assessment of perceived attributes of domains of life

	Assessment of Attributes	Level of Assessment					
1		1	2	3	4	5	6
	Housing						
	Level of home ownership	completely dissatisfied	very dissatisfied	dissatisfied	satisfied	Very satisfied	completely satisfied
	Housing affordability	Extremely high	Very high	high	low	Very low	Extremely low
	Crowding in a dwelling	Extremely crowded	Very crowded	Crowded	Less crowded	Very less crowded	Not crowded
	Hosing condition	Extremely dilapidated	Very dilapidated	dilapidated	Good	Very good	Extremely good
	Housing utilities affordability	Extremely high	Very high	high	low	Very low	Extremely low
	Assessment of number of rooms	Extremely small	Very small	small	Large	Very large	Extremely large
2	**Built-environment**						
	Attractive of living place	Extremely un attractive	Very un attractive	un attractive	Attractive	Very attractive	Extremely attractive
	Noise pollution	Extremely high	Very high	high	Less	Very less	Not noisy
	Suitability of living place for raising children	Extremely un suitable	Very unsuitable	unsuitable	suitable	Very suitable	Extremely suitable
	Neighbourhood is congested	Extremely congested	Very congested	congested	Not congested	Very small congestion	Not congested
3	**Neighbourhood safety**						
	Crime rate in the neighbourhood	Very great deal	Great deal	some	little	Very little	Not at all
	Road safety	Extremely unsafe	Very unsafe	Unsafe	Some what safe	Very safe	Extremely safe
	Police protection in the neighbourhoods	Extremely unsatisfactory	Very unsatisfactory	unsatisfactory	Satisfactory	Very Satisfactory	Extremely Satisfactory

Access to police stations	Extremely far	Very far	Far	Near	Very near	Extremely near

4 Quality of public services

Road maintenance	Extremely unsatisfactory	Very unsatisfactory	unsatisfactory	Satisfactory	Very Satisfactory	Extremely Satisfactory
Garbage collection	Extremely unsatisfactory	Very unsatisfactory	unsatisfactory	Satisfactory	Very Satisfactory	Extremely Satisfactory
Quality of primary school children attend	Extremely unsatisfactory	Very unsatisfactory	unsatisfactory	Satisfactory	Very Satisfactory	Extremely Satisfactory
Quality of secondary school children attend	Extremely unsatisfactory	Very unsatisfactory	unsatisfactory	Satisfactory	Very Satisfactory	Extremely Satisfactory
Quality of health facilities the family often used	Extremely unsatisfactory	Very unsatisfactory	unsatisfactory	Satisfactory	Very Satisfactory	Extremely Satisfactory

5 Access to the public services

Primary school	Extremely far	Very far	Far	Near	Very near	Extremely near
Secondary school	Extremely far	Very far	Far	Near	Very near	Extremely near
Health facilities	Extremely far	Very far	Far	Near	Very near	Extremely near
Sport and leisure facilities	Extremely far	Very far	Far	Near	Very near	Extremely near
Main shopping area	Extremely far	Very far	Far	Near	Very near	Extremely near
Living place is easily accessible to public transport	Extremely inaccessible	Very inaccessible	Inaccessible	Accessible	Very Accessible	Extremely easily Accessible