Assessment of Life Quality Using GIS and Remote Sensing Techniques: A Case Study on Assuit City, Egypt

Mohamed Farid Almetwaly Alsaid*

Abstract

Urban quality of life (QOl) is becoming the subject of urban research mainly in developed and developing countries. Such attention is due to an increasing awareness of the contribution of QOL studies in identification of problematic areas and in monitoring urban planning policies. However, most studies of quality of life accomplished in urban or country level. Therefore, change of quality of life in small scales especially in inter-urban areas is not well known. In addition, relation between objective and subjective quality of life also is not well specified. This paper applies a methodology for measuring QOL using both objective and subjective indicators by integration of remote sensing and GIS techniques in Assuit city. Objective environmental indicators like land surface temperature (LST), Greenness (NDVI), and impervious surface (IS) are extracted from landsat ETM+ images and objective socio-economic indicators such as GDP, unemployment rate and illiteracy are derived from census and other secondary sources. While Subjective indicators are derived from a survey that was conducted in 2010. For analyzing data statistical methods such as person correlation ,factor analysis, remote sensing and GIS for presenting distribution of quality of life. Generally, The main findings of the study indicate the presence of QOL variability and the importance of studying both subjective and objective indicators instead of any one of these separately. Also findings and methods of this study can be used in planning future studies of quality of urban life in Egypt.

1. Introduction

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). The quality of life (QOL) in the cities of both developing and developed countries is gaining interest of researchers from a variety of disciplines such as planning, geography, sociology, economics, psychology, political sciences, behavioral medicine, marketing and management since 1930s. They tried to identify the components of QOL and compared various geographical areas such as cities, states and nations by QOL indices that

* Department of Geography, Faculty of Arts, Ain Shams University.

they developed. In addition to the researchers, international organizations such as UNDP developed its own measures for QOL (Andrew, 1999 and Foo, 2001). The desire to improve the quality of life in a particular place or for particular person or group is an important focus of attention for planners and is becoming an important tool for policy evaluation, urban planning and management.

Quality of life (QOL) is a concept that has no agreed-on definition because a great variety of indicators can be used to measure it. It is accepted by sociologists that QOL is a collective attribute that adheres to groups of people, not to individuals. It is also clear that QOL comprises both objective and subjective elements. Various concepts concerning QOL can be found in the literature such as urban environmental, livability, quality of place, residential-perception and satisfaction and sustainability (Kamp et al., 2003). Reviewed some definitions about livability, QOL, environmental quality and sustainability. It pointed out that there was neither comprehensive conceptual framework in relation to urban quality of life and human wellbeing developed, nor any agreed- on indicator system to evaluate the physical, spatial and social aspects of urban quality owing to the fact that a broad range of disciplines addressed different aspects of urban quality of life based on different notions and theories.

A great variety of indicators can be used to measure quality of life, which consist of both often measured using either subjective or objective indicators. Quality of life (QOL) studies in urban areas have received an increasing research attention when it is considered that the world population is expected to reach somewhere between (7.6, 9.4) billion and the urban population is expected to reach 50 percent in the beginning of the next century. The multi-dimensional character and evolutional nature of quality of life led to different interpretations which made the investigation more difficult. So the recent research on quality of life emphasis on the quality of measuring this concept in the cities.

Egypt is ranked as (135) country in the index of quality of life with an average points (51). The safety score's is the highest rating variable (International Living Magazine, 2010). ILM evaluated these countries according to 9 socio-economic variables that take relative weights. 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.

In this Paper, quality of life is measured in the Assuit city – Egypt using the subjective and objective attributes of individual's life. GIS approach can be used to integrate the data from different sources such as satellite image, census, …, etc. The spatial variability of QOL also is analyzed. A causal model of QOL that relate to the subjective QOL of individual will be developed. The dimensions of subjective and objective QOL are identified. Objective QOL index is developed using both household and spatial variables.

1.1 *Assuit Background*

Assuit is located on the west bank of the Nile south of Cairo. It is one of the oldest cities in the whole world but the modern city dates largely from 1800 A.D. It is the capital city of Assuit governorate in Upper Egypt. Assuit is the largest city in Upper Egypt and lies about 375 Km south of Cairo and it is consisting of 16 Sheikhas (Figure 1). The total area of the governorate covers 1553 Km^2, of which it occupies around 24 Km^2. Assuit, comes first among upper Egyptian capital cities. It has almost 400,000 inhabitants. It is also has the University of Assuit, one of the largest universities in Egypt and branch of Al-Azhar University.

1.2 *Objectives of the Study*

The main objective of the present study is to measure and evaluate quality of life in Assuit City, Egypt. The following are the specific objectives of the study:

1. To examine objective and subjective indicators of life at Assuit city and it's Sheikhas.
2. To measure the relationships between objective indicators of the urban environment.
3. To develop an index to measure the overall QOL.

1.3 *Data Sources and Limitations*

- **Data Sources**

The analysis of this study depends on secondary data obtained from different sources and publications as follows:

- Ministry of Education, Schools Report in Assuit Governorate (2010)
- Ministry of Health and Population, Hospitals Report in Assuit Governorate (2010)
- Assuit Governorate Year Book (2010)
- Assuit governorate population census in 1998 and 2008.
- General and Strategic Plan of Assuit city (2010)
- Medium Resolution Satellite Images Landsat ETM+ (2010)

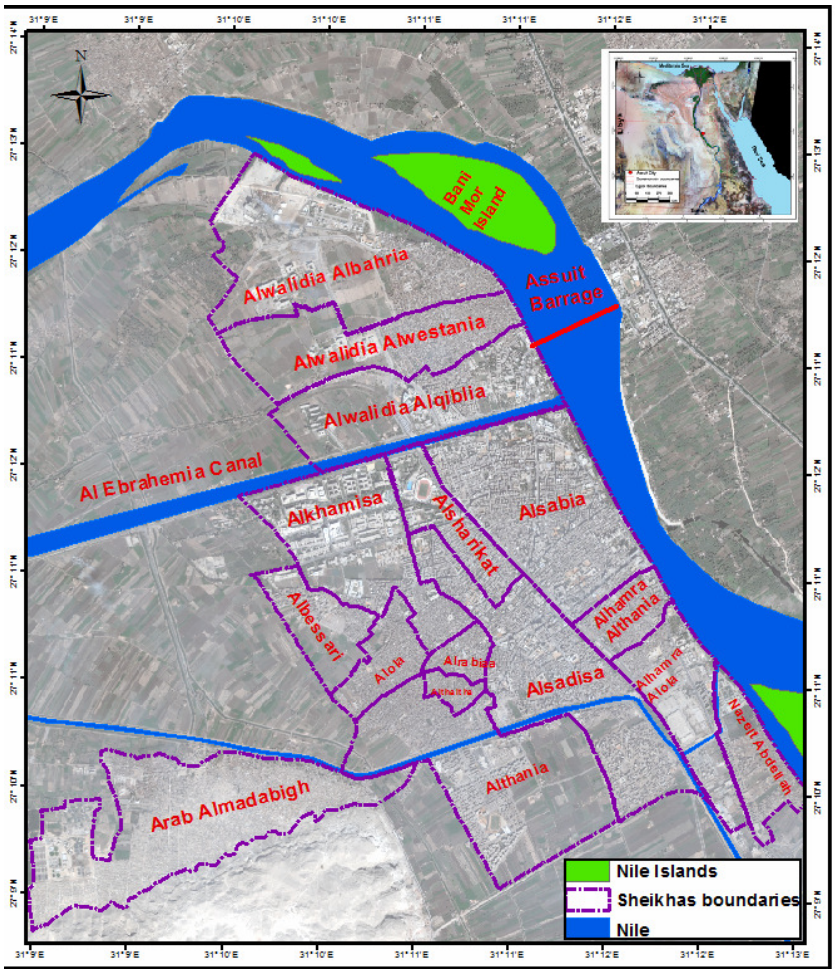

Figure 1. Location of Assuit city and it's Sheikhas in 2011.

In addition, the study depends on data derived from a field study conducted by the author in May 2011 in Assuit city.

- **Limitations:**

Visualization of people's perceptions and subjective indicators based research could offer very fruitful information on quality of life. However some time it cannot be validate due to less availability of validation or secondary data on subjective indicators. This study also will have the same

limitations which is unavailability of specific objective data (secondary data) at Sheikhas level to validate the research.

1.4 *Methodology*

The study used both descriptive and analytical approach. The descriptive analysis approach is used through cross tabulation. A standard of comparison, in this case Likert scale is required to quantify individual's perception. Statistical methods such as Person Correlation and Factor Analysis can be applied to analyze the collected data for QOL studies. GIS operations such as map calculation, map overlay and others will be applied to analyze the observations and display the results.

1.5 *Conceptual Framework*

Conceptual framework in Figure (2) shows that there are three methods for evaluation of quality of life by using to objective and subjective indicators. These three methods includes using subjective representatives, objective representatives and combination of objective and subjective representatives for evaluation of quality of life.

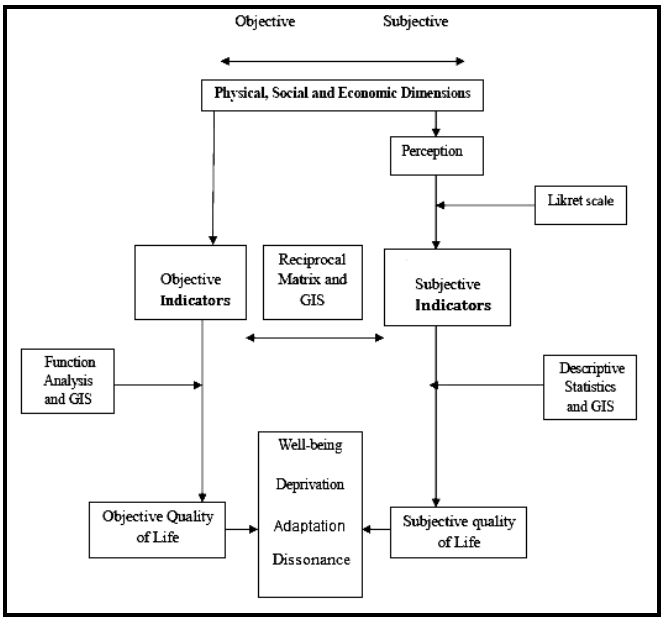

Figure 2. Conceptual Framework of Research.
Source: Malekhosseini and Joodaki, 2011.

Environmental and social – Economic dimension of life have subjective representatives which percept by individuals are used for evaluation of subjective quality of life. Comparison standard (in this case Likret scale) is used for quantification of individual's perception. Statistical methods such as descriptive are used for analyzing collected data and also GIS software for showing applied conclusions. Subjective quality of life in this study is measured. Environmental and social-economic dimensions of life also have objective representatives are used for evaluation of objective quality of life. Statistical methods such as descriptive statistic, function analyze for analyzing representatives and GIS for showing findings in objective dimension. Objective quality of life in this study is measured by using variations related to household and place variables. Also, conceptual model shows that objective and subjective quality are compared. Average and function analysis is used for extraction of objective and subjective quality of life points. Reciprocal Matrix is developed for objective and subjective quality of life and then GIS is used for showing combination effect of two events of quality of life including "well-being", "deprivation", "Adaptation", "Dissonance" in Sheikhas level.

Literature Review

- Liu, B., (1978), in his study on developing a theoretical model using a range of social indicators that reflect the differences in the quality of social life in the metropolitan medium-sized, and characterization of these areas as quality index of social life, helped decision makers to identify the strengths and weaknesses point in the areas by comparing it to each other and take a series of decisions to improve the quality of life in those areas.
- Massam, B., (1999), applied the multi-criteria analysis in the classification of individuals using a combination of different factors, to develop a model with relative weights and then rating the quality of life of individuals through the relative weights that was ranged between the best and the worst. The study was very useful for political decision-makers through reallocating resources to improve the quality of life in the study area.
- Muller, V., and Gossette, F., (2005), in their study aiming to link between social, economic variables and structural urban environment, including socio-economic variables and the structural variables such as access to various services, the degree of greenness of plants (NDVI) which is considered as index for vegetation in urban areas, also used

factor analysis to identify the most influential indicators in determining the quality of life in Southern California.

- Li, G., and Weng, Q., (2007), in their study aiming to develop an integrated approach combines the use of remote sensing and census data within the framework of geographic information systems to assess the quality of life in the city of Indiana Paul, Indiana in the United States by relying on environmental variables such as degree of greenness vegetable surfaces, impervious surfaces, surface temperature derived from satellite images of the type landsat (ETM+) as well as the use of socio-economic variables, including population density, income, poverty, unemployment, level of education, housing characteristics, has also been applied Pearson Correlation Coefficient to analyze the relationship between variables, in addition to the use of factor analysis to determine which factors are most influential in determining the quality of life in the study area.
- Kitchen, P., and Willim, A., (2009), focused on determining the relationship between the crime and the quality of life in the city of Saskatoon, and highlighted the impact of rates of crime and addiction on the quality of life of the population who live in neighborhoods of varying socio-economic conditions, has been used quantitative and qualitative data with chronology in the data analysis of a sample of the population during the period 2001-2007, the study recommended that increasing the social cohesion and try to reduce crime in order to improve the quality of life in the study area.
- Lotfi, S., and Solimani, N., (2009), in their study on developing a model that could be used for multi aspects analysis of urban quality of life, and apply the model on the two northern cities in Iran, as well as put weights to the indicators used in this evaluation. The features of this model are simple and clear, and decision-makers in urban areas can gain benefits from the results of this model.

Organization of the Study

The study is divided into four sections; Section I includes introduction, importance of the study, research problem, objectives of the study, data sources and it's limitations, research methodology, literature review and organization of the study. Section II consists of descriptive analysis of both objectives indicators of socioeconomic and environment variables and subjective indicators of socioeconomic and environment variables for QOL in Assuit. Section III includes In -Depth Analysis (Factor Analysis) for both objective and subjective Indicators and developing the index of QOL in

Assuit city using the weighted objective and subjective Indicators. Section V present conclusions and policy recommendations.

2. Quality of Life Indicators in Assuit City

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. At stated by Zapf (1984) cited, 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 (Craglia et al., 2004).

2.1 Objective Quality of Life Indicators in Assuit City

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. 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. Also Das (2008) stated that the objective indicators are very often imperfect and may suffer from either under reporting or over reporting. The objective indicators of QOL included twelve indicators represented the socio-economic characteristics, physical and environmental variables (Cicerchia, 1999).

2.1.1 Economic Indicators

The economic environment represents the external conditions under which people are engaged in, and benefit from it. Three indicators have been used to assess aspects of the quality of economic life in Assuit. It includes aspects of unemployment, income and female's participation in labor force.

Unemployment:

Unemployment is one of the key indicators to identify the objective quality of life as it is used to measure the health of the economy, because it related to the standard of living. It reflect the status of the imbalance in the national economy of any state which occurs due to the inability of the

production and service activities to provide job opportunities enough for new entrants into the labor market (Massam, 1999).

The number of unemployed persons in the city reached 13163 with rate of 12.3 percent in 1996, and increased to 17409 unemployed persons with rate of 13.9 percent in 2006, which is more than the overall average of unemployment rate in Assuit Governorate (9.5 percent). The Sheikhas can be categorized according to the unemployment rate in 2006 as shown in Figure (3). The Figure indicates that Assuit Sheikhas' can be classified into three classes: (a) one Sheikha with rate (20-30 percent) which is Alwalidia Alqiblia, (b) five Sheikhas with rate (10-20 percent) which are Nazlet Abdellah, Arab Almadabigh, Alkhamsa, Alsabiaa and Alsharikat, (c) ten Sheikhas with rate (0-10 percent) which are Alwalidia Albahria, Alwalidia Alwestania, Alhamra Alola, Alhamra Althania, Alsadisa, Alola, Althania, Althaltha, Alrabiaa and Albesari.

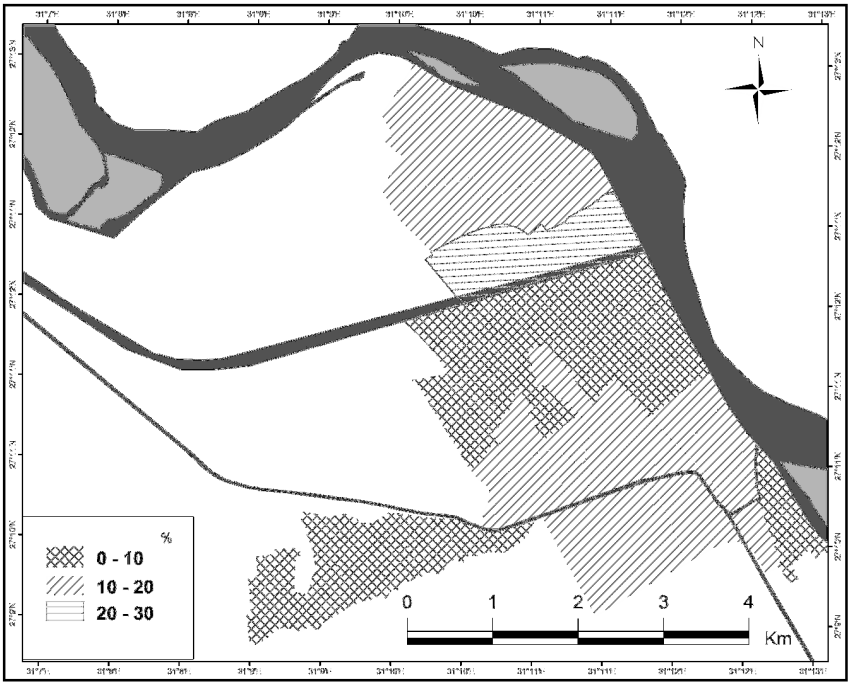

Figure 3. Unemployment rate of Assuit city and it's Sheikhas in 2006.

Source: Computed from Assuit Governorate Census in 2006.

Gross Domestic Product (GDP) per capita:

GDP per capita is often considered as an indicator of a country's standard of living. GDP is a good indicator of improving quality of life. Because GDP shows the value of all the goods and services an economy produces and delivers. Countries with small GDPs have very low quality of life standards, meanwhile, countries with high GDPs have high quality standards of life (Kitchen, P., and Willim, 2009).

The geographical distribution of GDP reflects the level of economic conditions in the city, and is related to the educational level and social status of the population. The highest average per capita GDP is 3852.4 LE in AlSadisa while the lowest one is 2680 L.E in Alwalidia Alqiblia. The Level of GDP is closely related to the human development index with strong positive correlation (0.666) and it indicates that the poverty has a geographical dimension. The expansion of the poverty among Assuit Sheikhas leads to fall in the quality of life in the city. There are three classes of Sheikhas according to the average per capita GDP in 2003 which are (a) Sheikhas with (2500-2900 L.E) such as Alwalidia Albahria, Alwalidia Alwestania, Alwalidia Alqiblia, Alsharikat and Arab Almadabigh, (b) sheikhas with (2900-3400 L.E) which are Alhamra Alola, Nazlet Abdellah, Alola, Althania, Althaltha, Alkhamsa and Albesari, (c) sheikhas with (3400-3900 L.E) such as Alsabiaa Alsadisa, Alhamra, Althania and Alrabiaa as shown in Figure (4).

Female's Participation in Labor Force:

Female's Participation in labor force is very important indicator for the quality of life. Because it give clear view for the production capacity's of female and how they contribute in the economic activity. High rate of female's participation leads to high level of quality of life and affect negatively on the fertility rates. This participation is affected by how the society looks at female and its educational and social level (Lotfi and Solimani, 2009). More balanced sex ratios in the cities may improve the quality of urban life. Figure (5) represent the category of sheikhas according to female's participation in labor force which divided into three classes; (a) sheikhas (0-12 percent) which are Alola, Nazlet Abdellah and Arab Almadabigh, (b) sheikhas (12-14 percent) which are Alwalidia Albahria, Alwalidia Alwestania, Alwalidia Alqiblia, Alola, Althania, Althaltha, Alrabiaa, Alkhamsa, Albesari and Alhamra Alola, (c) sheikhas (14-36 percent) which are Alsabiaa, Alhamra Althania, Alsharikat and Alsadisa.

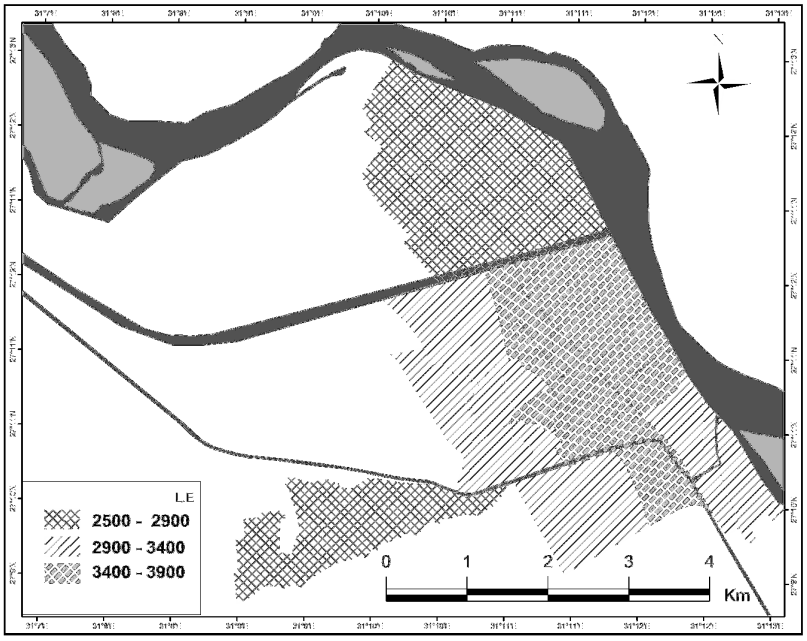

Figure 4. GDP per Capita of Assuit Sheikhas in 2003.

Source: Computed from Human Development Index of Assuit Governorate in 2003.

The size of female's labor force increased during the period (1996-2006) from 29834 female (about 24.3 percent of the labor force in the city) in 1996 to 37097 female in 2006 with growth rate 2.2 percent during this period. It formed (about 23.3 percent of the Labor force). The relative distribution of woman's participation is very concentrated; as Alsabiaa attract about 24.9 percent of the total female labor force in the city, while the lowest female participation in Nazlet Abdellah is about 1 percent. This reflects the influence of educational level of females on their participation in labor force in the city.

2.1.2 Social Indicators:

Illiteracy:

The illiteracy is one of the most important social indicators for quality of life. It is the true measure for the status of the people's education, and is considered as one of the main obstacles that face the development. It is used as a criterion to distinguish between the developed and underdeveloped areas (Bakir, 1990, p. 99).

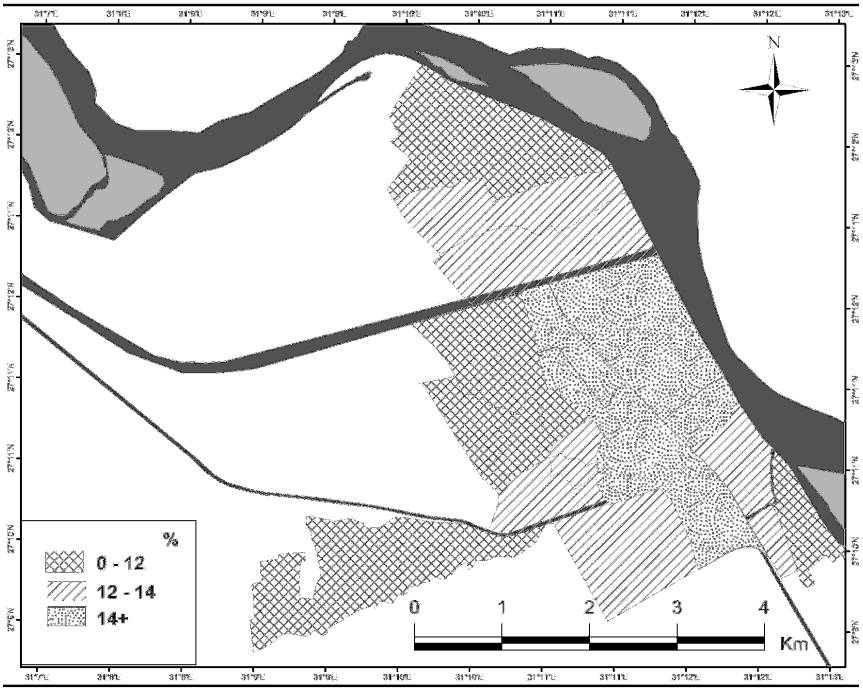

Figure 5. Female's Participation in Labor Force of Assuit Sheikhas in 2006.
Source: As Figure (3)

The number of illiterate people in the city is 37327 person with rate of 29.1 percent in 1996 which was increased to 51114 with rate of 15.7 percent in 2006. This indicates that the educational policy in the governorate has achieved good results in the reduction of illiteracy rates and also shows that improving in social mobility and awareness about the importance of education (Saad, 2006, p. 110). Figure (6) shows the classification of sheikhas according to illiteracy rate into three classes; (a) ten sheikhas with (0-20 percent) such as Alwalidia Albahria, Alwalidia Alwestania, Alwalidia Alqiblia, Alhamra Alola, Alhamra Althania, Alrabiaa Alkhamsa ,Alsabiaa and Alsadisa, (b) five sheikhas with (20-40 percent) Nazlet Abdellah,Alola, Althania, Althaltha and Albesari (c) one sheikh with (40-60 percent) which is Arab Almadabigh.

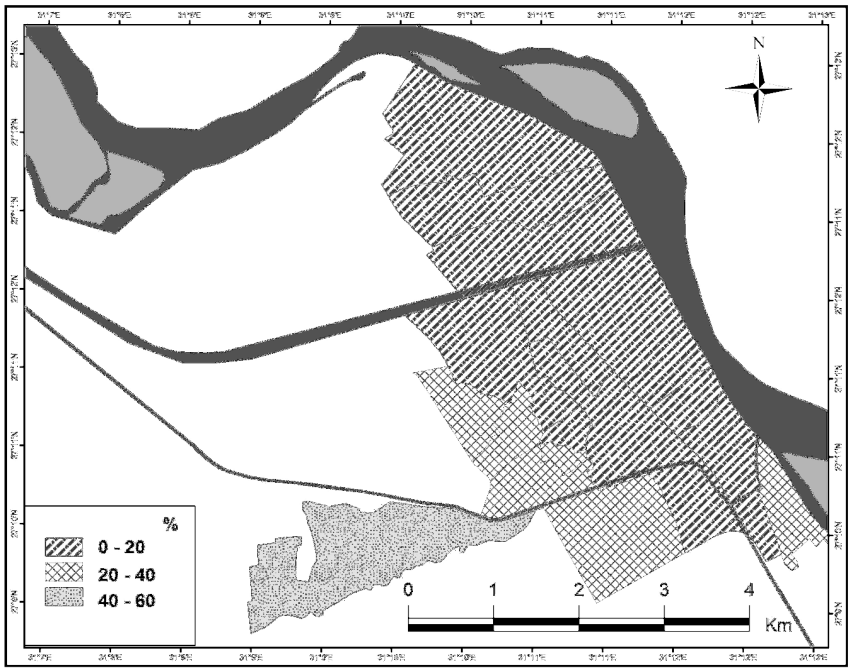

Figure 6. Illiteracy rate of Assuit Sheikhas in 2006.
Source: As Figure (3)

Dropouts:

Dropouts are defined as students disrupted the school in whole or in part a way that they can't finish their studies successfully (General Authority for Literacy and Adult Education, 1997). The problem of dropping out of education is one of the implications of poor educational system, The in-depth view to the highest rates of dropout recorded in fourth and fifth and the sixth grades in the primary schools that attract about 73 percent of the total number of dropouts at the primary level and it is mainly due to failing in examinations. While increasing the percentage of dropouts in the preparatory stage in the first grade number of dropouts are 524 students with 58.2 percent, and decline for the other two stages respectively; the second grade with 27.2 percent and finally the final third grade of about 14.6 percent.

Figure (7) shows that there are three classes of Assuit sheikhas' according to the dropouts rate of the primary education; (a) eight sheikhas from (0-4 percent) such as Alwalidia Albahria, Alwalidia Alwestania,

Alwalidia Alqiblia, Alsabiaa, Alsharikat, Alkhamsa, Alhamra Alola and Alhamra Althania (b) five sheikhas from (4-8 percent) which are Albesari, Alola, Alrabiaa, and Althania (c) one sheikha with the highest rate from (8-12 percent) which is Arab Almadabigh.

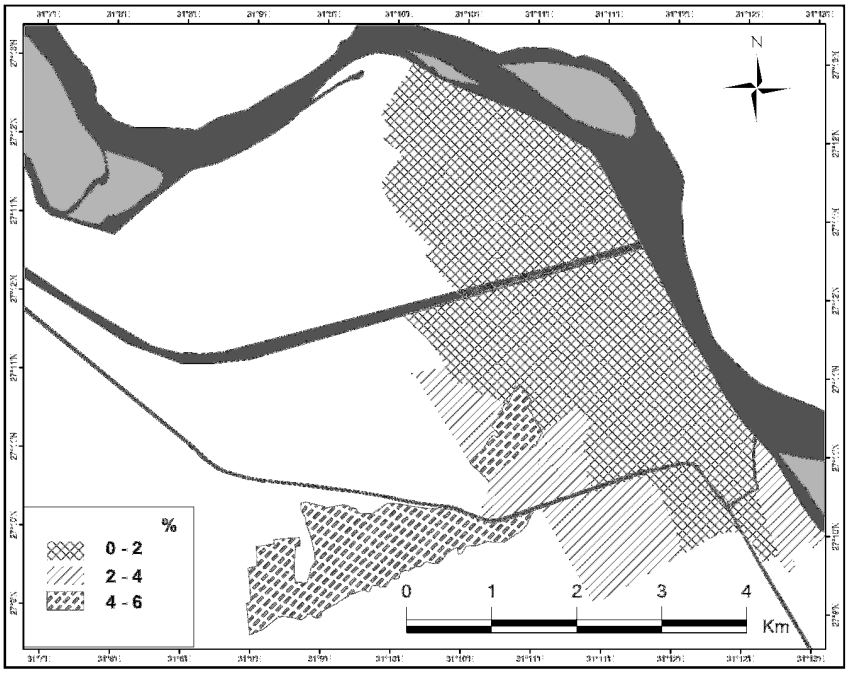

Figure 7. Total Dropout of Primary Education Rate of Assuit Sheikhas in 2006.
Source: As Figure (4)

Disability:

Disability is the consequence of an impairment that may be physical, cognitive, mental, sensory, emotional, developmental, or some combination of these (McVeigh, 1971). A disability may be present from birth, or occur during a person's lifetime. The number of disabled persons in the city is 2679 with a disability rate of 0.7 percent of the total healthy people in the city in 2006. it is accounted for the category of mentally retarded by about 579 disabled with 21.6 percent of the total disabled persons, followed by deaf with 16.3 percent, cerebral (kidney/partial) with 14 percent, blind with 11.4 percent, polio with 10.5 percent, and those five categories attracts about rate of 73.8 percent of the total disabled persons in the city in 2006.

The lowest class is whose lost one or both hands with about 1.3 percent. Figure (8) shows that the high rate of disability is found in Althania between (1-1.5 percent) and lowest class (0-0.05 percent) such as Alwalidia Alwestania, Alsabiaa, Alkhamsa, Alrabiaa and Alsadisa.

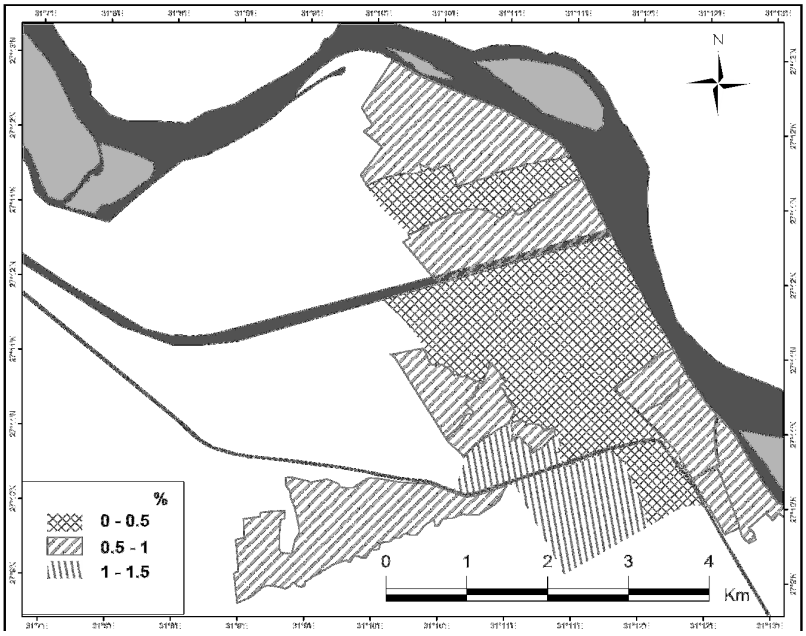

Figure 8. Disability Rate of Assuit Sheikhas in 2006.
Source: As Figure (3)

Physicians per One Thousand People:

The ratio of Physicians is one of the indicators for assessing the quality of service offered in the hospitals, and to know if there is a shortage on the medical service providers in the city (Liu, 1976). There is a great variation on the ratio of physicians between Sheikhas. Figure (9) indicates that the Sheikhas that located in the highest class are Alkhamsa and Althania, and it is mainly because most of governmental and university hospitals are concentrated in it.

Accessibility to Services:

Residential proximity to facilities and services can be theorized as contributing to health and wellbeing in a number of ways. In addition to easier and more direct access to places to shop, exercise, work, meet

neighbors, have a health check, etc, it confers opportunities by reducing the time and financial costs of access, which in turn frees individual a ices. We study the accessibility to hospitals as an example for a health service and household resources for use elsewhere. It also offers lifestyle to schools as an example for educational services. We used Network analysis which one of the GIS operations to have the levels of accessibility depending on the distance to the services (Li and Weng, 2007).

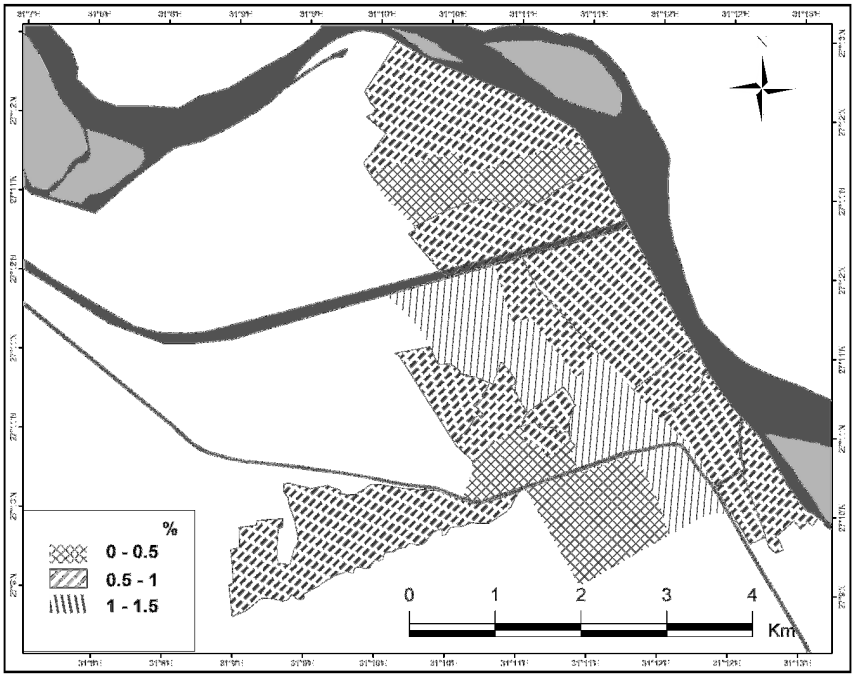

Figure 9. Physicians per 1000 people of Assuit Sheikhas in 2006.

Source: Computed from Assuit Hospital Report in 2011.

- **Accessibility to Hospitals**

There have been a number of different definitions of accessibility proposed in the health services research literature. Penchansky and Thomas argue that "access is most frequently viewed as a concept that somehow relates to consumers ability or willingness to enter into the health care system" and define access as "a concept representing the degree of 'fit' between the clients and the system" (Nicholas, 1982).

Figure (10) shows that the most of Alsabiaa, Alsadisa and Alwalidia Alqiblia have the easy access to the hospitals in Assuit (green belt) and it surrounded by another yellow belt in which the accessibility to health services is medium and finally there is the hard access to it at the marginal areas of the city with red color.

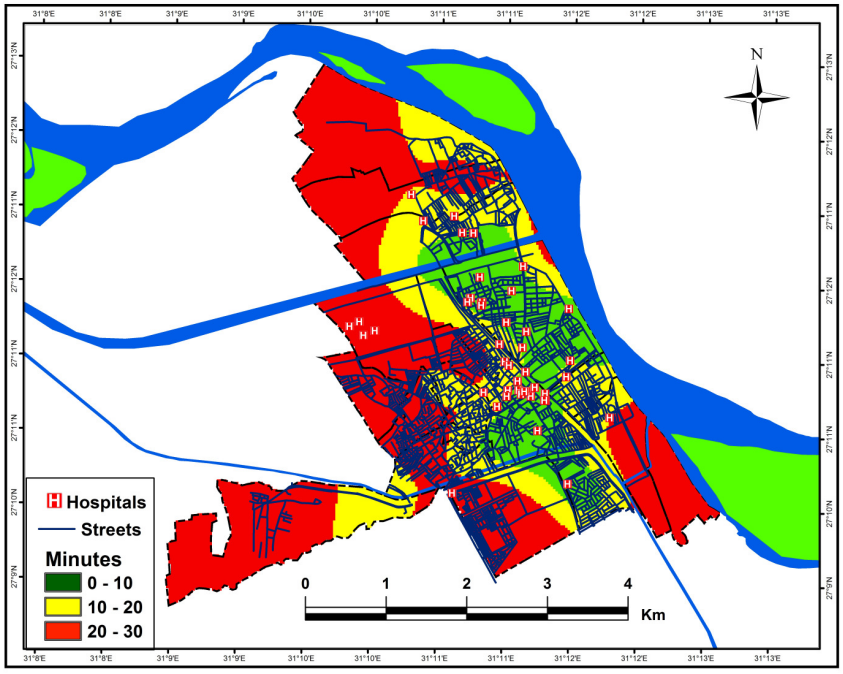

Figure 10. Accessability to Hospitals of Assuit Sheikhas in 2011.

Source: Computed using network analyst function in ArcGIS10.1

- **Accessibility to the Schools**

Quality of education is the other side of coin. Providing access to schools secures only one part of the right to education. Figure (11) shows the area that has the easiest access to schools (green area) covers the most of the city center's, and it is surrounded by yellow belt in which the accessibility to schools are medium then the last red belt in which the most difficult access to the schools.

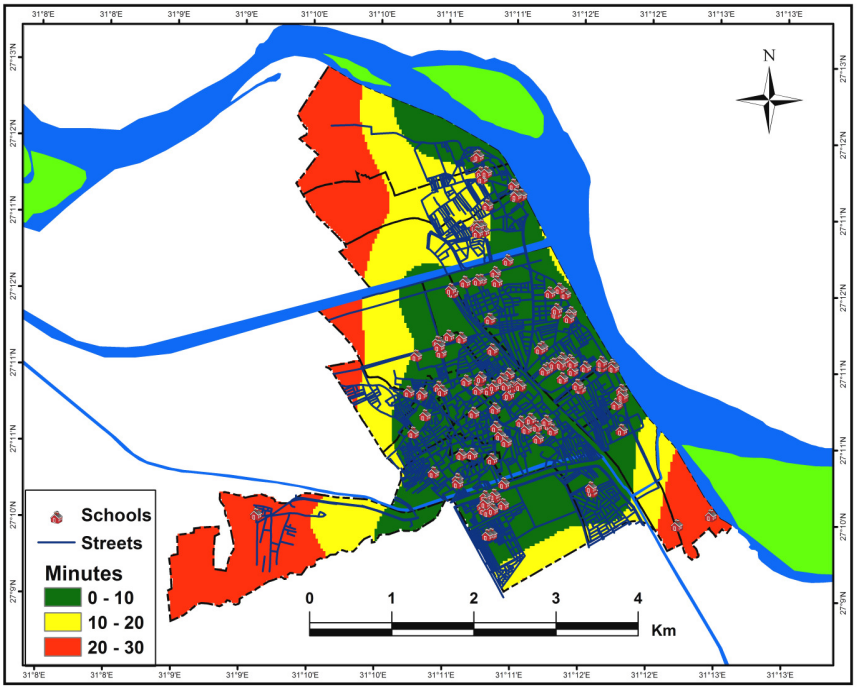

Figure 11. Accessability to Schools of Assuit Sheikhas in 2011.
Source: Computed using network analyst function in ArcGIS10.1

2.1.3 Environmental indicators

Environment pollution is a wide-reaching problem and it is likely to influence the health of human populations to a greater extent. Three indicators are studied for measuring the quality of environment in the city.

Land Surface Temperature:

Temperature is an important factor affecting human comfort. High surface temperature is regarded undesirable by most people; therefore, it can be used as an indicator of environmental quality (Lo & Faber, 1997 and Nichol & Wong, 2005). Urban heat island is a common phenomenon in the cities where the urban area shows a higher temperature than the rural area. Thermal infrared band of ETM+ provides the source to extract surface temperature. The procedure to extract land surface temperatures involves three steps; (i) converting the digital number of Landsat ETM+ band sex into spectral radiance, (ii) converting the spectral radiance to at-satellite brightness temperature, which is also called blackbody temperature; and (iii) converting

the blackbody temperature to land surface temperature (Apparicio, et al., 2008). Land surface temperature (LST) is a significant parameter in urban environmental analysis. There is a relationship between land cover and LST. The more surface land is covered by concrete, the more vegetation disappears. As a result, the temperature of urban surface has increased in compare with of rural area. Besides that, the urban activities affect the environment such air pollution and greenhouse gas emission problems, causing the human health be seriously threatened. Figure (12) shows that the maximum LST that recorded is about (36 °C) while the minimum is (20 °C).

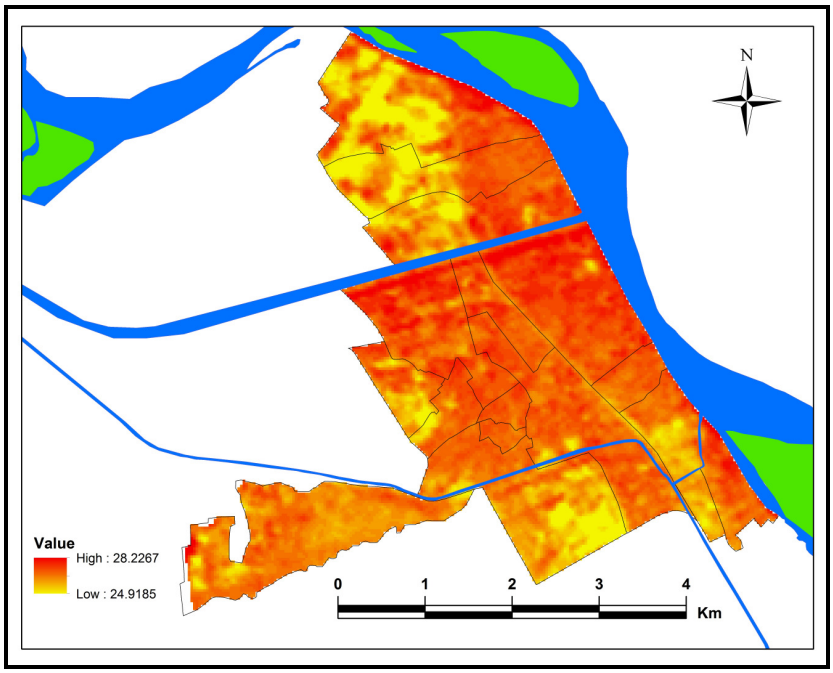

Figure 12. Average Land Surface Temperature (LST) of Assuit Sheikhas in 2011.

Vegetation:

Vegetation was regarded as a positive indicator of the physical environment of Assuit city as it can provide many aesthetic and environmental benefits to the citizens (Santos and Martins, 2007). The Normalized Difference Vegetation Index (NDVI) was calculated from Landsat 7 Satellite image for Assuit city in 2011.

Figure (13) indicates that the green areas are generally located at the margins of the Sheikhas nearly to rural areas. Normalized Vegetation Index (NDVI) was calculated from the ETM image using the following formula:

NDVI= (NIR-RED) / (NIR+RED)

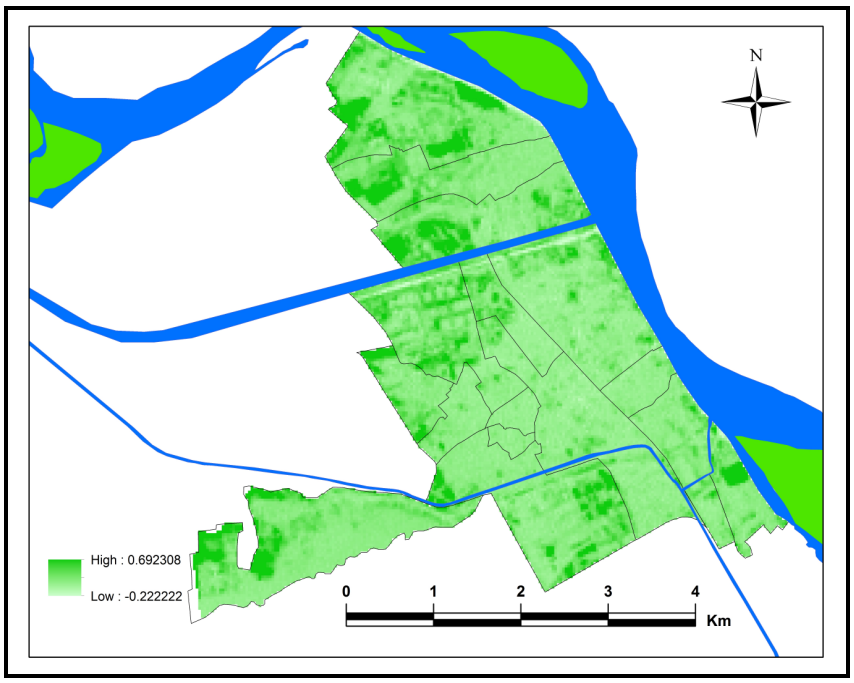

Figure 13. Average Normalized Difference Vegetation Index (NDVI) of Assuit Sheikhas in 2011.

Impervious Surfaces

An impervious surface refers to an anthropogenic surface that prevents water from infiltrating into soils (Arnold & Gibbons, 1996). The common types of impervious surfaces can be categorized into two primary components: the rooftops and the transport system (roads, sidewalks, and parking lots) (Schueler, 1994). The environmental impacts of impervious surfaces include impacts on water cycling, water quality, erosion of construction sites, non-point source pollution, stream health, and the urban heat island effect (Yuan & Bauer, 2007).

Satellite remote sensing images have been massively applied for impervious surface estimation due to their relatively low cost and suitability for large area mapping (Bauer et al., 2004). Many methods had been applied successfully for impervious surface extraction in previous research, including spectral mixture analysis, regression tree, artificial neural network, multiple regressions and sub-pixel classification (Lu & Weng, 2006). Sub-pixel classification is applied in this paper to extract the impervious surface in the city. There is very strong relationship between Sheikhas. As Figures (13) and (14) show there is reverse relationship between the green areas (NDVI) and impervious surface in the city.

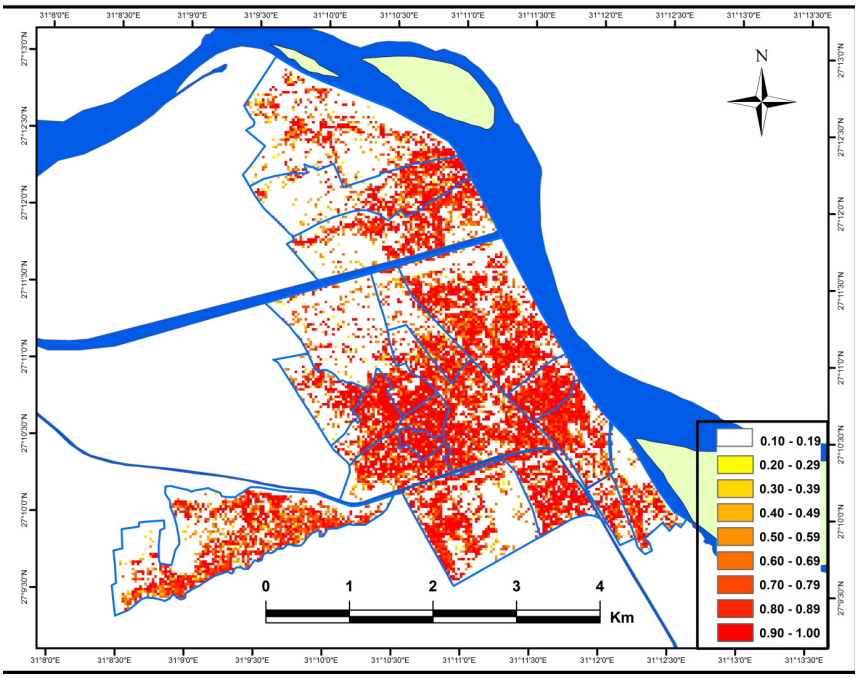

Figure 14. Impervious Surface in Assuit Sheikhas in 2011.

2.2 Subjective quality of life:

Subjective QOL of life reflects people's perception of their life and can be measured using subjective. Subjective indicators stand for individual's evaluation of objective conditions of life (Das, 2008). These subjective are

derived from surveys of residents' perceptions, satisfaction and evaluation of their life. Subjective QOL is often measured using Likert scale although there is no commonly range. Lee (2008) stated that quality must be subjective and the most appropriate method of exploring QOL is by directly asked people's perceptions of their life. Arnold and Gibbons 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 can't represent the environmental conditions in which people live. Resident's subjective perception of well being is often affected by expectations. There are eleven indicators which are used to measure the subjective wellbeing or the satisfaction about different life domain's in the city.

2.2.1 Economic indicators

Satisfaction about income:

There is one question that we often ask: ‘‘Are we satisfied with our income?’’, we can be satisfied in absolute terms, but often our level of satisfaction depends on what we see around us. As such, there is a relative notion according to which we compare ourselves to neighbors, colleagues, more generally, to a reference group, and it matters where we perceive ourselves in the social hierarchy. Social status of an individual plays, indeed, an important role in the determination of his well-being (Weiss and Fershtman, 1998). Level of satisfaction about income in Assuit is very related to GDP distribution among Sheikhas. As Figure (15) shows the highest level of satisfaction about income is found in five sheikhas which are Alsabiaa, Alhamra Althania, Alsharikat, Alsadisa and Alrabiaa.

Satisfaction about unemployment:

There is a relationship between unemployment and life satisfaction. Unemployment affects the economic status of people which reflects on their subjective wellbeing. Strong relationship between Unemployment rate and satisfaction about unemployment in Assuit city. Figure (16) shows seven sheikhas have the lowest level of satisfaction which are Alwalidia Albahria, Alwalidia Alwestania, Alwalidia Alqiblia, Alola, Althaltha, Albesari and Arab Almadabigh.

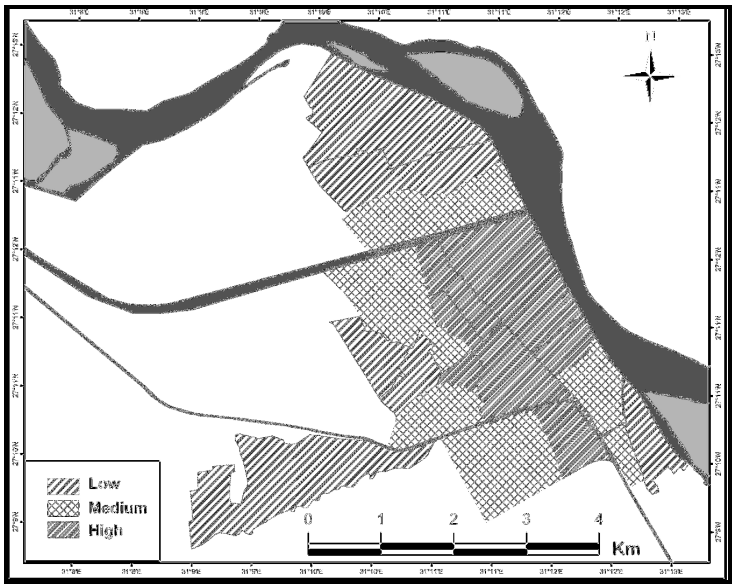

Figure 15. Satisfaction about income of Assuit Sheikhas in 2011.
Source: Computed using the results of the questionnaire during the field study in 2011.

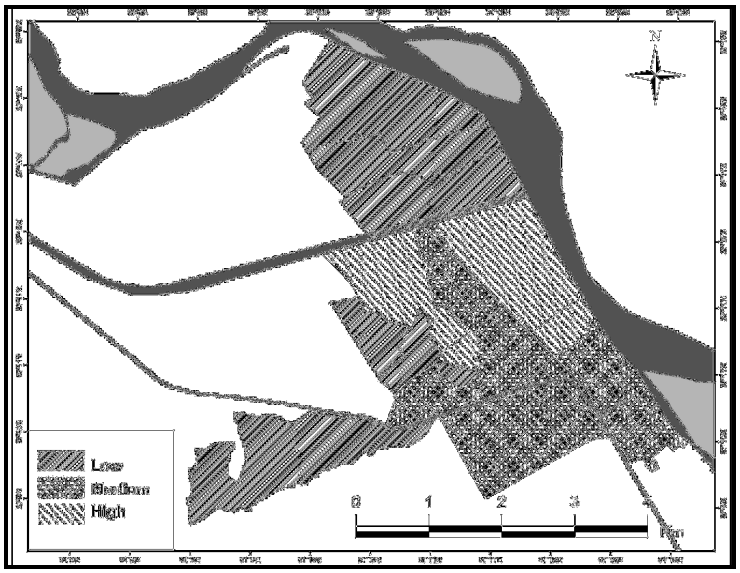

Figure 16. Satisfaction about unemployment of Assuit Sheikhas in 2011.
Source: As Figure (15).

Satisfaction about Female Participation in Labor Force:

Female participation in labor force is integrally linked to their economic empowerment. Changes in female participation in L.F can be due to educational level, fertility and traditions (Kamp, et al., 2003). Figure (17) indicates that satisfaction about female participation is high in three Sheikhas which are Alsabiaa, Alsadisa and Alrabiaa have the highest level of satisfaction.

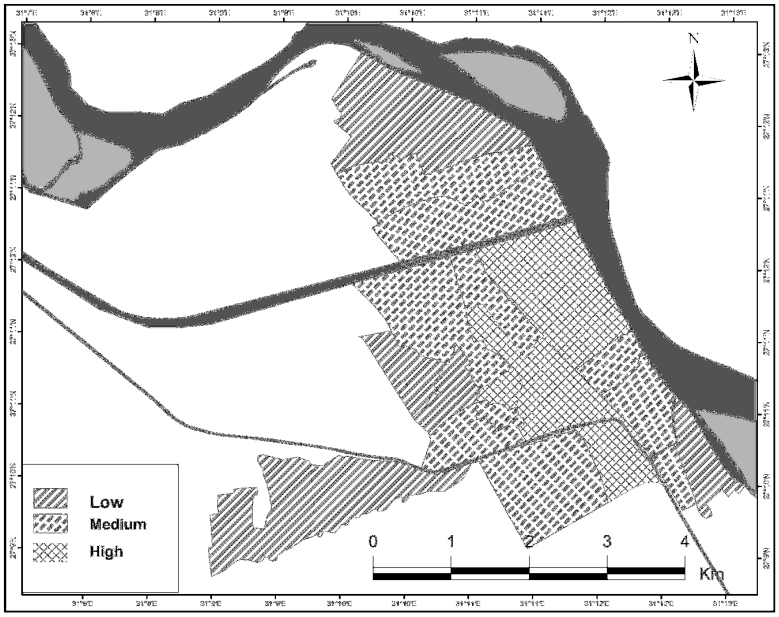

Figure 17. Satisfaction about women participation in Labor Force of Assuit Sheikhas in 2011.
Source: As Figure (15).

2.2.2 Social Indicators

Satisfaction about Illiteracy:

Does education matter to the quality of our life? The answer is high education levels are positively associated with higher income, with more highly qualified professions, with lower risk of unemployment, with better physical health and also with more happiness that affect the subjective well-being. Low satisfied Sheikhas have the lowest illiteracy rate in the city. Figure (18) shows that the lowest sheikhas of satisfaction about illiteracy are Arab Almadabigh, Nazelt Abdellah and Albesari.

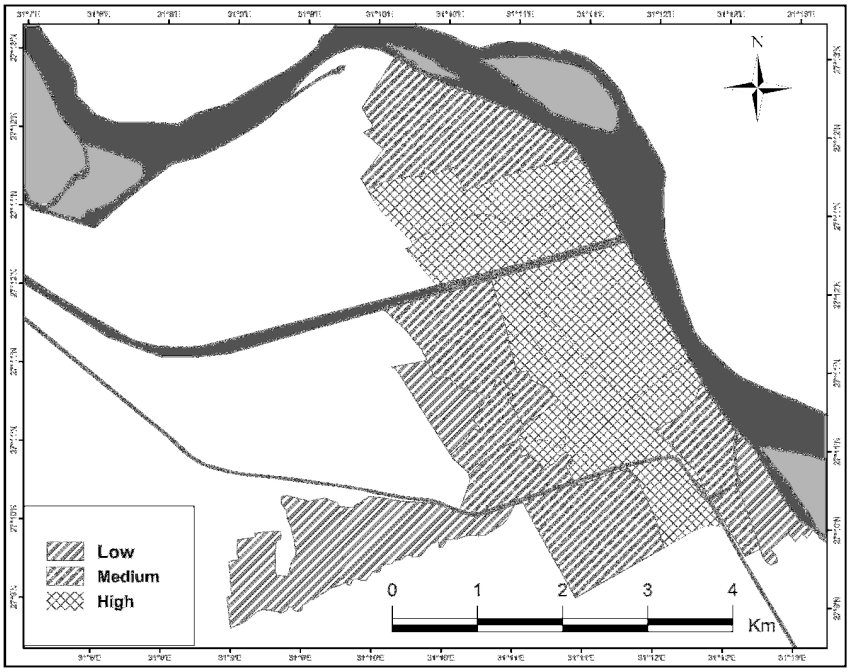

Figure 18. Satisfaction about illiteracy of Assuit Sheikhas in 2011.
Source: As Figure (15).

Satisfaction about Access to Services (Schools and Hospitals)

This is an important predictor of subjective QOUL and can be expected to vary between local areas in metropolitan, regional and rural areas**.** The theory of optimal centrality suggests that the level of access to services and facilities available in an urban center depends on the size of an urban center. This is particularly so for access to higher level services and facilities (such as medical specialists, universities and theaters) which are unlikely to be available or viable in smaller urban centers or rural areas (Glaeser et al., 2000 and Rogerson et al., 1989, 1996).

- **Access to Hospitals:**

The level of satisfaction for accessibility to hospitals in 2010 is related to the distribution of it. The most of high satisfied Sheikhas have the most number of hospitals in Assuit which are Alsabiaa, Alsadisa, Alhamra Alola, Alkhamsa and Alsharikat as shown in Figure (19).

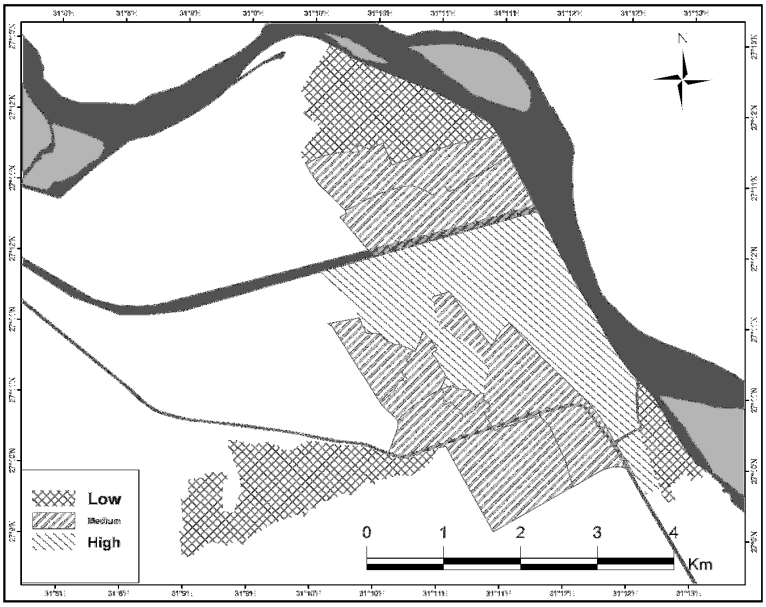

Figure 19. Satisfaction about Accessability to Schools of Assuit Sheikhas in 2011.
Source: As Figure (15).

- **Access to Schools**

The Level of satisfaction for accessibility to schools in 2010 is related to the distribution of it. The most of high satisfied Sheikhas have the most number of hospitals in Assuit which are AlSabiaa, Alhamra Alola, Alhamra Althania, Alkhamsa, Alsharikat and Alrabiaa as shown in Figure (20).

Satisfaction about Quality of Services:

- **Quality of Schools** include the satisfaction about some indicators such as educational staff performance, materials of education, …. etc. The high level of satisfaction concentrated in the sheikhas that have the highest standard of living and the largest number of private and language schools which have high level of satisfaction. Figure (21) indicates that the highest satisfied people were founded in sheikhas: Alsabiaa, Alhamra Althania, Alkhamsa, Althaltha, Alrabiaa and Althania.
- **Quality of Hospitals** consists of quality of health service offered, medical staff number, instruments, … etc. The highest level of satisfaction is concentrated in three Sheikhas which have the most

number of largest hospitals such as Alkhamsa that have Assuit university hospitals as shown in Figure (22).

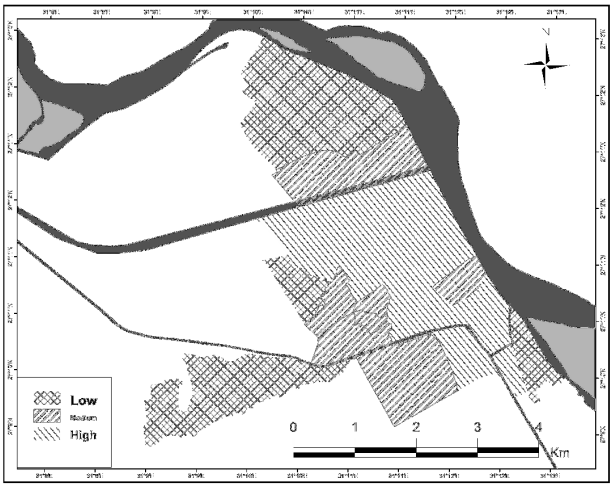

Figure 20. Satisfaction about Accessability to Hospitals of Assuit Sheikhas in 2011.
Source: As Figure (2.13).

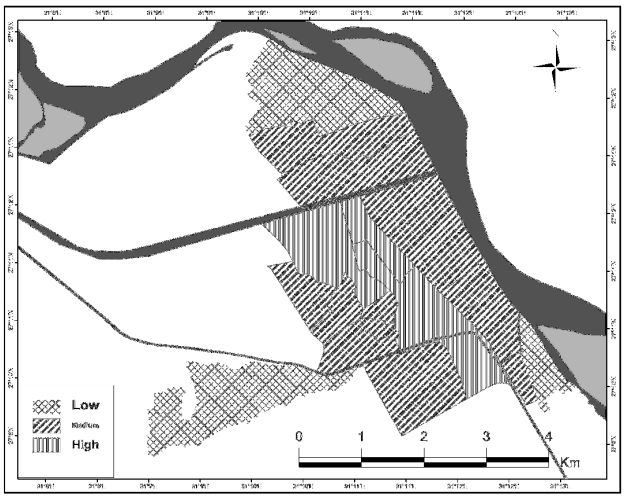

Figure 21. Satisfaction about quality of Hospitals of Assuit Sheikhas in 2011.
Source: As Figure (15).

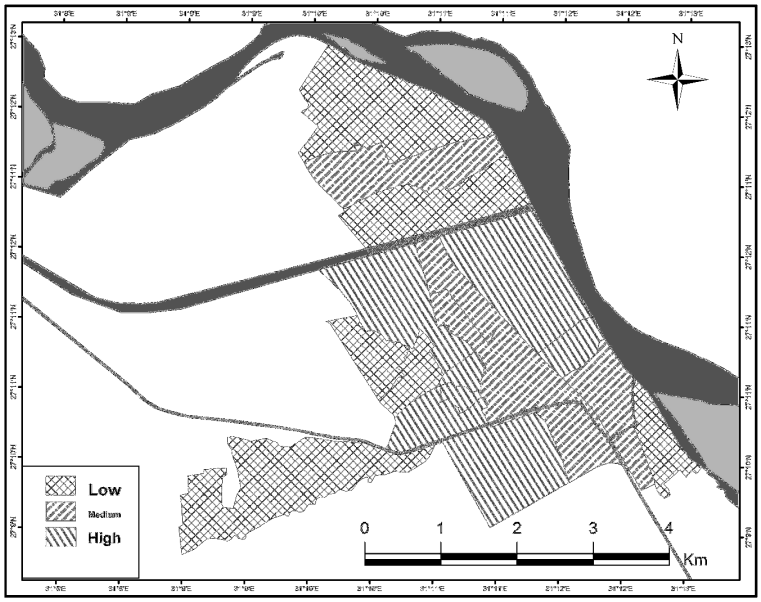

Figure 22. Satisfaction about quality of schools of Assuit Sheikhas in 2011.
Source: As Figure (15).

Satisfaction about dropout from primary education

School satisfaction as an indicator of dropout risk of students. Students attend two kinds of schools in Assuit for primary education which are primary and preparatory schools. The lowest level of satisfaction is found in three Sheikhas which are Nazlet Abdellah, Albessari and Arab Almadabigh as shown in Figure (23).

2.2.3 Environmental Indicators

Satisfaction about Environmental Quality

Environmental conditions are likely to have an effect on people's sense of life satisfaction, both directly and indirectly. In recent years there has been a burgeoning literature assessing the relationship between measures of environmental quality and subjective well-being. The lowest satisfied people are in the areas have the most sources of pollutions in Sheikhas Alsabiaa Nazlet Abdellah, Alkhamsa, and Althania as shown in Figure (24).

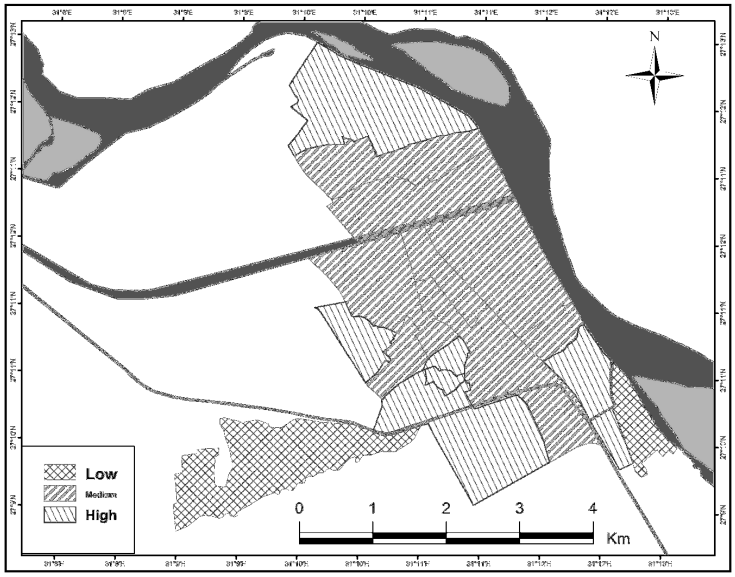

Figure 23. Satisfaction about dropouts of Assuit Sheikhas in 2011.
Source: As Figure (15).

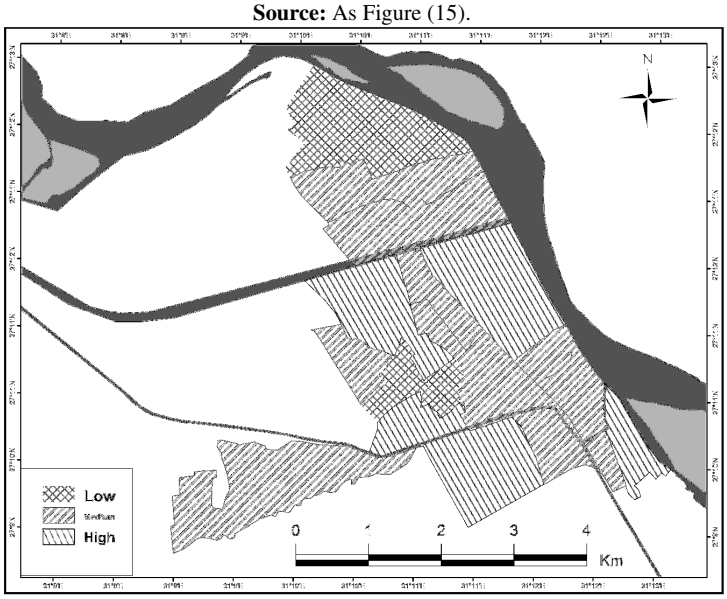

Figure 24. Satisfaction about environment quality of Assuit Sheikhas in 2011.
Source: As Figure (15).

Satisfaction about Green Areas

The green space is that growing of urban green spaces which have positive effects on health, integration and economy. It declines in the center of the city and increases at the marginal areas as shown in Figure (25).

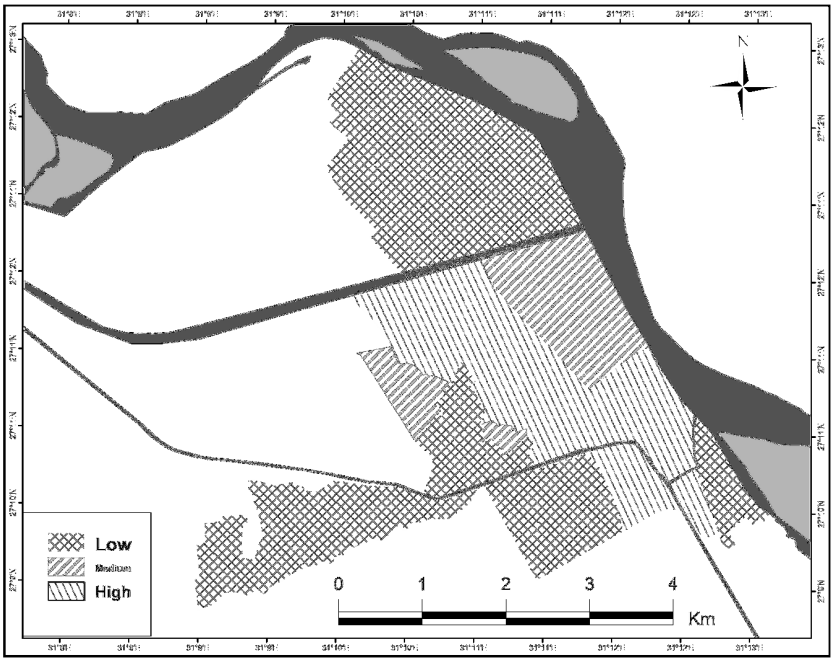

Figure 24. Satisfaction about green areas of Assuit Sheikhas in 2011.
Source: As Figure (15).

3. Developing Quality of Life Index

Pearson's correlation was computed to give a preliminary analysis of the relationships among all variables. Table (1) displays the correlation matrix. Green vegetation had a significant positive relationship with unemployment (0.107), illiteracy (0.032), disability (0.328), access to hospitals (0.547), access to schools (0.330) and a negative relationship with GDP (-0.592), temperature (-0.394), impervious surface (-0.772), female participation in labor force (-0.353), and Dropout rate (-0.275) and impervious surfaces (-0.772). Illiteracy rate had a very high correlation with income variables and house characteristics, which indicates that well-educated people made more money and live well as shown in the table.

Table 1. Correlation matrix between variables.

	GDP	Unemployment	Female work	illiteracy	Disability	Dropout	physicians	Access to hospital	Access to school	impervious	vegetation	LST
GDP	1											
Unemployment	-0.624	1										
Female work	0.447	0.206	1									
Illiteracy	-0.664	0.219	-0.851	1								
Disability	-0.492	0.101	-0.506	0.428	1							
Dropout	0.115	0.046	0.790	0.793	-0.441	1						
Physicians	0.554	-0.161	-0.071	-0.005	-0.095	0.136	1					
Access to hospitals	0.556	-0.219	-0.827	0.700	0.544	-0.706	0.027	1				
Access to Schools	0.385	-0.340	-0.685	0.692	0.440	-0.667	-0.091	0.861	1			
Impervious	0.657	0.104	0.221	-0.140	-0.354	0.209	0.020	-0.554	-0.468	1		
Vegetation	-0.592	0.107	-0.353	0.032	0.328	-0.275	-0.020	0.547	0.330	-0.772	1	
LST	0.785	0.254	-0.373	0.421	0.430	-0.359	0.345	0.419	0.208	-0.540	-0.494	1

3.1 *Factor Analysis of the Objective QOL Indicators:*

One of the objectives of the study is to identify the dimensions of objective quality of life in Assuit city. There are several objective attributes that may affect quality of life. The main challenge is how to develop indices from these attributes that can be used to predict QOL. Twelve variables which reflect both the household and spatial characteristics were studied.

As a general guide in interpreting factor analysis results, the suitability of data for factor analysis was first checked based on Kaiser–Meyer–Olkin (KMO) and Bartlett's test values. The data were acceptable for factor analysis only when KMO was greater than 0.5 and the significant level of Bartlett's test was less than 0.1. The second step was to validate the variables based on communality of variables. Small values indicate that variables do not fit well with the factor solution and should be dropped from the analysis. Initially all 13 variables were input for processing. The value of KMO is 0.604 and Bartlett's test (significant level 0.000) indicated that the data were suitable for factor analysis. Based on the rule that the minimum eigenvalue should not be less than 1, four factors were extracted from factor analysis. For the purpose of easy interpretation, factor solution was rotated using varimax rotation. The first factor (factor 1) explained about 45.59 percent of the total variance; the second factor (factor 2) accounted for 15.22 percent, and the third factor (factor 3) explained 10.79 percent, and the fourth factor (factor 4) explained 10.27 percent. Together, the first four factors explained more than 82.3 percent of the variance (Table 2).

Interpreting factor loadings is the key in factor analysis. Factor loadings are measurement of relationships between variables and factors. Generally speaking, only variables with loadings greater than 0.32 should be considered (Tabachnick and Fidell, 1996). Comrey and Lee (1992) suggested a range of values to interpret the strength of the relationships between variables and factors. Loadings of 0.71 and higher are considered excellent, 0.63 very good, 0.55 good, 0.45 fair and 0.32 poor. Table (2) presents factor loadings on each indicator.

A comparison between the variables of four factors and the attributes of the domains of life that are identified for the objective part of the household as shown in Table (2).

Table 2. Factor analysis for objective indicators of QOL.

Attributes	Factors			
	1	2	3	4
GDP	-0.685-			
Unemployment	0.922			
Female work	-0.906-			
Illiteracy		0.947		
Disability		0.571		
Dropout		0.884-		
Physicians			0.936	
Access to hospitals			0.785	
Access to Schools			0.758	
Impervious				-0.923
Vegetation				0.905
LST				-0.686
Eigenvalue	5.5	1.9	1.3	1.2
Percent of variance	45.6	15.6	10.7	10.3
Percent Total explained variance	82.3			

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

First Factor: This factor mostly shows the highest loadings on attributes of the economic dimension of the quality of life, the two variables are negatively correlated with the factor.

Second Factor: This factor shows the highest loadings on attributes related to social aspects of life.

Third Factor: This factor mostly shows the highest loadings on attributes of the accessibility and quality of services.

Fourth Factor: This factor shows the highest loadings on attributes related quality of the environment.

3.2 *Objective Quality of Life Index*

The QOL index is developed by combining the scores of the four 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:

$$QOL_i = (45.6*Eco_i - 15.6 * Sco_i + 10.7 * Serv_i + 10.3* Envi_i)/100$$

Where: QOL_i is quality of life score of respondent i, Eco is economic score, Sco_I is social score, Serv is the accessibility and quality of services and Envi is the quality of environment. Figure (25) shows that five sheikhas have the highest class of objective QOL which are Nazlet Abdellah, Arab Almadabigh, Alsabiaa, Alkhamsa and Alsharikat.

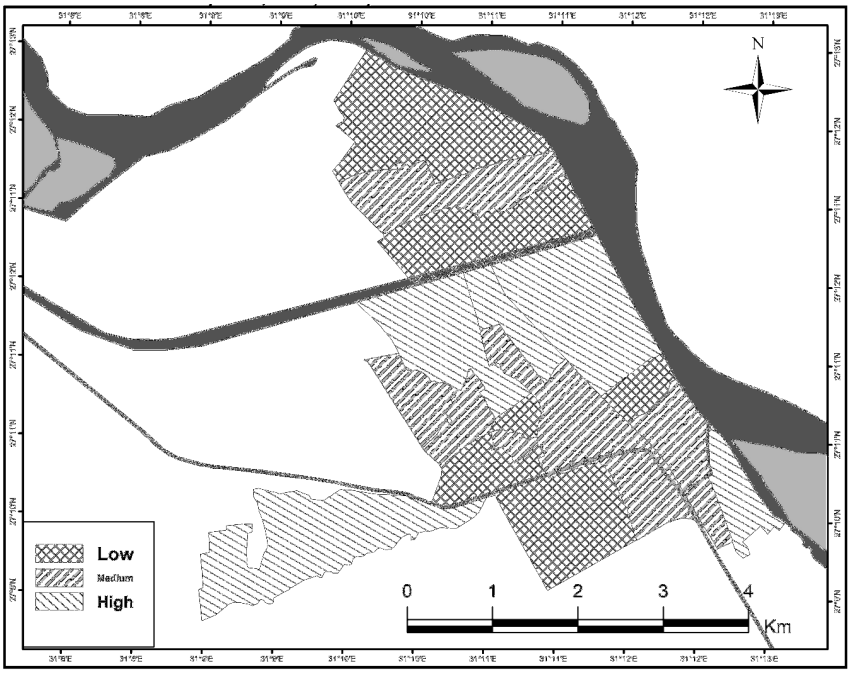

Figure 25. Objective quality of life index of Assuit Sheikhas depending on (2003, 2006, 2011) different time scale of data.

Source: Computed depending on factor analysis results for objective QOL indicators.

3.3 Factor analysis of the Subjective QOL indicators

There are several subjective attributes that may affect quality of life. The main challenge is how to develop indices from these attributes that can be used to predict QOL. Eleven variables which reflect the subjective wellbeing.

Initially all 13 variables were input for processing. The value of KMO is (0.604) and Bartlett's test (significant level 0.000) indicated that the data were suitable for factor analysis. Based on the rule that the minimum eigenvalue should not be less than 1, There factors were extracted from factor analysis. For the purpose of easy interpretation, factor solution was rotated using varimax rotation (Table 3). The first factor (factor 1) explained about 49.27 percent of the total variance; the second factor (factor 2) accounted for 18.12 percent, and the third factor (factor 3) explained 11.23 percent Together, the first Three factors explained more than 78.62 percent of the variance.

Table 3. Factor analysis for subjective indicators of QOL.

Attributes	**Factors**		
Satisfaction about	**1**	**2**	**3**
income	-0.755-		
Unemployment	0.822		
Female work	-0.936-		
Illiteracy		0.723	
Quality of schools		0.671	
Quality of hospitals		0.844-	
dropout		0.656-	
Access to schools		0.564-	
Access to hospitals		0.475-	
Environment quality			0.741
Vegetation			0.632
Eigenvalue	4.8	1.5	1.2
Percent of variance	47.27	18.12	11.23
Percent Total explained variance	78.62		

A comparison between the variables of four factors and the attributes of the domains of life that are identified for the subjective part of the household:

First Factor: This factor mostly shows the highest loadings on attributes of the satisfaction about the economic dimension of the quality of life, the two variables are negatively correlated with the factor.

Second Factor: This factor shows the highest loadings on attributes related to the satisfaction about social aspects, accessibility and quality of services.

Third Factor: This factor mostly shows the highest loadings on attributes of the satisfaction about environment quality.

3.4 *Subjective Quality of Life Index*

The overall score of each respondent is obtained by weighting each factor score by the respective variance as follows:

$$QOL_i = (47.27*Eco_i + 18.12 * Sv_I + 11.23* Envi)/100$$

Where: QOL_i is quality of life score of respondent i, Eco is economic score, SV_I is social aspects of life and accessibility and quality of services and Envi is the quality of environment. Figure (26) Sheikhas have the highest class of subjective QOL are Alhamra Alola, Alsadisa, Alrabiaa, Alsabiaa and Alsharikat

3.5 Combined subjective and objective quality of life Indicators:

The mean scores of objective QOL indicators and the mean scores of subjective quality of life indicators are compared in terms of the subjective and the objective QOL. The map in Figure (27) shows the distribution of QOL in Sheikhas depending on the comparison between subjective and objective QOL indicators and whether they are good or bad. Although in sheikhas such as Alsadisa, Alhamra Althania and Alwalidia Alqiblia where the objective living conditions are bad, individual's perception of living conditions is good. This is considered as a case of adaptation. On the other hand, in Albesari and Alola with good objective living condition, individual's perception of living conditions is bad so it can considered as a case of dissonance in these Sheikhas. If Both subjective and objective living conditions are bad so it is considered as a case of deprivation such as in Alwalidia Albahria. In the opposite case, when both subjective and objective living conditions are good so it can considered as a case of well-being such as in Alsabiaa, Alsharikat, Alkhamsa, Alsadisa and Alhamra Alola.

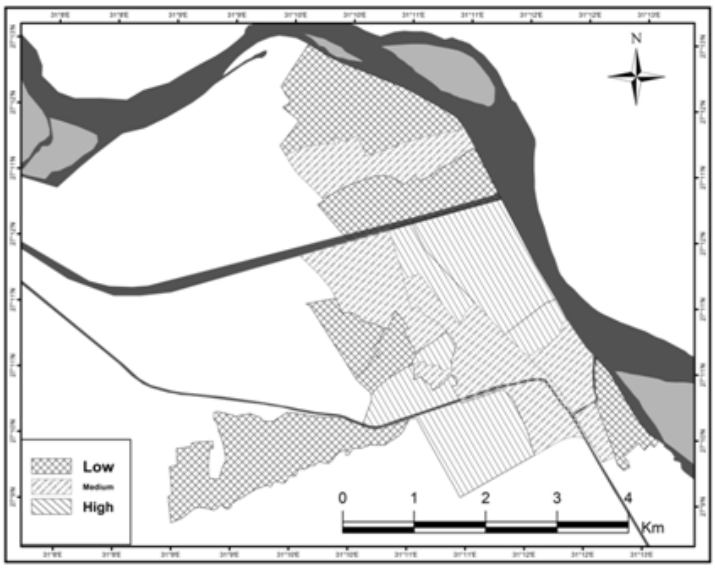

Figure 26. Subjective quality of life index of Assuit Sheikhas in 2011.
Source: Computed depending on factor analysis results for subjective QOL indicators.

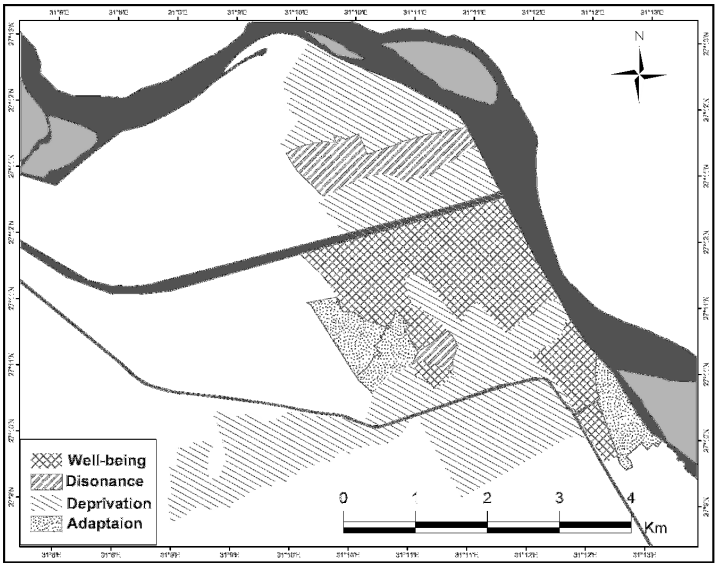

Figure 27. Combined objective and subjective quality of life index of Assuit Sheikhas in 2011.
Source: Computed depending on comparison between objective and subjective index.

4. Conclusions and Recommendations

4.1 *Conclusion*

This research has applied a methodology to develop measures for the quality of life in Assuit city study on Sheikhas level as a case study based on the integration of remote sensing imagery and GIS Techniques using both subjective and objective Quality of life (QOL) indicators.

The following are the major important concluding remarks:

- Both objective and subjective QOL are measured and its spatial distribution is evaluated. For subjective QOL, There is large variation in terms of response at five Sheikhas expressing high satisfaction while respondents in six Sheikhas expressed low satisfaction or worst feeling about the quality of their life.
- Correlation analysis explored the relationship between environmental and socioeconomic characteristics, and found that green vegetation. It had a significant positive relationship with unemployment, Illiteracy (0.032), Disability (0.328), Access to hospitals (0.547), Access to Schools (0.330), and a negative relationship with GDP, temperature, impervious surface, female participation in labor force, and dropout rate.
- A simplified model of subjective QOL is developed using three perceived attributes instead of eleven attributes. A causal model was developed for the subjective QOL in the sub-city. The model indicated that among the subjective QOL indicators, the strongest causal impact on the subjective QOL are economic factors while weakest causal impact on the subjective QOL is environmental factors.
- A simplified model for objective QOL is developed to reduce the twelve attributes into four factors. The dimensions of the objective QOL in Assuit are socio-economic status, quality and proximity to public services, environmental. The strongest causal impact on the objective QOL are economic factors while weakest causal impact on the subjective QOL is environmental factors.
- 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 Sheikhas indicated dissonance, adaptation, deprivation or well-being. In the Sheikhas with well-being and deprivation, the subjective and the objective perspectives could measure the same level of QOL.

- The domains of life that are included to measure the objective QOL are not included to measure the subjective QOL. For instance, impervious surface is not included in the subjective measure. It is difficult to conclude that the two perspectives will measure the same level of QOL. The result in this study also indicates the need to study the combined effect of both subjective and objective QOL.

4.2 Recommendations

- Given that sheikhas Alwalidia Albahria has the worst subjective and objective QOL the worst among Assuit sheikhas'. It should have a first priority in the development programs for from improving quality of life.
- Given that GIS and Remote sensing model have proved applicable and efficient, it is recommended to be generalized in urban areas in Egypt in future studies to make possible towards updating conditions of the all other areas of the country.
- Combined subjective and objective QOL should be studied together on all areas to assess both objective conditions and people's satisfaction.

Appendices

Appendix 1. Assessment of objective Indicators scores in Assuit city.

Objective Indicators	Assessment of objective Indicators scores		
	Low	**Medium**	**high**
Unemployment rate	0-10 %	10-20 %	20-30%
GDP per Capita	2500-2900 L.E	2900-3400 L.E	3400-3900 L.E
Female Participation in L.F	0-12%	12-14%	14-36%
Illiteracy rate	0-20%	20-40%	40-60%
Dropout rate	0-4%	4-8%	8-12%
Disability rate	0-0.05%	0.05-1%	1-1.5%
Physicians Per 1000 people	0-3%	3-9%	9+%
Access to Hospitals	2500-4000	500-2500	500>
Access to Schools	1500-3000	500-1500	500>
LST	24-26	26-28	28>
NDVI	0.05-0.1	0.1-0.15	0.15<
Impervious Surface	0-2	2-4	4<

Appendix 2. Objective Quality of Life Indicators in Assuit City.

Sheikhas	Objective Indicators											
	Unemployment rate	GDP per Capita	Female Participation in L.F	Illiteracy rate	Dropout rate	Disability rate	Physicians Per 1000 people	Access to Hospitals	Access to Schools	LST	NDVI	Imperviou s Surface
Alola	13.9	3135.5	15.6	14.9	4.6	1	0.000	2500	750	26.584	0.111	3.608
Althania	18.6	3377.6	25.3	19.1	3.1	1.5	6.355	2490	1100	28.226	0.161	1.988
Althaltha	15	3305.2	24.1	4.8	2.1	0.7	0.000	2450	800	26.16	0.097	5.669
Alrabiaa	17.7	3530.1	25.6	2.6	3.4	0.5	0.000	1250	550	25.746	0.088	3.739
Alkhamsa	9	3251.4	14.3	9.1	0.9	0.5	41.628	2300	1800	25.258	0.169	0.678
Alsadisa	13	3852.4	34.6	8	0.5	0.5	10.425	700	1350	26.322	0.106	1.844
Alsharikat	7.6	2546.9	33.7	0.7	0.1	0.4	0.715	900	1200	25.874	0.139	0.327
Almadabigh Arab	8.9	2728.1	5.8	4.6	6.1	0.6	0.000	4500	3200	28.219	0.133	0.635
Albesari	10.1	3191.8	17.4	5.1	3	0.7	0.000	2600	1450	27.576	0.18	1.816
Alola Alhamra	11.8	3389.9	23.9	4.6	1.4	0.7	0.054	2400	2100	28.072	0.127	1.9
Althania Alhamra	18.3	3492.7	31.8	3.5	0.4	0.6	0.105	1900	500	26.268	0.098	2.736
Albahria Alwalidia	17.7	2855.4	18.8	6	14.4	0.6	0.000	3500	2200	27.93	0.2	0.801
Alwestania Alwalidia	14.6	2785	25.8	5.3	1.1	0.5	4.704	3100	1950	28.158	0.172	1.933
Alqiblia Alwalidia	26.1	2680.4	25.6	3.7	0.4	0.6	2.693	2700	1700	26.963	0.198	1.539
Alsabiaa	9.4	3793.1	39.1	4.1	0.1	0.4	1.293	550	580	24.918	0.119	1.015
Abdellah Nazlet	7.3	3020.2	13.6	3.9	3.7	0.8	0.000	4300	3800	25.963	0.176	1.661
Average	13.9	3183.5	23.4	6.3	2.8	0.7	4.2	2383.8	1564.4	26.765	0.142125	1.991

Appendix 3. Assessment of Subjective Indicators scores in Assuit city.

Subjective Indicators	Assessment of Subjective Indicators scores		
	Low satisfied	Medium satisfied	High satisfied
Unemployment rate	2-3	3-4	4<
GDP per Capita	2-3	3-4	4<
Female Participation in L.F	2-3	3-4	4<
Illiteracy rate	2-3	3-4	4<
Dropout rate	2-3	3-4	4<
Disability rate	2-3	3-4	4<
Physicians Per 1000 people	2-3	3-4	4<
Access to Hospitals	2-3	3-4	4<
Access to Schools	2-3	3-4	4<
LST	2-3	3-4	4<
NDVI	2-3	3-4	4<
Impervious Surface	2-3	3-4	4<

Appendix 4. Mean Scores of Subjective Quality of Life Indicators in Assuit City.

Sheikhas	Mean Score of Subjective Indicators(Satisfaction About)										
	Income	Unemploy ment	Female Particip ation in L.F	Illiteracy	Dropout	Access to Hospitals	Access to Schools	Quality of Schools	Quality of Hospitals	Environm ental Quality	Green areas
Alola	2.1	4.1	2.5	3.1	2.2	3.5	3.6	2	3.2	2.1	2.1
Althania	3.3	3.2	3.4	3.2	3.5	3.4	3.4	4.4	3.3	3.1	2
Althaltha	4.2	4.2	3.3	2.4	3.6	3.2	3.7	4.1	3.6	2.2	2.3
Alrabiaa	4	2.2	4.4	2.7	3.7	4.4	3.8	4.3	3.5	2.3	3.5
Alkhamsa	3.1	2.3	3.3	3.8	4.2	4.1	4.4	4.1	4.1	4.4	4.1
Alsadisa	4.3	3.3	4.4	4.1	4.5	3.4	4.3	3.4	4.3	3.6	3.9
Alsharikat	4.4	3.4	3.2	4.3	4.3	4.2	4.2	3.6	4.4	3.2	4.3
Arab Almadabigh	2.1	4.5	2.1	2	2.2	2.1	2.3	2.4	2.3	3.9	2.6
Albesari	2.2	4.1	2.3	2.3	3.4	3.3	2.1	2.3	3.5	3.4	3.7
Alhamra Alola	3.4	3.4	3.4	3.1	3.7	4.2	4.2	3.4	3.7	3.8	4.1
Alhamra Althania	4.1	2.8	3.5	2.6	4.1	4.1	3.2	4.1	3.9	3.6	4.2
Alwalidia Albahria	2.3	4.2	2.2	3.4	4.4	2.2	2.1	2.3	2.8	2.4	2.6
Alwalidia Alwestania	2.5	4.1	3.7	4.2	2.7	3.3	2.3	3.2	3.1	3.6	2.7
Alwalidia Alqiblia	3.6	4	3.8	4.1	4.3	3.4	3.4	2.4	3.2	3.7	2.9
Alsabiaa	4.5	2.1	4.5	4.4	4.4	4.5	4.5	4.4	3.9	4.1	4.2
Nazlet Abdellah	2.4	3.5	2.5	2.2	2.3	2.2	2.2	2.3	2.3	4.5	2.9

References

1. Apparicio, P., and Daniel, N. (2008): The Quality of Urban Environment around public Housing Buildings in Montreal: An Objective Approach Based on GIS and Multivariate Statistical Analysis. Social Indicators Research, 86: 355-380.
2. Archibugi, F. (1974): The Quality of Life in a Method of Integrated Planning (Aspect of an Italian Research Project "Progetto");Socio Economic Planning Sciences, Vol.8, No 6.
3. Central Agency for Public Mobilization and Statistics (CAPMAS), 2007, Population Census 2006, Cairo, Egypt. "Population census in 1998 and 2008":, Vol. of Assuit Governorate .
4. Cicerchia, A. (1999), Measures of Optimal Centrality: Indicators of City Effect and Urban Overloading', Social Indicators Research 46(3), pp. 273–299.
5. Diener, E. (1984), Subjective Well-Being, Psychological Bulletin, 95(3), pp. 542–575.
6. General Authority for Urban Planning (2010) General and Strategic Plan of Assuit City.
7. Li, G. and Weng, Q.(2007) Measuring the Quality of Life in City of Indianapolis by Integration of Remote Sensing and Census data. International Journal of Remote Sensing, 28(2): 249-267.
8. Lotfi , S., and Solimani, N. (2009) An assessment of Urban Quality of Life using Analytic Hierarchy Process Approach (Case Study : Comparative Study of Quality of Life in the North of Iran) , International Journal of Social Sciences 5 (2): 123-133.
9. Marans, R. (2003): Understanding Environmental Quality Through Quality of Life Studies: The 2001 DAS and its use of Subjective and Objective Indicators. Landscape and Urban Planning, 65(1–2), 73–83.
10. McCrea et al. (2006): What is the Strength of Link between Objective and Subjective Indicators of Urban Life Quality ?, Applied Research in Quality of Life, Queensland, Australia.
11. McCrea, R. (2007): Urban Quality of life: Linking Objective Dimensions and Subjective Evaluations of the Urban Environment. Unpublished PhD Thesis, The University of Queensland, Brisbane.
12. McVeigh, T. (1971): Social Indicators: A Bibliography. Monticello: Council of Planning Librarians Exchange Bibliography No. 52.
13. Ministry of Education (2010): Schools Reports in Assuit Governorate.
14. Ministry of Health and Population (2010) Hospitals Reports in Assuit Governorate.
15. Moser, C. (1970). Measuring Quality of Life. New Society, 428, 1042–1043. Dec.10.
16. Nicholas, H., (1982) Geography and Quality of Life, Annals of The Association of American Geographers, Vol.72, No. 4.PP. 445-456.
17. Perz, S., (2000) The Quality of Urban Environments in the Brazilian Amazon. Social Indicators Research, 49(2), 181–212.

18. Rogerson, R., et al (1989) Indicators of Quality of Life – Some Methodological Issues. Environment and Planning A, 21(12), 1655–1666.
19. Santos, L. and Martins, I., (2007). Monitoring Urban Quality of Life: The Porto experience. Social Indicators Research, 80(2), 411–425.
20. Smith, D. M. (1973) The Geography of Social Well-Being in the United States: An introduction Territorial Social Indicator. New York: McGraw Hill.
21. Weber , C. and Hirsch (1992), Some Urban Measurements From SPOT Data : Urban Life Quality Indices, Journal of Remote Sensing.