

An Assessment of Urban Life Quality with Reference to Geographic Information Systems

Dr. Hanadi A. K. Alharbi

Social Sciences Department, Assistant Professor, College of Arts and Humanities, Taibah University-Medinah, Saudi Arabia

***Corresponding Author:** Dr. Hanadi A. K. Alharbi, Social Sciences Department, Assistant Professor, College of Arts and Humanities, Taibah University-Medinah, Saudi Arabia

Abstract: In the rapidly evolving landscape of urbanization, the quality of life in cities has become a paramount concern. As cities grapple with diverse challenges such as population growth, infrastructure development, environmental sustainability, and socio-economic disparities, the integration of Geographic Information Systems (GIS) has emerged as a transformative tool in enhancing urban life quality. The multifaceted role of GIS are shaping and improving various aspects of urban living. GIS technology enables the collection, analysis, and visualization of spatial data, offering valuable insights into urban planning, resource management, and decision-making processes. The integration of geospatial information facilitates a holistic understanding of urban dynamics, supporting evidence-based policy formulation and implementation. The GIS acts as a catalyst for positive change in urban environments. The integration of geospatial technologies not only provides valuable insights but also promotes collaboration among stakeholders, fostering a data-driven approach to urban development and ultimately contributing to an improved quality of life for urban residents. The paper delves into specific applications of GIS in urban life quality enhancement.

Keywords: Geographic, Information, quality, technology, urban life.

1. INTRODUCTION

The Role of Geographic Information Systems (GIS) in Urban Life Quality is a compelling and multifaceted exploration into the dynamic intersection of technology, geography, and urban living. In an era characterized by rapid urbanization and the increasing complexity of urban environments, GIS emerges as a pivotal tool that significantly influences and enhances various facets of urban life.

GIS refers to a system designed to capture, analyze, interpret, and visualize spatial data, providing a unique lens through which urban landscapes can be understood. This technology integrates geographic information, such as maps, satellite imagery, and data sets, enabling city planners, policymakers, and residents to make informed decisions for the improvement of urban life quality [11].

The urban environment is a complex web of interconnected elements, including infrastructure, transportation, public services, and environmental factors. GIS plays a crucial role in managing and optimizing these components, fostering sustainable urban development. Through the spatial analysis capabilities of GIS, cities can identify areas of congestion, plan efficient transportation routes, allocate resources effectively, and respond proactively to environmental challenges [9,10].

Moreover, GIS facilitates community engagement by providing a platform for citizens to interact with and contribute to urban planning processes. By incorporating public input, GIS helps ensure that urban development aligns with the diverse needs and preferences of the community, ultimately enhancing the overall quality of life [4].

In this exploration, we will delve into specific applications of GIS in urban life, including but not limited to urban planning, transportation management, disaster response, and environmental sustainability. By examining real-world examples and success stories, we aim to highlight the transformative impact that GIS can have on urban life quality, fostering smarter, more resilient, and inclusive cities for the benefit of all residents. Through this lens, we can gain a deeper understanding of how GIS serves as a powerful catalyst for positive change in the ever-evolving landscape of urban living [2, 3].

1.1. Roadmap for the Study

The integration of geospatial information facilitates a holistic understanding of urban dynamics, supporting evidence-based policy formulation and implementation. The roadmap for the study delves into specific applications of GIS in urban life quality enhancement, including about not limited to:

1. **Urban Planning and Design:** GIS aids in the efficient allocation of resources, optimal land-use planning, and the creation of sustainable urban environments. By modeling and simulating different scenarios, planners can make informed decisions to enhance the overall livability of the city[1].
2. **Transportation and Traffic Management:** GIS is instrumental in optimizing transportation networks, reducing traffic congestion, and improving accessibility. Real-time data analysis assists in the development of smart transportation systems, leading to enhanced mobility and reduced environmental impact [6].
3. **Environmental Sustainability:** GIS supports monitoring and management of environmental factors, such as air and water quality, green spaces, and waste management. This contributes to creating ecologically balanced and resilient urban ecosystems [5 7].
4. **Public Health and Safety:** GIS plays a crucial role in disease surveillance, emergency response planning, and healthcare resource allocation. Mapping disease patterns, identifying vulnerable populations, and optimizing emergency services contribute to a safer and healthier urban environment.
5. **Social Equity and Community Development:** GIS enables the identification of socio-economic disparities, helping policymakers address issues related to housing, education, and healthcare. Community mapping and participatory GIS empower residents to actively engage in decision-making processes, fostering inclusive urban development.

Through an examination of case studies and successful implementations, this paper illustrates how GIS acts as a catalyst for positive change in urban environments. The integration of geospatial technologies not only provides valuable insights but also promotes collaboration among stakeholders, fostering a data-driven approach to urban development and ultimately contributing to an improved quality of life for urban residents [12, 7].

1.2. Objective

An empirical study on the Role of GIS in Urban Life Quality with various aspects including Urban Planning and Design, Transportation and Traffic Management, Environmental Sustainability, Public Health and Safety, Social Equity and Community Development.

The study will focused on the public opinion about the utilization of GIS in the modern context in order to manage quality urban life.

Also making an assessment about the efficiency and utility of GIS in the development of urbanization and managing the daily routine.

1.3. Dataset

As per the nature of the study minimum opinions of the 450 peoples are recorded through the survey and analysis the same according to framed hypothesis. To collect the data 5-Point Likert scale will be utilized. A 5-point Likert scale is a commonly used method for measuring attitudes, opinions, or perceptions in survey research. It provides respondents with a range of response options to express their level of agreement or disagreement with a statement.

Strongly disagree (1): This response indicates a strong disagreement or a low level of agreement with the given statement. The respondent strongly opposes or disagrees with the idea presented.

Disagree (2): This response suggests a moderate level of disagreement with the statement. While the respondent may not strongly oppose the idea, they still express a negative sentiment.

Neutral (3): This point represents a neutral stance. The respondent neither agrees nor disagrees with the statement. It is a midpoint on the scale and often serves as a baseline for neutrality.

Agree (4): This response indicates a moderate level of agreement with the statement. The respondent is in favor of the idea presented, but not emphatically so.

Strongly agree (5): This response signifies a strong agreement or a high level of agreement with the statement. The respondent strongly supports or agrees with the idea presented.

1.4. Hypothesis

The study addresses a broad domain with multiple application of a particular technology, thus there is need to assessment with multiple hypothesis then after the outcome will be summarized to conclude the assumptions in broad sense.

H1: There is significant correlation between of GIS in Urban Planning and Design in present context.

H2: There is significant contribution of GIS software in transportation and traffic management.

H3: There is significant requirement of GIS support in Environmental Sustainability.

H4: There is significant contribution of GIS software in public health and safety.

H5: There is significant relation between of GIS in Social Equity and Community Development

2. RESEARCH METHODOLOGY

The research approach for the study comprises multifold features to assess the actual outcome required. In this study, at the early stage the collection of data made by the survey. Here the collection of opinion accomplished by the help of selected expert and critical user of the GIS technology and traditional technology. Thus we can say that primary data were gathered for the study and the scale of the data collection is 5-point Likert scale as mentioned above.

Data cleaning and transforming is the next step where the recorded data will be finalized for the further process with unified approach. After finalization of the dataset in all the aspects, analysis of the data will take place in different forms as demographic data, factor data, opinion analysis and hypothesis analysis..After analysis of the data and results of various hypothesis test final conclusion will be accomplish which gives an outcome of the study.

2.1. Data Analysis

The analytical framework will comprise demographic data analysis, close loop data analysis along with the hypothesis analysis.As per seeing the subject wideness 05 hypothesis will be made to form the final conclusion.The statistical test like z-test, ANOVA and Regression analysis will be applied as per nature of data and hypothesis.

2.2. Demographic Data Analysis

The researcher has taken sample of respondents from Saudi Arabia region. As per the opinion finalized for the study after the transformation, the total figures of the respondents are 450, where the received data were 525. Out of this it is observed that the count of the male respondents is 242 which are 54% of the total similarly the count of the female is 208 whichis 46% of the total data.

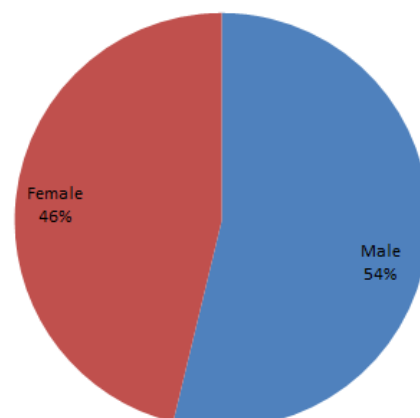


Figure1. Gender ratio

According to data received by the respondents, there are various types of expert and user are get involved as Potential User of GIS applications, Urban planner officials, Navel user, Researcher of the domain and GIS experts. The variety of the respondents plays critical role in the development of proper outcome also they play crucial role to stop the biasness of the responses. The figure of Potential GIS user is highest with 240, GIS experts holds the figure of 66, Researcher carries 44, Urban planner officials are 55 and number of novel user are 45.

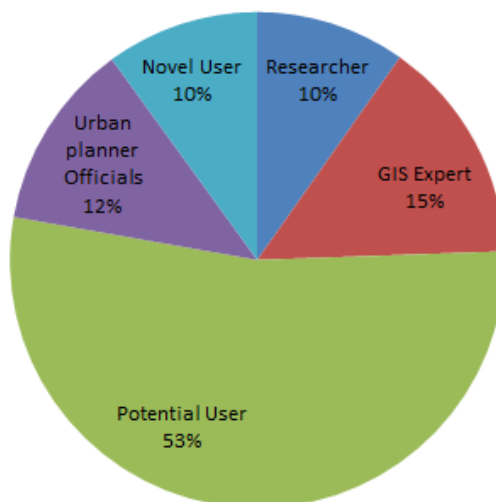


Figure 2. Ratio of Respondents

2.3. Hypothesis Analysis

In this section we are assessing hypothesis on the basis of opinion received from the respondents. These hypothesis output provides us a clear view about the factors which are enhanced by the help of GIS and it's vice versa.

Analysis of Hypothesis-1

H1: There is significant correlation between of GIS in Urban Planning and Design in present context.

H0: There is no significant correlation between of GIS in Urban Planning and Design in present context.

To assess the hypothesis -1 we have to take opinion of the respondents in the reference of enhanced form of urban planning and designing by the support of geographical information system. Therefore we are taking two key questions for the same and applying regression analysis to find out the correlation between the statements. The opinion collected through the questions / variables are:

1. It is observed that modern urban planning and designing is too efficient in all aspects.
2. The support of GIS enhanced the modern city/ town planning with efficient manner.

Table 1. Regression value for hypothesis-1

Regression Statistics	
Multiple R	0.509605
R Square	0.259697
Adjusted R Square	0.258044
Standard Error	0.879716
Observations	450

According to the regression test value of the hypothesis -1 test it is find that the value of R is 0.5096 which shows that there is above average correlation exists in between the variables. Thus we can say that the null hypothesis accepted but not in the full swing, the relation is not fully connected to each other, although correlation is exists among them. So we will consider that there is average correlation between of GIS in Urban Planning and Design in present context.

Analysis of Hypothesis-2

H2: There is significant contribution of GIS software in transportation and traffic management.

H0: There is no significant contribution of GIS software in transportation and traffic management.

To assess the hypothesis -1 we have to take opinion of the respondents in the reference of enhanced form of transportation and traffic management by the support of geographical information system. Therefore we are taking two key questions for the same and applying Z test analysis to find out the significance between them. The opinion collected through the questions / variables are:

1. It is observed that modern transportation and traffic management is moreover efficient in the entire aspects.
2. The provision of GIS enhanced the modern transportation and traffic management with efficient manner.

Table2. z values for hypothesis-2

	Variable 1	Variable 2
Mean	3.786	3.693
Known Variance	0.658	0.845
Observations	450	450
z	1.615	
P(Z<=z) one-tail	0.053	
z Critical one-tail	1.65	

According to the z test value of the hypothesis -2 test it is find that the value of observed of the z is 1.61 which shows that the observed z value is lesser than critical z values 1.65 for one tail test. Thus we can say that the null hypothesis accepted so we can say that there is significant contribution of GIS software in transportation and traffic management.

Analysis of Hypothesis-3

H3: There is significant requirement of GIS support in Environmental Sustainability.

H0: There is no significant requirement of GIS support in Environmental Sustainability.

To assess the hypothesis -3 we have to take opinion of the respondents in the reference of enhanced form of environment and sustainability by the support of geographical information system. Consequently we are captivating two key queries for the analysis of said hypothesis and applying z test to find out the significance between them. The opinion collected through the questions / variables are:

1. Environment protection and sustainability should be one of the key considerable with the modern town planning.
2. The GIS support is useful for maintaining environment sustainability in modern context.

Table3. z values for hypothesis-3

	Variable 1	Variable 2
Mean	3.837	3.753
Known Variance	0.969	1.05
Observations	450	450
z	1.26	
P(Z<=z) one-tail	0.104	
z Critical one-tail	1.65	

According to the z test value of the hypothesis -3test it is find that the value of observed of the z is 1.26 which shows that the observed z value is lesser than critical z values 1.65 for one tail test. Thus we can say that the null hypothesis accepted so we can say that there is significant requirement of GIS support in the environmental sustainability.

Analysis of Hypothesis-4

H4: There is significant contribution of GIS software in public health and safety.

H0: There is significant contribution of GIS software in public health and safety.

To assess the hypothesis -4 we have to take opinion of the respondents in the reference of finding assessment about the public health and safety by the support of geographical information system. Therefore we are taking two key variable / questions based on the public health and safety along with GIS influences. After that we are applying regression analysis to find out the correlation between the statements. The opinion collected through the questions / variables are:

1. It is observed that modern public health and safety approach is increased rapidly.
2. The influence of GIS enhanced the public health and safety in efficient manner.

Table4. Regression value for hypothesis-4

<i>Regression Statistics</i>	
Multiple R	0.510
R Square	0.260
Adjusted R Square	0.258
Standard Error	0.880
Observations	450

According to the regression test value of the hypothesis -4test it is find that the value of R is 0.510 which shows that there is above average correlation exists in between the variables. Thus we can say that the null hypothesis accepted but not in the full swing, the relation is not fully connected to each other, although correlation is exists among them. So we will consider that there is average correlation between of GIS in public health and safety in present context.

Analysis of Hypothesis-5

H5: There is significant relation between of GIS in Social Equity and Community Development.

H5: There is no significant relation between of GIS in Social Equity and Community Development

To assess the hypothesis -5 we have to take opinion of the respondents in the reference of finding assessment about the Social equity, Community development and Geo-informatics software approaches to modernized the urban scenario. Therefore we are taking three key variable / questions based on the Social Equity and Community Development along with GIS influences. After that we are applying analysis of variance (ANOVA test) to find out the significance of the statements. The opinion collected through the questions / variables are:

1. In the present the social equity get enhanced by the help of software exposure.
2. The community development gets pace by approaching online / software support.
3. Geo-informatics software provides key platform to social equity and community development.

Table5. ANOVA for hypothesis-4

Groups	Count	Sum	Average	Variance		
Variable 1	450	1724	3.83	0.43		
Variable 2	450	1750	3.88	0.46		
Variable 3	450	1741	3.87	0.47		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.843	2.000	0.421	0.927	0.396	3.002
Within Groups	611.872	1346.000	0.455			
Total	612.715	1348.000				

According to table-5 it is observed that the mean values of the opinion for all the variables are almost equal which shows similarity in the opinion for each variable. It is also noted that variances are also showing similarity. As per the result of analysis of variance the observed F value is 0.927 which is lesser than the critical F value, which is 3.002. Thus as per the F value we can say that null hypothesis is accepted and alternate hypothesis is rejected. So conclusion is there is significant relation between of GIS in Social Equity and Community Development.

3. RESULT

As per the study point of view there are four major factors which are taken in the account namely urban planning and design, Transportation and traffic management, Environment sustainability, Public health and safety, along with Social equity and community development. All the major factors are examined with the influence of geographical information system software approaches. From the hypothesis analysis it is found that 03 hypotheses are strongly influenced by the GIS and 02 are average influences.

SN	Factors	Relation
1	Urban planning and design	Average
2	Transportation and traffic management	Strong
3	Environment sustainability	Strong
4	Public health and safety	Average
5	Social equity and community development	Strong

Thus, we can say that GIS gives positive effect on the urban quality life and it is one of the great influencer tool and technology to manage and upgrade the modern world with diverse geographical areas.

4. CONCLUSION

The result and hypothesis analysis shows clearly the zest of the study that the role of GIS is too much important in the quality life of the modern city and urbanization. This is great geographical development which reduces the geographical distances as well as curvature fittings on the earth. The GIS application software provides efficient support to measure and present the geographical information for utilization in the multiple aspects. This increase the efficiency and fast development along with enhanced decision capacity. Therefore finally from the study it is drawn that the role of GIS is too much important in urban quality life.

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