



Urban Governance and Renewable Energy for Sustainable City Planning and Management

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Abstract

In recent years, significant transformations have occurred in urban systems and their management by enhancing and developing governance through a comprehensive and organized framework based on multiple studies and methods in city management, particularly in the environment and energy sectors. To achieve a balance in the utilization of natural resources and improve the quality of life, the research aims to transform energy into sustainable forms, known as renewable energies, through urban governance as a transitional approach in traditional energy systems and the establishment of long-term sustainable planning systems through self-organizing governance work. This method enables all city sectors to rely on clean energy sources by creating digital governance maps to determine the future directions of cities, bridge gaps, and solve pollution problems and environmental issues. The goal is to develop flexible cities with advanced communications technology and digital governance capable of managing their systems independently. These efforts provide an organized and integrated approach to sustainability assessment, which is an essential part of the city planning process, including the classification and evaluation of alternatives and plans. By analyzing data through SPSS and utilizing Cronbach's Alpha, the research evaluates energy-related factors affecting the sustainability of cities by assessing suitability and quality criteria.

Keywords: Urban Governance; Sustainable Energy; Smart City; SPSS Software.

1. Introduction

The concept of governance is a system through which decisions are made, outlining a set of methods by which individuals and institutions, both public and private, plan to manage the common affairs of the city. This includes both formal and informal institutions through planning, financing, and managing urban areas to make decisions regarding urban issues in various economic, social, and environmental conditions to provide essential urban services by defining objectives. Urban management is considered essential to the concept of equitable and sustainable urban development [1]. This is most evident in the form and structure of urban administrative content, as urban governance serves as a political guiding framework for sustainability and resilience. It should be adopted as a systematic local framework in the agendas, programs, and approaches of cities. Urban governance aims to organize the processes and relationships that govern how public authorities, civil society, and the private sector interact in planning, financing, and managing urban development. As urbanization accelerates globally, effective governance is critical to ensuring that cities remain sustainable, inclusive, and resilient [2].

1.1. Literature Review

Mitra et al. (2024) addressed urban governance in a traditional manner, defining it as a set of methods through which individuals and institutions, both public and private, plan and manage the shared affairs of a city. It includes both formal and informal institutions by engaging in planning, financing, and managing urban areas to make decisions on urban

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decisions on urban issues under different geographical, social, and political conditions to provide essential urban services. Urban governance is considered essential for the concept of fair and sustainable urban development. It is most apparent in the political content and structure of urban governance and is a guiding political pathway for sustainability and resilience. Urban governance should be adopted as a systematic local framework in cities' agendas, programs, and approaches [3].

Zhang (2023) focused on improving the efficiency of urban governance to achieve sustainable development by introducing digital technology into urban community management, transforming them into smart communities. It integrates urban community management with digital technology to ensure the rational use of resources through data monitoring and analysis to address societal challenges like transportation systems and environmental pollution. It aims to create communities that use information and communication technology in their management, enabling a better understanding of urban community conditions and providing more suitable and efficient public services to improve residents' quality of life. The goal is to create a structural decision support system, with localized intelligence for each community, aiding in decision-making through the use of various informational resources and analytical tools [4].

McGuirk & Dowling (2021) addressed the scope of urban management in European cities as a dynamic phenomenon that consists of a diverse social dimension connected by multiple lines of local authorities. Thirty years ago, the urban system was a networked governance model involving urban management that produced social achievements through the coordination of various actors (public, private, and community) to manage and control cities. Urban management expanded to urban governance through methodologies, analyses, urban experiments, and societal techniques to understand the interconnected nature of the city, identify problems, and have centralized and directed capacities to formulate decisions flexibly and increasingly improve urban planning towards sustainable development [5].

Yigitcanlar & Kamruzzaman (2015) highlighted the importance of policies and strategies related to sustainable urban development in the management and planning of future cities. It points out that sustainability operates in two opposing directions: strong sustainability, which focuses on preserving and enhancing natural capital, and good sustainability, which allows for the replacement of human and natural capital at an acceptable level. To ensure strong and long-term sustainability, the concept of urban sustainability has adopted a new approach that relies on the principle of integrated urban governance. This aims to create sustainable cities across all their systems—environmental, health, economic, and social. The approach introduces new frameworks and guidelines for incorporating urban sustainability into urban planning and governance processes to achieve long-term and effective strategies. The study concludes that urban management is an integrated mechanism within planning and development processes. It emphasizes the need for a continuous link between urban planning and development to form a cohesive mechanism that achieves sustainable outcomes [6].

Urban governance plays a critical role in shaping the sustainability of cities. As urban areas continue to expand, the challenges associated with urbanization necessitate effective governance frameworks that prioritize sustainable development. This literature review examines contemporary research on urban governance and its impact on city sustainability, highlighting key concepts, trends, and findings. Urban governance encompasses the institutions, policies, and processes through which urban areas are managed. It involves multiple stakeholders, including local governments, private sectors, and civil society, working collaboratively to achieve urban development goals. Effective urban governance is essential in fostering sustainability through various mechanisms. Policy formulation: strong governance frameworks enable the development of policies that integrate environmental, social, and economic considerations. Research shows that cities with robust governance structures are more likely to implement sustainable practices [7].

2. Theoretical Approach

2.1. Urban Governance

To achieve the concept of sustainable development in city planning, systems and policies must be followed in managing urban and community affairs through developmental methods characterized by guidance, accountability, and transparency. This coordination is crucial for the governance and control of the city [8]. Governance has evolved to encompass all aspects of the city, including economic, social, environmental, and institutional (administrative) dimensions, forming a new, more comprehensive concept known as "urban governance". This concept involves organizing sustainability aspects to ensure sound management in decision-making by the entities responsible for city and community affairs. The diagram below illustrates the relationship between governance and sustainable development for optimal planning, highlighting the main factors and indicators of urban sustainability (see Figure 1) [9].

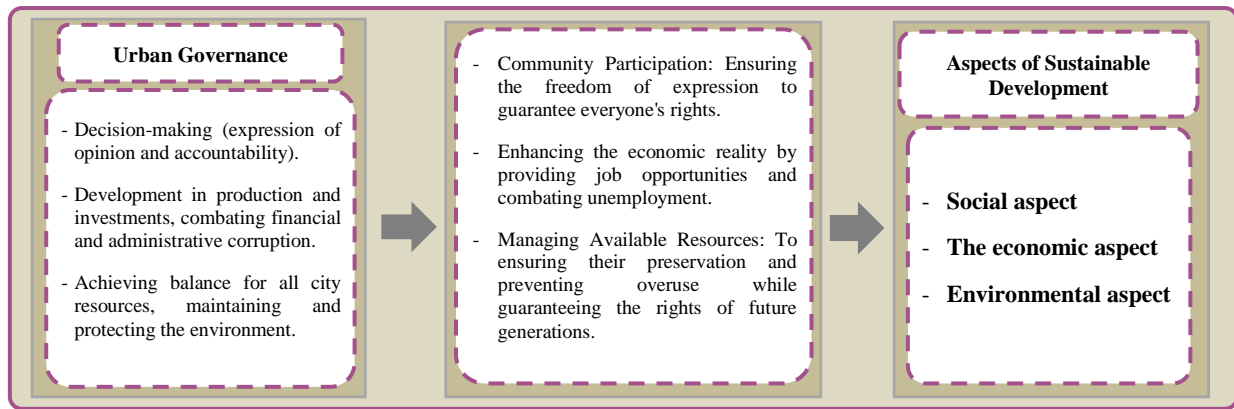


Figure 1. The figure illustrates the governance aspects of cities

2.2. Sustainable Development

The concept of sustainability emerged in an era characterized by increasing environmental degradation and social inequality [10]. Growing concerns about climate change and social responsibility have led institutions to reassess their decision-making methods. Integrating governance standards with aspects of sustainability (environmental, social, and economic) is crucial in core decision-making processes and leadership development to achieve sustainable urban governance [11]. Additionally, the effective evaluation of environmental risks within cities is a major focus of this research, highlighting governance pathways that align with sustainability aspects to enhance urban resilience in the face of environmental risks. This leads to continuous and equitable balance, aiming to empower societies with self-development capacity, ensuring an improved quality of life for all individuals and meeting current needs without causing harm to future generations [12].

2.3. Sustainability Aspects

It is essential to understand the three dimensions of sustainability and how they interact. These aspects are interrelated, and none can exist without the others, making it impossible to determine which is more urgent or critical [13, 14].

- **Economic Aspect:** The economic aspect generally refers to the ability of an economy to maintain a certain level of output over a long period [15]. Economic sustainability requires continuous growth of businesses or the economy over time through appropriate resource allocation, enabling efficient production, profitability, and capital preservation. It is vital for addressing social crises such as reducing poverty and unemployment by providing investment opportunities and jobs [16]. Hence, economic activities must be sustainable to guarantee future generations' right to job opportunities, ensuring the efficient use of resources and understanding the strategic efficiency of the current environment through urban governance. This is achieved by assessing strategic positions on resource use and environmental conditions or vice versa; when environmental strategic plans are established by governments or institutions, they usually adhere to environmental measures, ensuring that activities and industries are environmentally friendly [17, 18].
- **Social Aspect:** A sustainable society is based on social justice and environmental equity, fostering long-term human interaction and ensuring fair and inclusive provision of community environments [19]. More compact, high-density, and mixed-use urban forms are environmentally sound, transport-efficient, socially beneficial, and economically feasible. Urban governance plays a role in managing social, environmental, and economic factors by examining sustainable development and sustainability in relation to the built environment. Managing the social aspect is challenging due to its invisibility, as it involves complex relationships governed by traditions, race, identity, and other factors. Governance plays a crucial role in managing community interactions through organizations and institutions, ensuring that needs are largely met, and that the community is involved in decision-making processes [20, 21].
- **Environmental Aspect:** The environmental aspect of sustainability focuses on improving human well-being by protecting the natural resources used to meet human needs. Sustainability is achieved within an ecological-economic framework with limited resources [22]. Governance plays a role in limiting key activities related to the subsystems of the human economy, such as resource use, pollution, and waste management, to maintain the biosphere and support life on Earth. Effective management ensures maximizing future options for both current and future generations by promoting biodiversity, managing climate risks, and utilizing renewable energy sources [23]. This framework covers energy systems, including the use of renewable energy, energy conservation, and bioenergy (see Figure 2) [24].

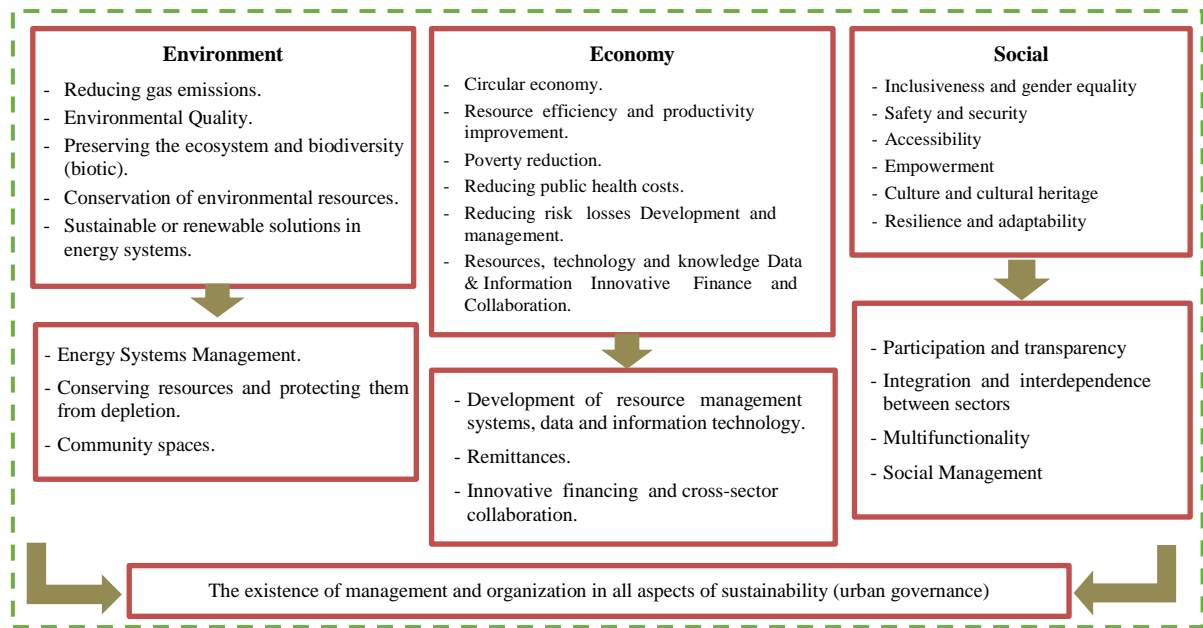


Figure 2. The presence of urban governance with sustainability aspects

2.4. Urban Governance Indicators

- **Participation and Transparency:** These are the primary drivers for communication and interaction in decision-making processes and services designed to address societal issues [25]. The goal is to achieve high-quality, efficient results. An analytical approach based on participatory digital governance is essential for urban planning and service design [26].
- **Social Management:** Social management systematically strives to achieve goals by providing public services and initiatives efficiently, equitably, and transparently [27]. Governance officers and stakeholders play key roles in planning processes, with limited community involvement. This type of management requires transparency and diversity in planning [28].
- **Multi-functionality:** A key strategy for land use in urban communities involves managing land equitably and fairly. The aim is to achieve harmonious use of spaces, ensuring balance among different land uses such as tourism, economic activities, cultural spaces, and residential areas [29].
- **Energy Systems Management:** The use of renewable energy sources increases energy security and enables countries to meet climate change mitigation goals. Sustainable energy is closely linked to climate policies, innovation, trade, foreign, and security policies. Urban governance plays a critical role in developing long-term strategic plans to reduce pollution through environmental laws and energy management [30, 31].
- **Resource Protection:** Resource preservation is essential to preventing environmental degradation. Urban governance is responsible for safeguarding resources from depletion, ensuring long-term protection and sustainability [32].
- **Community Spaces and Green Structures:** Urban green spaces are vital components of ecosystems and sustainable community development, serving both as recreational areas and as the “lungs” of the environment. These spaces fulfill users’ needs through their functions and are essential elements in any community development, including housing, commercial areas, and recreational zones [33]. The quality of green spaces is measured by factors like infrastructure, vegetation, accessibility, and safety. Effective management is required to ensure proper distribution, ease of access, and optimal usage of urban green spaces, with walking distances being a key factor for determining accessibility [34].
- **Finance and Cross-sector Collaboration:** One of the main challenges facing sectors is sustainable financing and management. Four key areas must align across sectors: shared objectives, a common vision, and priorities, all of which are vital to ensuring sustainable long-term financing. Strong governance structures, including local representation and voices in decision-making, help guide action and ensure progress. Sustainable financing encourages partners to remain accountable and responsible for future development [35].

- **Information Technology:** Information technology (IT) impacts nearly all sectors of society, with active IT development closely linked to economic growth. IT also plays a significant role in the organization and management of community affairs. The need for advanced IT in different sectors is crucial for the full, timely collection of information, as well as for its storage, exchange, and processing. This ensures that the system remains competitive and organized [36].

From the above, we observe that urban governance is a key factor in achieving urban sustainability by providing effective management and organization of cities and communities across economic, social, and environmental dimensions. Urban governance aims to enhance sustainability indicators through proactive management and sustainable urban planning, ensuring efficiency and equity among stakeholders and institutions. Urban governance offers technical solutions to address social issues such as rapid urbanization by prioritizing services and ensuring their equitable and fair spatial distribution. It also addresses environmental issues, including energy management and climate protection, as well as economic concerns related to financial management and the regulation of technology across sectors. The primary goal is to build a flexible structure that facilitates collaboration and participation in decision-making, thus promoting long-term urban sustainability. The concept of governance emerged from the need to address crises caused by corruption and poor management, and to enhance transparency and accountability in decision-making. Governance is essential for ensuring more efficient and fair management of institutions, whether public or private, especially following financial crises and economic collapses. It prompts a revaluation of how resources are managed and policies directed to achieve sustainable development and the public good.

3. Research Methodology

The researcher relied on previous studies to establish the relationship between urban governance and sustainability. Several papers relevant to the study topic were reviewed to identify useful indicators for achieving sustainable urban governance in the study area. The descriptive method was used for the theoretical framework, while both quantitative and qualitative analyses were applied. A questionnaire was administered and analyzed using SPSS software, with Cronbach's Alpha used to test the reliability of the data. The practical part of the research focused on evaluating indicators in the Sultan Complex, located in Najaf, Iraq (see Figure 3).

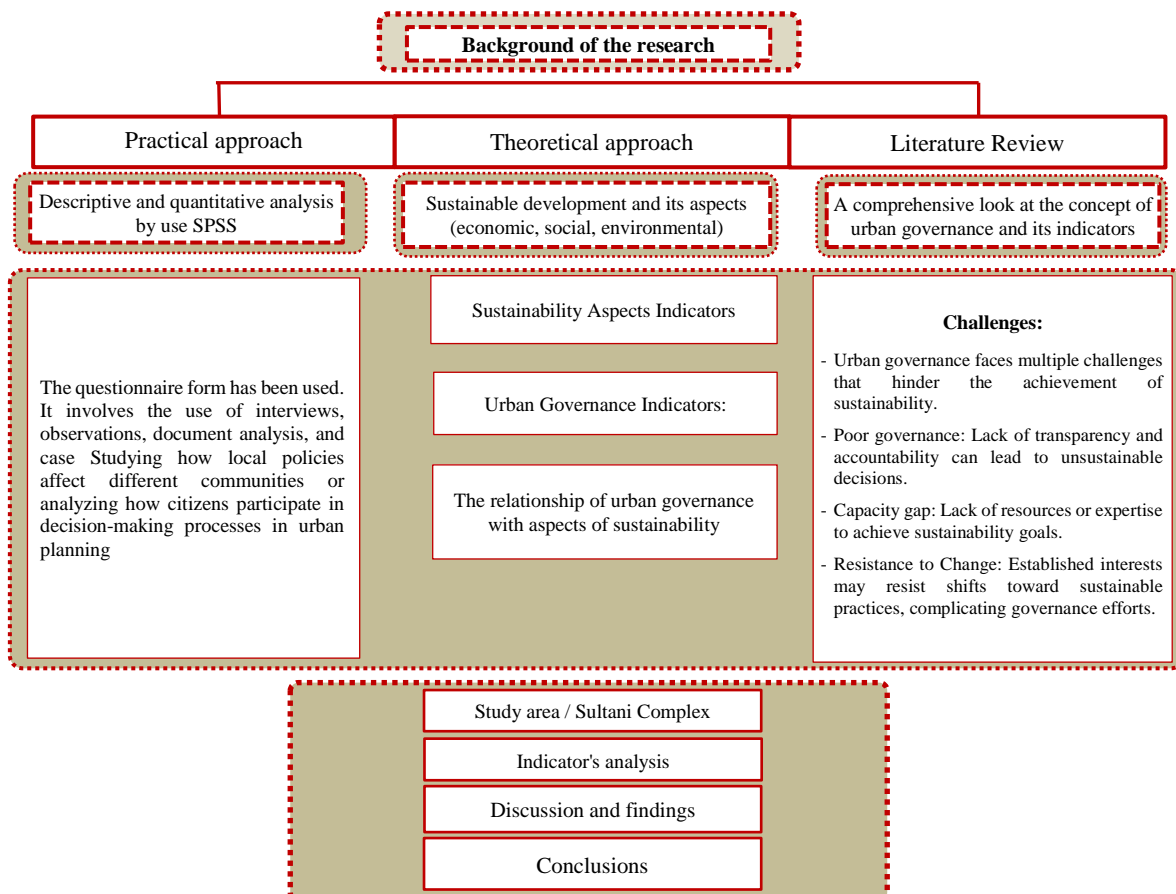


Figure 3. Methodology of the research

4. Case Study

The Sultan Complex is located in the northern sector of the city of Najaf, geographically positioned at the north-eastern corner of the administrative region of Najaf. It is near the city center and covers an area of 211 dunams (approximately 52 acres). The complex contains 1,050 housing units, varying in land size, building size, and price. In addition to residential units, the complex includes public service and recreational facilities, such as schools and a three-story commercial center with a basement level. There is also a local market serving the residents, along with green spaces interspersed throughout the complex. The complex is equipped with the latest services and was constructed using ICF (Insulated Concrete Form) technology, an environmentally friendly method that provides thermal insulation for residential units, reducing energy consumption for heating and cooling. The complex was established in 2011 to address the housing crisis (see Figure 4).

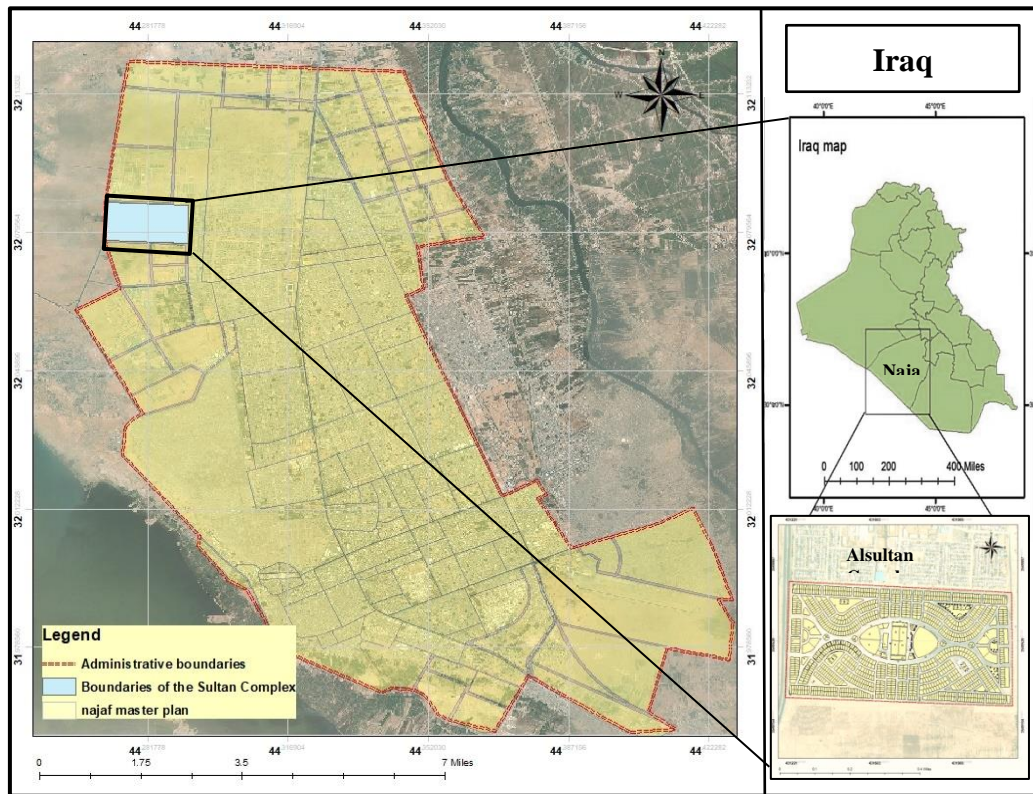


Figure 4. Location of the study area; (Alsultan Complex) in the city of Najaf

5. Results and Discussion

The data used in the practical framework of the study was collected from several sources, including relevant government agencies such as the Najaf Municipality and the Directorate of Urban Planning in Najaf. Additionally, the researcher conducted a field survey and gathered data through a questionnaire, the results of which were analyzed using the Statistical Package for the Social Sciences (SPSS). Geographic Information Systems (ArcGIS) were also employed for spatial data analysis.

5.1. Land Use

Land use is a fundamental consideration in urban studies, as cities function as systems composed of residential, commercial, industrial, tourism, and transportation sectors, all interconnected. Urban governance plays a crucial role in managing these systems. Through governance mechanisms, city authorities can manage zoning laws, land allocation, infrastructure development, and public services, all of which directly influence how land is utilized. Land use is typically measured through three key indicators:

- **Spatial distribution:** This refers to how different activities are spread across the city and their degree of variety.
- **Mixed-use development:** This refers to the integration of various activities within the same area, reducing reliance on transportation and increasing efficiency.
- **Functional proximity:** This indicates how close complementary activities are to each other, facilitating ease of access.

Spatial Distribution of Land Use in the Sultan Complex:

Land use percentages in the complex vary depending on the type and size of activity. The distribution of land use across different sectors is shown in Table 1 and Figure 5.

Table 1. The land use (Alsultan Complex) in the city of Najaf

Land use	Area (ha)	Percentage %	Analysis
Residential	25.58	55 %	Conforms to the standard (It demonstrates a high degree of compliance with the standard)
Roads	12.72	27.3 %	
Green Spaces	5.15	5 %	
Educational	18.30	4.1 %	
Commercial	1.49	2 %	
services	1.08	2 %	
Religion	0.005	0.1 %	
Health	0.005	0.1 %	
Publics	0.0049	0.09	
Total: 95 %			

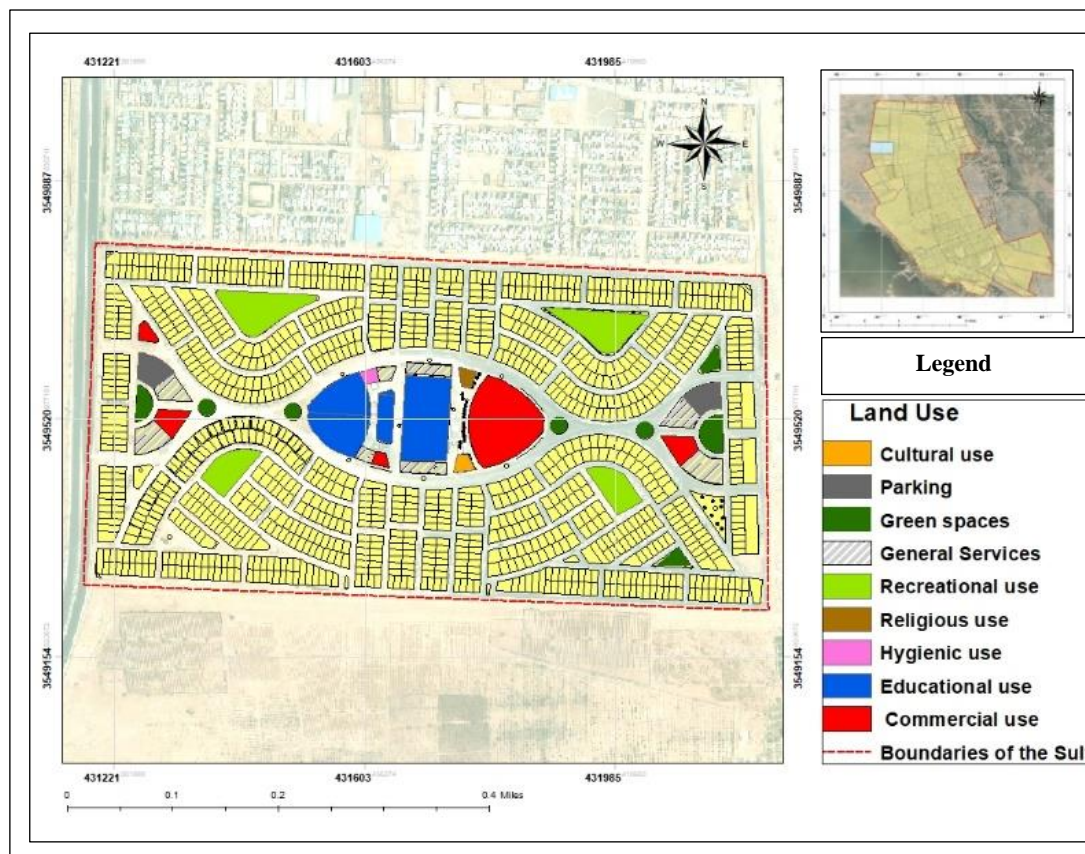


Figure 5. The land use (Alsultan Complex) in the city of Najaf

Mixed Use:

Mixed Land Use: This involves combining residential, commercial, cultural, and institutional functions, integrating these purposes both physically and functionally. The integration of these functions creates efficient design spaces and enhances connections among areas. However, in the Sultan Complex, there are no mixed-use buildings or multi-functional vertical structures, as indicated by the survey results from the complex residents. The findings show that the residents do not support the presence of multi-story buildings for residential or mixed-use purposes, as shown in Figure 6.

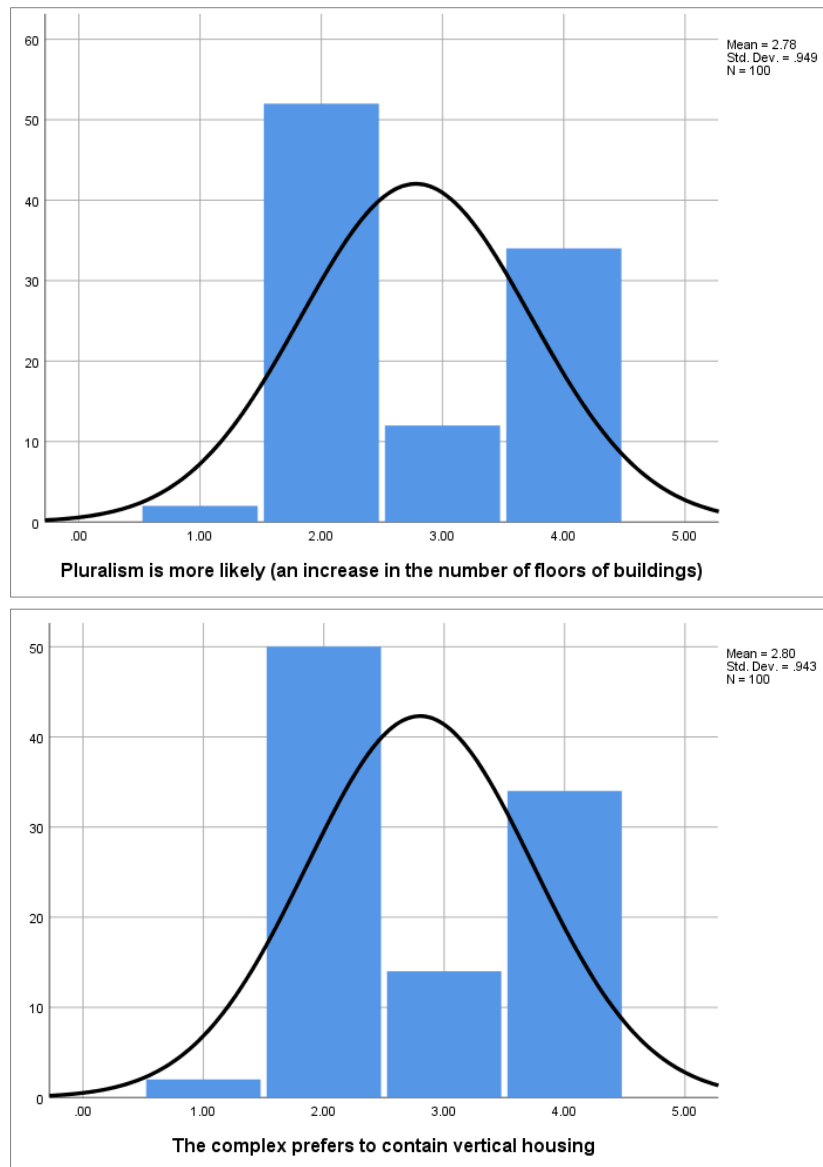


Figure 6. The Mixed Use (Alsultan Complex) in the city of Najaf

Functional Proximity:

Proximity refers to the morphological quality of the urban context that encourages walking by arranging primary types of land use and services. The preferential walking standard is usually between five to ten minutes, which corresponds to a distance of approximately 400-800 meters. The effectiveness of functional proximity is influenced by spatial systems, links, and transportation patterns. This indicator ensures equal access to services for all residents. According to the field survey, the Sultan Complex achieves functional proximity, as the map illustrates that all housing units have equal access to all services within the complex.

5.2. Environmental and Energy

One of the most crucial factors to consider is the need for communities to reduce pollution, protect biodiversity, and conserve natural resources. This involves improving resource efficiency and advancing renewable energy management to mitigate the effects of climate change. Three indicators are used to measure this factor: renewable energy management, green spaces, and recycling.

- **Renewable Energy Management:** Renewable energy provides a means of ensuring energy security and improving environmental protection. It represents a strategic peak for the new generation of energy technologies. As national policies evolve and renewable energy technologies advance, achieving sustainability relies heavily on renewable energy. Through field surveys, it was observed that the Sultan Complex supports and promotes the use of renewable energy, particularly solar energy. Many homes are equipped with designated areas for solar panels, although they are not efficient enough to meet household energy demands due to damage and a lack of knowledge about their maintenance. The researcher suggests establishing a specialized area within the complex for managing and maintaining these panels regularly, as shown in Figure 7.

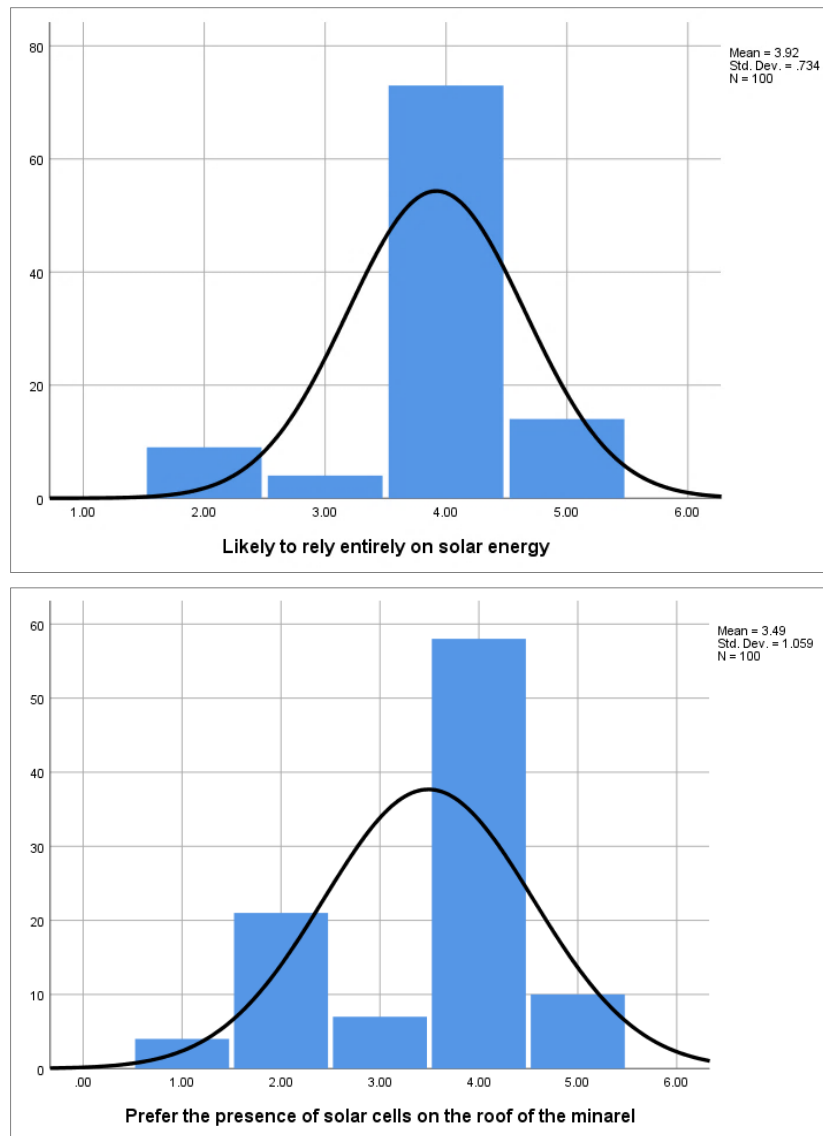


Figure 7. Use of renewable energy (Alsultan Complex)

- **Green Spaces:** Urban green spaces are recreational facilities and play a vital environmental role in sustainable communities. There are two aspects to green space availability: proximity, which relates to social access to the nearest green space, and availability, which can be measured through the individual green space index (the amount of green space per person in the complex). This is assessed against the natural standard of 20 square meters per person.
- **Recycling:** This indicator measures the process of treating solid waste and recycling it into new, useful materials. Designated recycling areas and systems for sorting waste by residents are essential for effective recycling efforts. The indicator measures the percentage of recycled waste compared to the total waste generated in the residential area, which should not be less than 50% of the total waste produced.

5.3. Economy

The economic aspect of governance and sustainable cities is a key element in achieving balanced and sustainable urban development. Building sustainable cities requires not only environmental and social planning but also a focus on economic sustainability to ensure long-term prosperity and improved quality of life for urban residents. It includes three indicators: developing resource management systems, data and information technology, innovative financing, and cross-sector collaboration.

There is no clear economic link or economic indicators within this complex, as such complexes may form part of an urban development plan that includes the construction of religious and educational institutions, which in turn may affect the economic activity in the city. Government or private investment in building such complexes may be part of a larger investment strategy that includes providing jobs and enhancing the service economy in the city.

Urban governance and city sustainability are deeply interconnected, as effective management of urban resources is key to balancing economic, environmental, and social needs. Urban governance involves organizing decision-making processes and engaging multiple stakeholders, such as local governments, civil society, and the private sector, to ensure collaborative efforts toward sustainable development goals. Successful governance is based on principles like transparency, accountability, and efficiency in managing urban resources and directing them toward uses that support economic prosperity and social well-being. Sustainable cities are an urgent necessity, especially given the increasing environmental pressures from climate change and the degradation of natural resources. Urban sustainability focuses on developing resilient and integrated infrastructure that incorporates renewable energy, smart transportation systems, and eco-friendly waste management. It also aims to achieve social equity by ensuring equal access to essential services such as education, healthcare, and housing. Achieving this balance between governance and sustainability requires cooperation on multiple levels, starting with smart urban planning that considers green spaces and reduces carbon emissions and extending to greater citizen participation in decision-making processes. Technology plays a key role in supporting these efforts by enabling smart cities that use data and analytics to improve resource efficiency and reduce waste.

6. Conclusion

Governance in urban contexts primarily focuses on the process of governing cities, involving interactions between various formal and informal urban institutions and influencing policies and decisions that impact urban public life. The success of urban governance depends on reinventing city governments and reinvigorating non-governmental sectors with a focus on sustainable urban development. Political will, urban normative concerns, and organizational flexibility are crucial. It is essential to pay close attention to the mechanisms and modalities employed by urban governments to formulate and implement policies and equally important to critically examine whether these policies are being efficiently and honestly implemented by urban agencies and organizations tasked with executing them.

It is also necessary to assess whether, and to what extent, urban governments have established meaningful linkages with various elements of urban civil society that can support the concern for sustainable urban governance. Governance in the urban context needs to be transformed to serve as the key instrument toward the effective implementation of urban public policies. This transformation requires a multi-pronged strategy to strengthen the capacities of all actors involved in urban governance, including municipal authorities, private entities, and civil society.

Urban governance for sustainable human development must be given a broader meaning, encompassing not just efficient city government but also other formal and informal urban institutions, public-private partnerships, legal and regulatory reforms, decentralization of city functions, and the empowerment of urban communities. The state, the private sector, and NGOs, particularly community-based organizations (CBOs), should cooperate and coordinate to make sustainable urban governance a reality. This cooperation is vital for addressing the unique challenges of cities and ensuring the sustainability and well-being of urban residents.

7. Declarations

7.1. Author Contributions

Conceptualization, S.K.A. and S.F.A.; methodology, S.K.A.; software, S.F.A.; validation, S.K.A. and S.F.A.; formal analysis, S.A.S.; investigation, S.F.A.; resources, S.K.A.; data curation, Y.F.A.; writing—original draft preparation, S.K.A.; writing—review and editing, S.K.A.; visualization, S.K.A.; supervision, S.K.A.; project administration, S.F.A.; funding acquisition, S.K.A. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7.4. Institutional Review Board Statement

Not applicable.

7.5. Informed Consent Statement

Not applicable.

7.6. Declaration of Competing Interest

The authors declare that there are no conflicts of interest concerning the publication of this manuscript. Furthermore, all ethical considerations, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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