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Research titled

Importance of GIS APLICATION IN MUNICIPAL WORK: Al Mafraq greater municipality case study

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Abstract

GIS mapping technology is a cornerstone of modern government operations, enhancing everything from the citizen experience to data-driven decision-making. By providing visual and valuable insights into a wide range of issues, GIS technology enables local governments to function more effectively and efficiently.

This study focuses on the application of Geographic Information Systems (GIS) in municipal work, using the Al Mafraq Greater Municipality as a case study. It highlights the significance of integrating GIS into municipal operations, especially in surveying buildings and lands, which require precision and clarity. GIS achieves this by leveraging spatial data for processing, distribution, usage, maintenance, and preservation, making it an essential tool in contemporary municipal work.

The study employs a descriptive analytical approach to examine scientific phenomena or problems. This method involves systematically describing the subject matter and deriving logical explanations based on evidence. Such an approach allows the researcher to thoroughly understand and emphasize the importance of GIS implementation in municipal settings.

keywords: GIS, municipality, Al Mafraq

Introduction

Since its inception, the Internet has brought transformative changes to information tools and computer systems. Today, people have access to advanced, full-service computer workstations. The Internet has interconnected vast repositories of human knowledge, providing access to centuries of accumulated information. It has permeated nearly every area of human interest, becoming an essential resource for users across various fields. However, this widespread availability of information raises an important question: how effectively can this information be delivered to and utilized by the public? (1)

In recent years, information technology has emerged as one of the fastest-growing scientific disciplines, spanning across all fields of knowledge. This growth is evident in state administration, where there is an increasing demand for Geographic Information Systems (GIS) to manage and analyze data within their jurisdictions. GIS is utilized not only at the regional level but also within smaller municipalities and local city districts, highlighting its widespread application and importance. (2)

Geographic Information System (GIS) technology is a branch of information technology that leverages location data to integrate diverse types of information. By adopting a geographic or geospatial approach, GIS combines data from multiple sources, revealing complex relationships that might otherwise go unnoticed. This technology significantly impacts nearly every aspect of modern local government operations, offering a solid foundation for coordinating and integrating municipal services. Many communities have developed extensive information systems using GIS, recognizing it as a critical tool for decision-making and planning analysis. Local government agencies have also discovered its potential to provide decision-

makers with comprehensive, real-time information, enhancing their ability to make informed decisions (Peng, 2001). (1)

As cities expand, the complexity and volume of spatial databases managed by municipalities continue to grow. To address this, all data must be efficiently collected, utilized, and maintained using the tools provided by a local government GIS. Additionally, city managers require access to a robust information system to support their decision-making processes. Similarly, citizens should have the ability to access map information and geospatial services, which can save time and simplify their interaction with geographical data (Huxhold, 1991). (1)

There is often an implicit, and sometimes explicit, assumption that employing GIS at the local level is both efficient and effective. It is believed that GIS can simultaneously address planning content, answer geo-information queries, and align with the interests of local stakeholders. Participatory GIS (P-GIS) is particularly expected to be implemented in an inclusive manner, incorporating local information, including Indigenous Spatial Knowledge (ISK), as a distinct category. This assumption frequently positions GIS as a tool for improving governance (3)

However, GIS outputs have limitations. They may distort or oversimplify spatial realities by representing patterns without capturing underlying processes, and even flows can be challenging to depict. While GIS excels in answering questions such as "what," "when," "who," and "where," it falls short in addressing the "how" and "why." Fundamental aspects such as economic and social power, which are crucial for understanding the "why," are often absent in GIS analyses. (3)

Geographic Information Systems (GIS) is a framework for collecting, managing, and analyzing geographic data. The key aspect of this technology is geography, which means that some of the data is linked to specific locations on the earth. (4)

GIS enables municipalities to manage their assets more effectively, enhance communication and collaboration, address critical questions, and integrate various types of geographic data in different ways. A robust GIS program includes trained personnel and a set of information technology tools that capture, store, manipulate, analyze, manage, and present geographically referenced data. (4)

What can my municipality do with GIS technology? (4)

- Manage community infrastructure and assets.
- Ease accessibility to public information with online zoning, utility and parcel maps, and other public data.
- Track and plan for infrastructure maintenance and updates related to water, sewer, electricity, and roadway infrastructure.
- Plan more effectively for the future.
- Visualize, explore, and assess the opportunities and challenges associated with future growth and development.
- Determine the most suitable locations for new homes, businesses, schools, and parks.
- Use printed base maps at public meetings to engage with citizens.
- Optimize public safety information and reporting.
- Support emergency response systems.
- Empower citizens to geographically pinpoint non-emergency issues, such as potholes and non-working light fixtures, and communicate those concerns to city management.

- Save time and money.
- Increase operational efficiency and effectiveness by consolidating a community's geospatial data and automating tasks.
- Analyze trends to allocate budgets and evaluate programs.
- Facilitate collaboration and data sharing between different sectors of local government.

Municipal GIS (MGIS) is a collection of methodological, organizational, software, technical, and informational tools aimed at enhancing the management of city infrastructure through the application of new information technologies. Geographic information systems are utilized in government for decision-making at all levels, from national to neighborhood levels. Local government authorities recognize the importance of improving the quality of their products, processes, and services by using resources more efficiently. A GIS can be employed to inventory resources and infrastructure, plan transportation routes, enhance public service delivery, manage land development and administration, and generate revenue by boosting economic activity. (6)

Local governments utilize GIS technology in distinctive ways. They are responsible for ensuring the long-term health, safety, and welfare of their citizens. Therefore, broader issues must be taken into account, such as integrating public values into decision-making, providing services fairly and equitably, and representing citizens' views by collaborating with elected officials. Common applications of GIS include monitoring public health risks, managing public housing, allocating welfare assistance funds, and tracking crime rates. Similar to geo-demographic analysis, geographic information systems are also employed for operational, tactical, and

strategic decision-making in areas like law enforcement, health care planning, and education system management.

Al Mafraq Greater Municipality: an overview

Greater Mafraq Municipality, situated in northeastern Jordan within the Mafraq Governorate, holds significant importance due to its strategic position near the borders of Syria and Iraq. It is responsible for delivering essential services, including infrastructure and waste management, while emphasizing sustainable development through collaborative projects with local and international organizations. The municipality encounters considerable challenges stemming from population density and the influx of numerous Syrian refugees, yet it continually strives to enhance services and foster social integration, positioning itself as a model that balances historical context with contemporary challenges. (Mafraq.gov.jo)

The Geographic Information System (GIS) Department of the Municipality of Mafraq is part of the Organization and Planning Department, which manages all organizational matters within the borders of the Greater Mafraq Municipality. This includes introducing organization, expanding administrative borders, creating, canceling, and modifying streets, aligning organizational plans with the ministry, issuing building licenses, handling all separation and unification transactions, purchasing road and street waste, managing clearing sales and transfer transactions, and all related activities.

This department also issues site plans and demarcation for all plots affiliated with the Greater Mafraq Municipality, carries out all surveying work, and provides technical opinions for all transactions related to the organization. It also grants clearances for any transactions within the department and follows up on all construction and project works within the municipality's borders. Additionally, it

names streets within the city and its suburbs, divides plot subject to the division project, and then clears the plots that have been separated from division work using a division form. It follows up and implements all decisions received from the local and municipal councils and the district committee, and grants technical consultations for all areas affiliated with the Greater Mafraq Municipality.

MGM has established a GIS department in the recent short period, where the USAID Municipal Support Program (MSP) successfully supported the institutionalization of the GIS Unit within the organizational structure of Mafraq Municipality.

This initiative included:

1. Equipping the GIS section with two high-specification desktops and installing ArcGIS software, provided through the Ministry of Local Administration (MOLA).

2. MSP delivered five customized on-the-job training sessions for the GIS staff

3. These sessions focused on developing a robust GIS database with critical 10 layers, such as land use, municipal zones, roads, landmarks, and municipal assets.

A set of tasks has been set for the GIS department to perform:

- Building a base map for the city of Mafraq and updating the geographical layers for the work of the departments and regions.
- Updating land divisions and providing them to the departments.
- Producing maps and plans and providing the departments and regions of the Mafraq Municipality in addition to satellite images.
- Preparing geographical analytical studies "spatial".
- Developing geographical applications for the work of the departments and regions.

- Providing government institutions, security agencies, and the local community with data and geographical maps.
- Raising awareness of the Geographic Information System (GIS) by holding workshops for employees and university students.
- Exchanging information with external departments and institutions.

Research problem

MGM has recently established a GIS department to enhance its performance and increase its effectiveness. The municipalities currently lack an overall database. Therefore, it is crucial to demonstrate how GIS can be applied at MGM to ensure reasonable growth through partnerships among departments and state institutions.

Importance of the study

This study will highlight the significance of implementing GIS as a component of modern technologies, where municipalities have become integrated into e-governments and are connected to state institutions in various procedures, such as collecting dues and taxes, as well as expropriation, land divisions, and clearance. Therefore, it is crucial to establish a system that facilitates this cooperation and shares the necessary database.

Research objectives

Describe the importance of applying GIS in municipal work.

Show how GIS be applied in municipal work.

Research questions

How can GIS be applied in municipal work?

What is the importance of applying GIS in municipal work?

The importance of applying GIS in municipal work

GIS enables a municipality to effectively manage its assets, enhance communication and collaboration, address critical questions, and integrate various geographic data in diverse ways. A robust GIS program includes trained personnel and a suite of information technology tools designed to capture, store, manipulate, analyze, manage, and present geographically referenced data. (11)

Moreover, a common observation, particularly in developing countries, is that the potential benefits of GIS technology in the development process are not sufficiently disseminated or understood. This gap exists both among the recipients of planning and development and those who oversee the planning and development processes.(7)

Geographical Information System (GIS) technology is an information technology that employs location data to integrate various types of information. It adopts a geographical or geospatial approach to combine data from multiple sources and reveal complex relationships that might be challenging to comprehend otherwise.(1)

The use of GIS aims to simplify workflows. It enables the application of spatial or geographical methods for managing municipal resources. Furthermore, by allowing the registration of non-spatial or attributive information about geographical objects (known as features in GIS terminology), GIS empowers users to define spatial locations geographically, utilizing maps instead of textual descriptions. GIS can identify spatial relationships between features and analyze their impact on city development, population growth, criminal activity, and more. Importantly, GIS facilitates the integration of data from various city agencies and municipal departments into a cohesive "municipal environment." (1)

Applying GIS will facilitate the municipality's communication with institutions and citizens, making it easier for them to obtain information without needing to visit the municipality headquarters and explore their city. It also assists municipal employees in updating their data remotely and generating reports on municipal activities. Additionally, GIS helps establish clear work paths before going on-site, limiting variables such as the number of buildings, housing, and facilities for planning purposes. It also streamlines the process of directing employees and workers to specific addresses to provide certain services and to navigate between different municipal areas. (5)

Several benefits of use of GIS applications in municipal work are as presented below:

- rapids official procedures therefore Save time.
- Increases efficiency.
- Important for decision support and planning analysis in a faster and cost-effective way.
- Optimize accuracy between different data resources.
- Manages resources in the territory of the municipality concerning environmental protection.
- Saves money, time human resources and Automates tasks.

Use of GIS applications in municipal work

GIS technologies can be applied in all areas of municipal e-services provided to citizens, such as issues related to municipal property, segregation, unification, purchasing road and street waste, clearing sales and transfer transactions, planning,

security, environment, and other services. The most important of these applications are the following:

decision making

GIS allows users to extract information from various systems and present the data together in both digital and paper maps. For instance, library user data from a library management system can be visualized on a map alongside recreation class registrations from another software system to identify potential usage patterns. GIS can assist in managing and utilizing data for better decision-making and workflow efficiency. With regional and shared-service approaches, the barriers related to resources and expertise in using the technology decrease, making it accessible even for the smallest agencies. (9)

Better Access to Property Records

GIS is a geospatial database that can connect information about individual properties to specific locations on a map. This database can store a wide range of information, including ownership, zoning, land use, tax assessments, and building permits, allowing localities to quickly and efficiently retrieve important data.

Planning and zoning

Planners and land use specialists rely on GIS to analyze land use patterns, identify potential development sites, create zoning maps, and document zoning regulations. GIS also assists planners in generating more accurate population projections, assessing the impact of new developments on traffic patterns, and making well-informed decisions regarding the allocation of new public services. (10)

GISs have been recognized as a very important tool for decision support and planning analysis. Moreover, city managers must have access to an appropriate

information system that could help them in the decision-making process. Just the same, citizens should have access to map information and geospatial services to save their time and facilitate access to geographical data. (1)

Transportation Planning and Service Routing

Geographic information systems are also used to plan and classify urban roads. The map below shows the road network in a municipality. Using GIS technology, the roads were classified as trunk, primary, secondary, and access roads. A road condition survey was conducted to collect information on each segment of the urban roads for a spatial database. This included road (and street) names, road dimensions (width and length of the road), pavement type, major landmarks on the road, and economic activities along the road. The database was used for planning urban roads, classifying them in a hierarchy, naming the roads, and installing road name signage. The GIS was useful for mapping road conditions, activities along the road, and accessibility and then planning accordingly for road upgrading and prioritizing investments in road making. (12)

Conclusion

GIS implementation is not without its obstacles. There are short-term costs of hardware and software procurement and maintenance, as well as the costs (in both money and time) of training staff who lack experience and expertise. These initial costs may require a reallocation of resources, affecting other programs and staff. It may also be a challenge to keep up with ever-advancing technology and a greater demand for services.

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