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RESEARCH PAPER

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Use of GIS in Urban Planning: A Case Study of Mashad the Holy City of Iran

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ABSTRACT

Urban planning is a technical and political process concerned with the development and use of land, planning permission, protection and use of the environment, public welfare, and the design of the urban environment, including air, water, and the infrastructure passing into and out of urban areas, such as transportation, communications, and distribution networks Urban planning is also referred to as urban and regional planning, regional planning, town planning, city planning, rural planning or some combination in various areas worldwide. It takes many forms and it can share perspectives and practices with urban design. GIS has reduced the time needed to complete mapping tasks by more than 90 percent and the result is a better product. Advances in GIS and supporting technologies have led to the development of decision support systems that facilitate the community planning process. There are several planning support systems (PSS) available on the market today to ESRI users. PSS use indicators and alternative development scenarios to measure the attributes and performance of communities and their plans increased customer service efficiency. GIS Division provides board access to geospatial data and applications throughout the City and to the public.

Key words: GIS, Urban Planning and Mapping.

INTRODUCTION

Urban planning guides orderly development in urban, suburban and rural areas. Although predominantly concerned with the planning of settlements and communities, urban planning is also responsible for the planning and development of water use and resources, rural and agricultural land, parks and conserving areas of natural environmental significance. Practitioners of urban planning are concerned with research and analysis, strategic thinking, architecture, urban design, public consultation, policy recommendations, implementation and management Davreu, Robert (1978).

Urban planners work with the cognate fields of architecture, landscape architecture, civil engineering, and public administration to achieve strategic, policy and sustainability goals. Early urban planners were often members of these cognate fields. Today urban planning is a separate, independent professional discipline. The discipline is the broader category that includes different sub-fields such as land-use planning, zoning, economic development, environmental planning, and transportation planning (Kolb, Frank 1984).

GIS were developed in the late 1960s, yet in the early days very few planning departments installed them because of the prohibitive cost of hardware and the limited capabilities of the software. Most of the early software systems focused on computer mapping with few analytical functions. The most powerful software at that time was grid based (e.g. IMGRID: Sinton 1977). The subsequent fall in the prices of hardware, computer storage, and peripherals, accompanying improvement in the performance of hardware and software (particularly the speed of computer processors), and advances in the data structures and related algorithms of vector-based GIS (see Worboys, Chapter 26), has made GIS more affordable, less time consuming and more workable. Since the early 1980s, there has been a marked increase in the installation of GIS in different levels and departments of urban and regional governments in the developed countries, notably of Europe (Bardon et al 1984; Campbell 1994) and North America (French and Wiggins 1990): see Campbell, Chapter 44. With the further decrease in the price of computer hardware and software, the use of GIS has emerged in urban planning in the dev eloping countries in the 1990s (Yeh 1991). GIS is increasingly accessible to planners and is now an important tool for urban planning in developed and developing countries alike.

GIS is just one of the formalized computer-based information systems capable of integrating data from various sources to provide the information necessary for effective decision-making in urban planning (Han and Kim 1989). Other information systems for urban planning include database management systems (DBMS), decision support systems (DSS), and expert systems. GIS serves both as a database and as a toolbox for urban planning (Figure 1). In a database-oriented GIS, spatial and textual data can be stored and linked using the geo- relational model. Current GIS support efficient data retrieval, query, and mapping. Planners can also extract data from their databases and input them to other modelling and spatial analysis programs.

When combined with data from other tabular databases or specially conducted surveys, geographical information can be used to make effective planning decisions. As a toolbox, GIS allows planners to perform spatial analysis using geo processing functions such as map overlay, connectivity measurement, and buffering (Berry 1987; Tomlin 1990). Of all the geo processing functions, map overlay is probably the most useful tool. This is because planners have a long tradition of using map overlay inland suitability analysis which is itself an important component in urban planning (Hopkins 1977; McHarg 1969; Steinitz et al 1976).

Database management, visualisation, spatial analysis, and spatial modelling are the main uses of GIS in urban planning (Levine and Landis 1989; Marble and Amundson 1988; Webster 1993, 1994). GIS is used for the storage of land use maps and plans, socioeconomic data, environmental data, and planning applications. Planners can extract useful information from the database through spatial query. Mapping provides the most powerful visualization tools in GIS. It can be used to explore the distribution of socioeconomic and environmental data, and display the results of spatial analysis and modelling exercises. Spatial analysis and modelling are used for spatial statistical analysis, site selection, identification of planning action areas, land suitability analysis, land use transport modelling, and impact assessment.

Interpolation, map overlay, buffering, and connectivity measurement are the most frequently used GIS functions in spatial analysis and modelling. The use of the above functions varies according to different tasks and stages of urban planning.

The many benefits in using GIS in urban planning include (Royal Town Planning Institute 1992): improved mapping – better access to maps, improved map currency, more effective thematic mapping, and reduced storage cost; greater efficiency in retrieval of information; faster and more extensive access to the types of geographical information important to planning and the ability to explore a wider range of 'what if ' scenarios; improved analysis; better communication to the public and staff; improved quality of services, for example speedier access to information for planning application processing.

Fig 1. Use of GIS for new information of Emam Reza (A.S.) location.

THE USE OF GIS IN DIFFERENT FUNCTIONSAND STAGES IN URBAN PLANNING

Urban planning involves many functions, scales, sectors, and stages. In general, the functions of urban planning can be classified into general administration, development control, plan making, and strategic planning. General administration and development control are relatively routine planning activities, whereas plan making and non-routine strategic planning are undertaken much less frequently. The scale of the planning area covered can range from a whole city, to a sub-region of a city, a district, or a street block. The most frequently involved sectors of urban planning are land use, transport, housing, land development, and environment. At each scale of planning there are different stages: the determination of planning objectives; the analysis of existing situations modelling and projection; development of planning options; selection of planning options; plan implementation; and plan evaluation, monitoring, and feedback. Different functions, scales, sectors, and stages of urban planning make different uses of GIS.

The use of the data management, visualisation, spatial analysis, and modelling components of GIS varies according to different functions of urban planning (Figure 2(a)). Data management, visualisation, and spatial analysis are used more in

Fig 2. Use of GIS for Mashad Emam Reza (A.S.) place.

There is evidence of urban planning and designed communities dating back to the Mesopotamian, Indus Valley, Minoan, and Egyptian civilizations in the third millennium BCE. Archeologists studying the ruins of cities in these areas find paved streets that were laid out at right angles in a grid pattern (Boerefijn, Wim 2010). The idea of a planned out urban area evolved as different civilizations adopted it. Beginning in the 8th century BCE, Greek city

states were primarily centered on orthogonal (or grid-like) plans.[6] The ancient Romans, inspired by the Greeks, also used orthogonal plans for their cities. City planning in the Roman world was developed for military defense and public convenience. The spread of the Roman Empire subsequently spread the ideas of urban planning. As the Roman Empire declined, these ideas slowly disappeared. However, many cities in Europe still held onto the planned Roman city center. Cities in Europe from the 9th to 14th centuries, often grew organically and sometimes chaotically. But many hundreds of new towns were newly built according to preconceived plans, and many others were enlarged with newly planned extensions. Most of these were realized from the 12th to 14th centuries, with a peak-period at the end of the 13th (Smith Morris, 1997).From the 15th century on, much more is recorded of urban design and the people that were involved. In this period, theoretical treatises on architecture and urban planning start to appear in which theoretical questions are addressed and designs of towns and cities are described and depicted. During the Enlightenment period, several European rulers ambitiously attempted to redesign capital cities. During the Second French Republic, Baron Georges-Eugène Haussmann, under the direction of Napoleon III, redesigned the city of Paris into a more modern capital, with long, straight, wide boulevards (Choi et al., 1996).

Planning and architecture went through a paradigm shift at the turn of the 20th century. The industrialized cities of the 19th century grew at a tremendous rate. The pace and style of this industrial construction was largely dictated by the concerns of private business. The evils of urban life for the working poor were becoming increasingly evident as a matter for public concern. The laissez-faire style of government management of the economy, in fashion for most of the Victorian era, was starting to give way to a New Liberalism that championed intervention on the part of the poor and disadvantaged. Around 1900, theorists began developing urban planning models to mitigate the consequences of the industrial age, by providing citizens, especially factory workers, with healthier environments.

Urban planning started to become professionalized during this time. The Town and Country Planning Association were founded in 1899 and the first academic course in Great Britain on urban planning was offered by the University of Liverpool in 1909 (Kim, 1996). In the 1920s, the ideas of modernism and uniformity began to surface in urban planning, and lasted until the 1970s. Many planners started to believe that the ideas of modernism in urban planning led to higher crime rates and social problems (Peng, 1997). Urban planners now focus more on individualism and diversity in urban centers.

ESRI is the leading provider of GIS software to land records, assessment, and cadastral agencies worldwide. ArcGIS is the enterprise foundation for these agencies. It integrates mapping, surveying, registration, valuation, and public access. These solutions can be deployed on the desktop, on the Web, or across the enterprise. ESRI products work in an integrated and flexible manner. They provide just the right software for your needs today and can be scaled to meet future needs.

The ESRI Family of GIS Solutions

Arc GIS

Arc GIS, a family of software comprising a complete GIS, is built on industry standards. Out of the box, it provides rich functionality and the applications in Arc GIS—Arc View, Arc Editor Arc Info—can be configured to match an organization's needs. Built out of modern object-based components, these software programs share the same core

applications, user interface, and operating concepts. Arc GIS is used for the creation, management, integration, analysis, display, and dissemination of spatial data. Strong visualization, editing, and analysis, along with advanced data management, distinguish the Arc GIS software family as the leading GIS software.

Arc View

Arc View is designed with an easy-to-use, Windows-like user interface and includes Visual Basic for Applications (VBA) to allow for customization. ArcView consists of three desktop applications:
Arc Map, Arc Catalog, and Arc Tool box, display, query, and analyze data in Arc Map. Manage, create, and organize geographic and tabular data using Arc Catalog. Use the tools and wizards in Arc Tool box to convert data to other formats.

Arc Editor

Arc Editor is a state-of-the-art GIS data visualization, query, and creation solution. Designed for the Windows desktop, Arc Editor can create and edit all ESRI-supported vector data formats including shape files, coverages, personal geo databases, and multiuser
Geo databases.

Arc Info

Arc Info is the complete GIS data creation, update, query, mapping, and analysis system. Arc Info includes the most comprehensive collection of GIS tools available. As part of the Arc GIS software family, Arc Info encompasses all the functionality of Arc View and Arc Editor and adds the advanced geo processing and data conversion capabilities that make it the de facto standard for GIS.

Arc SDE

Arc SDE is an application server that facilitates storing and managing spatial data (raster, vector, and survey) in a database management system (DBMS) and makes the data available to many kinds of applications. Arc SDE allows you to manage spatial data in one of four commercial databases (IBMDB2, Informix, Microsoft SQL Server, and Oracle). Arc SDE serves data to the Arc GIS Desktop products (Arc View, Arc Editor, and Arc Info) and through Arc IMS.

Arc GIS Server

Arc GIS Server is a comprehensive platform for delivering enterprise GIS applications that are centrally managed and support multiple users. Arc GIS Server provides the framework to build and deploy centralized GIS applications and services to meet a variety of needs using a variety of clients

CONCLUSION

The present study indicates the uses of Remote Sensing and Geographic Information System for spatial planning. Very easy to use analysis and visualization tools, Rapid development in city poses several challenges including problems associated with urbanization for urban managers and policy makers. Meeting these challenges requires access to timely and reliable information. Geographic Information System (GIS) A GIS is a computer based information system capable of assembling, storing, manipulating and displaying geographically referenced information.

The juxta postion of words in the title reflects the sequence of the argument of this chapter. Urban planning comes first because it has a long history as an activity which makes extensive use of geographic information. This extends from the sanitary maps that were made by the precursors of the modern planners in the 1830s and 1840s in Britain and the United States to the multi-purpose, multi-user geographic information systems (GIS) that have been implemented in many of today's cities. In many ways, the needs of planning have actually anticipated the development of GIS. For example, Lewis Keeble (1952) argues in his manual for the new generation of British planners created by the 1947 Town and Country Planning Act, that: "*There are two ways in which interrelated survey subjects can be compared: the first is by means of overlays, the second by means of combination or sieve maps*" which suggest "*the metaphorical straining of all the land in the area under consideration through a series of sieves — standards of unsuitability — that which passes through all the sieves being prima facie the most suitable for the purpose in question and that which passes through the fewest the least suitable*.

Fig 3. Use of GIS in urban planning.

GIS and Sustainability Planning

The Upper San Pedro Basin has a population of around 114,000 people. It is a dry, arid region on the border between Arizona and Mexico and is said to present a number of challenges to the Environmental Planner. This is one of the best examples of where several competing factors must play off against each other and make compromises for the good of the whole. Stakeholders include businesses who wish to utilize the resources, the people who live and work there who want to keep their jobs but also want a healthy environment, the authorities in charge of preserving the natural habitats and the water authorities concerned with a sustainable water supply. Sustainability is often the key to many of the

applications for which GIS is used **(7)**. It can provide up to date information that can be easily manipulated.

As desert / dry regions are environmentally fragile, in terms of the ecosystems as well as what can be reasonably achieved economically and socially in marginal environments, the area is subject to careful management policies. It sits on the border between two deserts that both have a variable climate and distinct ecologies that present problems to Environmental Planning **(5, p351)**. It is also under the authority of two separate countries, making a delicate situation potentially difficult at times.

Fig 4. Use GIS in urban planning and plant cultivation.

This area is a great case study for professionals in the field on proper management because over-pumping activities of the 20th century has led to an acknowledged loss of biodiversity **(6)** and was the cause of the first application of agreed international environmental law anywhere in the US**.** The Pinal County was successfully sued for misusing the waterways in the area and today it has legal protection. It is also one of the first areas to have utilised GIS as a management tool to preserve the delicate ecology, to keep a watch on the various elements, businesses and authorities operating in the ecosystem while allowing conservation groups to protect and promote wildlife as the law dictates **(6)**. A large number of migratory birds use the area seasonally. The US Army, the EPA and a number of other responsible agencies combined GIS data to build a full picture of the activities of the area, allowing for proper management and taking on the full range of factors that will be affected by and will affect the decision **(8)**.

GIS and Urban Development Planning

Urban centres on their own can provide a multitude of problems: from resource allocation, crime statistics, employment levels, age demographics, traffic build up and relief, infrastructure - the list goes on an in terms of environmental planning, GIS is an essential tool to managing the changing ecology and topography of our urban centres.

Most urban development is driven by growth - growth of economy, growth of industry, growth of infrastructure which are all knock-on effects of population growth. The urban and environmental planners of today use GIS as the most efficient system yet of keeping our roads as clear as possible and resources to where they need quick and efficient access. There must be a balance between promoting the needs of people while protecting the environment and it seems we cannot build our way out of congestion or resources and

amenities stretched to their limit. No matter how small or large a community, the planners will need to use spatial data and work with maps**)** to decide how to manage the landscape.

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