IGI PUBLISHING **ITB14306**

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This paper appears in the publication, **Modern Public Information Technology Systems: Issues and Challenges** edited by **G. Garson © 2007, IGI Global**

Chapter XV

Geographic Information System Applications in the Public Sector

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Abstract

Geographic information systems emerged in the 1970s and have become a significant decision-making tool as their capabilities have been enhanced. This chapter discusses various GIS applications and highlights issues that public managers should consider when evaluating implementation of a geographic information system. GIS applications provide benefits at the planning level by producing maps efficiently, and at the management decision-making level through an ability to geographically display important information for policy-level decisions. While GIS analysis can be a powerful tool, there are a number of issues that pubic managers should consider in order to achieve effective implementation and use of geographic information systems.

Geographic Information Systems

The defining feature of geographic information systems, or GIS, is the ability to integrate a variety of information, such as economic, infrastructure, political, or demographic data, with the geographic locations associated with the data of interest. GIS applications have the ability to access large databases and create maps of almost any combination of data. For example, a map may include locations of blighted or substandard housing, attendance zones for elementary schools, land-use patterns, household income levels, and even consumer spending patterns for individuals within households.

The term geographic information system emerged in the 1970s when it was used to describe a variety of techniques employed to create maps as an aid in data analysis. This application was an outgrowth of the development of various tools such as computer-aided mapping (CAM) and computer-aided design (CAD) systems used primarily by cartographers, draftsmen, and engineers to produce detailed and accurate maps. Through the application of CAM and CAD programs, very precise maps could be drawn and updated quickly to reflect changes in infrastructure, political boundaries, and topography. Cartographers found these new techniques to be an especially efficient addition to their craft. As the use and availability of these techniques increased, other disciplines found new applications for the technology. Public agencies and private-sector organizations discovered that these applications provided the foundation for spatial analysis of geographic data stored in large databases. This application of spatial (geographic) analysis allows policy analysts to present economic, demographic, and other data in map form, which enhances their ability to understand and communicate complex relationships (Huxhold, 1991).

GIS involves a combination of computer hardware, specialized software applications, trained personnel, and the creation and maintenance of a geographically coded database. Implementation of a GIS requires a managerial commitment to data-driven decision making as an aid in reducing uncertainty; using maps to display data combined with statistical analysis allows managers to visualize important geographic patterns in the data. The integration of a wide variety of social, economic, physical-resource, landform, and other data creates the potential to improve the quality of public-sector decision making (O'Looney, 2000).

The continuous development of GIS technologies, such as advances in mapping software, database systems, satellite remote sensing, and global positioning system (GPS) devices, creates dynamic parameters for spatial analysis. The result is that GIS continues to evolve and has an ever-expanding ability to incorporate a wide range of analytic techniques that were separate and distinct in the past. This means that the public administrator is faced with financial and managerial challenges associated with an increasingly useful technology that will continue to consume resources as it evolves. The decision to acquire GIS technology is a two-edged sword. It facilitates information flow, but it also requires a significant commitment of resources in future years if the system is to be maintained and used to its potential. For example, the utility of GIS for decision making is directly related to the quality of information contained in the database. Inaccurate or obsolete information in the database will produce flawed maps with potentially adverse effects when used in decision making. This means that geographic information systems involve a significant long-term investment not only in hardware, software, and personnel training, but also in continuous database development, expansion, and maintenance.