Chapter III

Spatial Decision Support Systems

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ABSTRACT

Many types of challenging problems faced by decision makers have a geographic or spatial component. Spatial decision support systems (SDSS) can effectively support this class of problem. This represents a growing class of DMSS, taking advantage of the increasing capability of technology to deal with spatial data. SDSS is characterized by the use of significant amounts of public data external to the organizations that use it and the increasing availability of such spatial data facilities wider use of such systems. This chapter describes spatial systems, their history, their relationship to other systems, their mean areas of application and their future development.

INTRODUCTION

Spatial decision support systems (SDSS) provide computerized support for decision making where there is a geographic or spatial component to the decision. Computer support for spatial applications is provided by systems based around a geographic (or geographical) information system (GIS) (Keenan, 2002). Spatial applications represent an area of information technology (IT) application with a significantly different history from the other decision making systems discussed in this book. There are a variety of definitions of GIS (Maguire, 1991); these generally identify a GIS as a computer system that facilitates the display and storage of geographically or spatially related data that allows the integration of this data with nonspatial (attribute) data. A GIS has a sophisticated data manager that allows
queries based on spatial location. The GIS interface facilitates interaction with this database. A GIS can be distinguished from a simple map display program that lacks these query features. The acronym GIS has also been used as an abbreviation for geographical information science, referring to a body of research on techniques for processing geographic information. A geographic information system employs these techniques. In common usage the expression GIS refers to a computer system, and this convention will be used in this text.

The distinct contribution of GIS to decision making lies in the ability of these systems to store and manipulate data based on its spatial location. Spatial data is of interest in a wide range of government and business activities. Early areas of GIS application included primary industries such as forestry and mining. An important area of GIS application is the transportation field, both in the design of transport infrastructure and in the routing of vehicles that use this infrastructure. More recent developments have included the use of GIS for location analysis and related problems. These include a variety of business and government applications, such as the siting of public facilities (Maniezzo, Mendes, & Paruccini, 1998) or large retail outlets (Clarke & Rowley, 1995). GIS continues to grow in importance, playing a central role in the provision of new services such as mobile telephony. Mobile commerce is an emerging field, largely distinguished from electronic commerce by the presence of a locational element (MacKintosh, Keen, & Heikkonen, 2001). In this environment the importance of GIS and spatial decision making systems can only increase.

**ORIGINS OF SDSS**

GIS was first used in the 1950s in North America, largely for the automated production of maps. The 1960s saw the introduction of many of the basic concepts in GIS, although their widespread implementation awaited further developments in computer technology. Consequently, more powerful computers were needed, as relatively large volumes of data characterize spatial applications when compared to conventional business data processing. Therefore, the development of sophisticated GIS applications required the introduction of computer systems that had the necessary speed and storage capacity to process queries on the larger quantities of data involved. In the early years of GIS use, these systems required the use of powerful and expensive mainframe computers and could not be easily used in a flexible way.

In the 1970s the concept of decision support systems (DSS) began to develop in the information systems (IS) community, notably with the work undertaken at the Massachusetts Institute of Technology (Gorry & Scott-Morton, 1971; Little, 1971). By the early 1980s there were many books and papers published in the DSS field (Alter, 1980; Bonczek, Holsapple, & Whinston, 1981; Sprague, 1980) and DSS had become a recognized part of IS. DSS had evolved out of the business data processing tradition and usually dealt with the financial and operating data associated with
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