Chapter 17
Decision-Making Processes Based on Knowledge Gained from Spatial Data

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ABSTRACT

The increasing popularity of spatial data opens up the possibility to include it in decision-making processes in order to help discover existing interrelationships between facts that might otherwise be difficult to describe or explain. To achieve this goal, Spatial Data Infrastructures (SDIs) are seen as a platform to provide and share spatial and conventional data, especially among public institutions. However, SDI initiatives face many problems due to the lack of standards for data publications, the heterogeneity of participants that build and use the system, and participants' different backgrounds, level of preparation, and perception about the objective that SDIs should fulfill. Furthermore, to obtain better benefits from using spatial data, non-expert users in geo-concepts (i.e., users unfamiliar with complex concepts related to spatial data manipulation) should count on a variety of tools that hide spatial data complexity and facilitate knowledge generation with the goal of shifting from traditional spatial data sharing to an intelligent level. In this chapter, the authors refer to different issues related to knowledge generation from spatial data in order to support decision-making processes with an emphasis on public institutions. They look for the answers to several aspects: what tools are available for non-expert users to handle spatial data, who will provide spatial and related conventional data to stakeholders interested in analyzing them, and how to ensure data quality.

INTRODUCTION

Decision making is a process of establishing different alternatives and choosing one that better suits the specific situation at hand, according to users' knowledge and available data. During many years, different systems (with the generic name of Decision Support Systems, DSSs), were developed to assist users at different levels of management. Currently, these systems evolve or form part of Business Intelligence

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(BI) solutions (Turban, Sharda & Delen, 2010). BI requires current and historical data as well as adequate tools and techniques that allow users to perform different kinds of analysis to formulate hypotheses and to look for their confirmation or rejection in order to solve problems that companies or organizations are facing. In this way, users are able to convert data into information and information into knowledge, allowing companies/organizations to grow and be more competent and competitive.

Traditionally, data delivered for analysis is represented in tabular spreadsheet-like formats or graphs and charts that report changes in numeric values, e.g., quantity of sold products, amount gained from providing services, among others. However, it is well known that presentation of data in a space helps to discover interrelationships that might otherwise be difficult to describe or explain (Gonzales, 2004). Nevertheless, until the mid-1990s spatial data and Geographic Information Systems (GISs) that managed it were perceived as a standalone technology and were used mainly by experts in the field (Yeung & Hall, 2007), i.e., geo-experts, e.g., geographers, cartographers, surveyors. This limitation was imposed due to the complexity of tools that manage spatial data and the necessary specialized knowledge (i.e., geo-knowledge) required to understand the concepts related to spatial data format, operations, and manipulations.

On the other hand, the popularization of spatial data by Internet providers, such as Google maps, opens different alternatives to include spatial data in various kinds of applications including the ones used for decision-making. The need to deliver spatial and conventional data to the people who make decisions, and not only to the ones that dominate the technological aspect of manipulating them, is constantly growing. As a consequence different solutions must be proposed to hide spatial data complexity and integration problems from users that lack knowledge in geo-concepts. Specialized GIS software must be enhanced, extended, or combined with the features/tools that allow this kind of users to freely manipulate spatial data in the way that conventional data is handled. Furthermore, these users require more data related to their own region, e.g., schools or road distribution, risk zones extension, vegetation coverage, soil types, among others. This request forces the development of a platform for providing and sharing spatial data referring to the extension of a specific country.

Spatial Data Infrastructures (SDIs) represent "the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data" (OMB, 2010). SDIs, usually as a governmental initiative, should converge with e-government projects providing a platform that enables sharing of spatial and related conventional data with a goal of converting a society into information and knowledge society (Álvarez, Gallego, Gil & Zerpa, 2012). However, SDI initiatives face many problems due to the heterogeneity of participants that build and use the system, their different backgrounds, level of preparation, and perception about the objective that SDIs should fulfill. In addition to that, there is a pressing need of transformation from a traditional spatial data sharing to an intelligent level (Lin, Chen, Wu, Wu & Wand, 2011).

In this chapter, we refer to different challenges that public institutions must face and solve to be able to generate knowledge from spatial data in order to support decision-making processes. First, we present works related to the BI and different approaches for its spatial extension, as well as a platform to provide spatial data to stakeholders. In the subsequent section, we refer to different issues that exist and make difficult the process of creating new knowledge from spatial data repositories: (1) the challenges in applying BI solutions in the public sector, (2) the necessity of accepting the evolution in handling spatial data from geo-experts to users with no knowledge of geo-concepts, (3) the need of establishing SDIs as a spatial and related conventional data provider, and (4) the obligation to ensure good data qual-