



Chapter X

Multicriteria Decision Analysis for Collaborative GIS

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Abstract

This chapter provides a critical review of GIS-based multicriteria decision analysis (GIS-MCDA) for supporting group (collaborative and participatory) decision making. The review is based on a survey of referred papers that have been published over the last 15 years or so. The chapter offers a classification of the GIS-MCDA approaches for group decision making. First, the articles are classified according to the generic elements of the MCDA methods. Second, the GIS-MCDA methods are classified according to the various perspectives on collaborative decision support. These taxonomies of the GIS-MCDA approaches provide a background for an evaluation of the contribution of MCDA to GIS-based collaborative decision making.

Introduction

At the most rudimentary level, GIS-based multicriteria decision analysis (GIS-MCDA) can be thought of as a procedure for combining geographical data and value judgments (the decision maker's preferences) to obtain information for decision making. In group settings, GIS-MCDA takes the form of aggregating individual judgments into a group preference so that a consensus or compromise alternative can be identified. It involves a set of activities such as (Limayem & DeSanctis, 2000) problem definition and structuring; identification of evaluation criteria by group members; determination of individual preferences with respect to evaluation criteria and/or alternatives; combination of individual judgments into a single collective preference; sensitivity analysis with respect to the set of evaluation criteria and alternatives; exploration of alternative ways of combining individual preferences into group judgments; refinement of individual and group preferences through negotiation, collaboration and consensus seeking; and final ordering of alternatives so that a compromise alternative can be selected (see also Jankowski & Nyerges, 2001a; Malczewski, 1999). A comprehensive survey of MCDA methods for group decision making can be found in Hwang and Lin (1987).

There is now a well-established body of literature on GIS-MCDA (e.g., Banai, 1993; Carver, 1991; Chakhar & Martel, 2003; Church, Loban, & Lombard, 1992; Diamond & Wright, 1988; Eastman, Kyem, Toledano, & Jin, 1993; Heywood, Oliver, & Tomlinson, 1995; Jankowski, 1995; Janssen & Rietveld, 1990; Joerin, Theriault, & Musy, 2001; Laaribi, 2000; Laaribi, Chevallier, & Martel, 1996; Malczewski, 1999; Pereira & Duckstein, 1993; Thill, 1999). The basic rationale behind the efforts to integrate MCDA into GIS is that the two distinctive areas of research can complement each other. While GIS offers unique capabilities for storing, managing, analyzing, and visualizing spatial data for decision making, MCDA provides a rich collection of techniques and procedures for structuring decision problems, designing, evaluating, and prioritizing alternative decisions. Although the GIS-MCDA approaches have traditionally focused on the MCDA techniques for individual decision making, considerable efforts have recently been made to integrate GIS with MCDA for group decision making (Bennett, Wade, & Armstrong, 1999; Feick & Hall, 1999, 2002; Jankowski & Nyerges, 2001a, 2001b; Jankowski, Nyerges, Smith, Moore, & Horvath, 1997; Kyem, 2001, 2004; Malczewski, 1996; Nyerges, Montejano, Oshiro, & Dadswell, 1997).

The aim of this chapter is to provide a critical review of the MCDA approaches for collaborative GIS. The review is based on a survey of refereed papers on GIS-MCDA that have been published between 1990 and 2004. Abstracts of those papers are available at <http://publish.uwo.ca/~jmalczew/gis-mcda.htm>. In addition, the Web site provides a description of the literature survey method. Of

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