

Geog 461 Learning Objective Outline

LOO 04 Decision Problems and Basic Workflow for GIS

04.1 How might you characterize the difference between closed systems decision problems and open systems decision problems in relation to content, structure, process, and context characteristics of such problems? [Nyerges and Jankowski GISDS Chapter 2. Section 2.1](#)

Several researchers have described complex planning decision problems in various ways. Structured, semi-structured / ill-structured, unstructured (decision) problems are terms that have been used. They are great concepts, but troublesome to make operational, and thus troublesome to use. Many people can understand the following four terms “simple, difficult, complicated, complex”, and might agree there is a difference in these terms. However, here we can deepen that understanding through a framework about complex problems.

Table 2.1. Characterizing decision problems in terms of systems components

Type of Decision Problem	<i>4 Decision Problem Components in an Open System</i>			
	3 Decision Problem Components in a Closed System			
	Content	Structure	Process	Context
Simple	X			
Difficult (semi-structured)	X	X		
Complicated (ill-structured)	X	X	X	
Complex (wicked)	X	X	X	X

There are two ways to make use of the problem framework.

- 1) use of the framework to describe the wastewater facility as operating as part of a water system.
- 2) use of the framework to consider the GIS to be part of a decision making system.

If we could enumerate all parts of a system, then we would have a *closed* system. If we cannot enumerate all parts of a system then we have an *open* system. The two types of problems are intertwined. Understanding of the wastewater flow problem is at the core of the wastewater facility site selection problem. The content of the waste water flow decision problem becomes the location problem.

04.2 What are the major software capabilities in GIS?

[Nyerges and Jankowski GISDS Chapter 2](#). Section 2.2

Table 2.2 A Framework for Understanding GIS Capabilities

	Content		Structure			Process	
	Features	Cells	Spatial	Logical	Temporal	Spatial	Temporal
Geocoding Tools	X		X				
Data Management Tools	X	X	X	X	X	X	X
Map visualization tools	X	X	X	X	X	X	X
Analysis Tools	X		X				
Spatial Analyst Tools		X	X	X	X	X	X
Network Analyst Tools	X		X	X	X	X	

ArcGIS Functionality matrix

<http://www.esri.com/library/brochures/pdfs/arcgis92-functionality-matrix.pdf>

04.3 How might we describe a basic GIS-based workflow approach?

[Nyerges and Jankowski GISDS Chapter 2](#). Section 2.3

Let us use first explore a **simplified workflow approach** for a GIS project

Note: a GIS project is different than a planning and/or capital improvement project.

- 1) Identify project objectives (e.g. concerns about growth of wastewater and what to do with it)
 - e.g., What is the problem to be solved, e.g., in terms of criteria as in **Table 2.3**?
 - Who is the intended audience?
 - Will data be used again?
 - What are the final products expected?

- 2) Create a project database (for examining the wastewater facility location problem)
 - e.g., Designing the database (lab assignment is rather simple – naïve - in this regard)
 - Acquiring the data (for example from various organizations as in **Table 2.4**)
 - Automating/preparing the data for further analysis (as in **Table 2.5**)
 - Managing the data

- 3) Analyze the data (to identify several options for location suitability)
 - e.g., geometric modeling as in calculating distances, generating buffers, calculating area coincidence modeling as in overlaying data layers,
 - adjacency modeling as in path finding, nearest neighbor, and allocating
 - (Example analysis workflow **See Figure 2.1**)

- 4) Present the results (of the analysis) to those interested
 - e.g., create a particular type of map (Example sketch layout **See Figure 2.2**)