Economic and Social Urban Indicators: A Spatial Decision Support System for Chicago Area Transportation Planning

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SDSS Development: Learning from Real World Experiences
Outline of Presentation

- Description of the Chicago-Area Spatial Decision Support System (SDSS)
- What institutional factors have affected the evolution of the SDSS?
- What are the major challenges to the SDSS?
- Speculations on pathways to integrate into practice
- Conclusions
What does the Spatial Decision Support System do?

- Tool to support variety of transportation decision problems
- Strongly integrates transportation applications with housing, economic development, community development and physical planning
- Enables decision-makers to “look at data” in maps
- Enables use of data for decision-support problems including prioritization of areas and communities for investments of different kinds
Current SDSS

- Base data with indicators
- GIS environment – allows mapping/visualization of spatial distribution of indicators
- Limited web-based functionality at this time
- Statistical modeling of relationships between variables
- MCDM Module: Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) MCDM models
Current SDSS - Examples of Indicators

- **Basic Indices including**
  - Affordable housing index
  - School quality index
  - Crime rate index etc
  - Health quality indices
  - Land-use diversity index
  - Various sociodemographic indices

- **Composite Data Indices (out of models)**
  - Small-area employment estimates based on forecasted job openings and actual jobs
  - Regional employment accessibility estimates by auto and public transportation
  - Transit availability index
  - Pedestrian Friendliness index
SDSS Environment

SDSS

GIS

Survey

MCDM

GIS + Expert Opinion or Client/User Preferences

Mapping/visualization of spatial distribution of urban indicators

Sort & rank census tracts on each of the above criteria

Statistical studies linking indicators to transportation system

Decision-support functions
Process Data Collection Tools

- Initial structured interview phase – identify issues, main concerns, problem situation
- Soft Systems Methodology meeting phase – to incorporate input from stakeholders, restructure ill-defined complex problem situation, develop rich picture of problem situation.
- Develop indicators for problem situation accordingly
- AHP/ANP survey implementation to capture stakeholder preferences
- Final decision – rank, prioritize geographical units for various types of planning decisions
Examples of Major Applications to Date

- Development of Public Transportation Information System involving public transportation agencies and DOT’s
- Job Accessibility Study involving transportation, housing, economic development and health and human services stakeholders
- Housing Relocation Analysis involving low-income Latino workers
- Transit Oriented Development (TOD) - Labor Shed Spatial Analysis using Employment Accessibility and Transit Availability Index
Location of Low-Income Families & Entry-Level Jobs in Chicago Metro Area
Job Accessibility in Six County Chicago by Low-Income Workers

Entry-level Jobs Reached by Different Modes at 30 Locations in Chicago

- Reached by Automobile
- Reached by Transit

- Travel Time in Minutes
- Percentage of Total Entry-level Jobs
Auto Destination accessibility in the six-county Chicago Metro area

Four distinct areas
Policies for enhancing economic opportunities may be quite different in the 4 areas

Updates of this type of analysis will potentially be possible on a continuous basis with LEHD data
Transit Destination Accessibility in the six-county Chicago Metro area

Unlike auto destination accessibility, employment accessibility by transit for entry-level jobs tends to be far more localized into “clusters”
Transit Availability Index

- TAI decreases gradually from CBD to region periphery
- TAI highest in majority of Cook and immediate tracts neighboring Cook
- Also, high along Metra Corridors
- Low at fringes of Region

**Key to TAI Index Values**

- 0.000 - 0.559
- 0.560 - 0.631
- 0.632 - 0.662
- 0.663 - 0.754
- 0.755 - 0.904

**Statistics**

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What are the institutional factors that have affected the evolution of the Spatial Decision Support System?
Evolution of Spatial Decision Support System

- Rapid changes in the field regarding types of information needed
- Evolution of transportation planning agencies and perspectives
- Evolution of nature of stakeholders involved in transportation planning and operations
- Technological changes
- “Unstructured” data collection to “structured” data collection
Changing Information Needs

- Rapid changes in the field regarding types of information needed and in overarching policy drivers
- Impacts on housing, air quality, low-income population, land-use etc needed due to various federal and state legislations
- Traditional travel demand models cannot provide many of these – can serve as input into creation of indicators for some of these impacts
- Example – Evaluations of Transportation Improvement Program and Long-range Transportation Plan, Environmental Justice compliance requirements, Area Wide Job Access and Reverse Commute Transportation Plan, now Human Services Transportation Plan.
Evolution of Relationship to Public

- Called upon to involve communities and the public to a far greater extent than 15 years ago
- Much greater focus on visioning and scenario development
- Input from communities is sought and knowledge of public priorities is highly desirable
- Examples – Chicago Metropolitan Agency for Planning (CMAP) Common Ground Process, Context Sensitive Solutions initiatives
Changes in Stakeholders Involved

- Stakeholders involved in transportation planning and operations have changed over time (either because they are legally required to or there is potential of match).
- Many of these stakeholders are interested in measures and impacts that go beyond the traditional measures of Vehicle Miles Traveled (VMT) etc.
- Example – Chicago Metropolitan Agency for Planning (CMAP) Indicators project.
Technological Changes/Development/Use Habits

- Rapid increase in the level of web use in the form of blogs, listservs, trip planners and traveler information systems, online comments posted in response to news articles
- Public and stakeholders more used to geographic/map-based information than ever before
- Easier interface between outputs of travel demand models and SDSS
Adaptations in Data Collection

- Household travel surveys that feed regional transportation models are expensive – the current CMAP household travel survey cost well over $2 million.
- No cheap alternative to this type of data – however, pooling together available data into indicators can be a cost-effective solution.
- Result of previous points – traditional transportation professionals more willing to consider the use of “hybrid” data.
What are the major difficulties in the systematic adoption of SDSS for transportation planning?
Main Difficulties

- Historically, the adaptation of new planning technologies in transportation has been somewhat slow – for example, many agencies continue the 4-step process instituted in 1962, the CORSIM traffic simulation package supported by FHWA.

- A variety of administrative functions, university education programs, private industry products and expensive data programs develops around a particular technology – inertia sets in.

- Organizational mindset is changing but barriers still exist regarding perceived lack of transparency and difficulty of use.
Main Difficulties

- However, SDSS is not an alternative to the traditional planning models. This, in turn, can make it difficult to get people to understand and to see the value added by the MCDM
- Data sharing agreements and significant IP issues associated with some data sources
- Funding – “if we are giving the data, then it should be free to us”
  - Sustainability becomes a problem
  - Keeping the data current becomes difficult
  - Training and outreach is needed
  - Major marketing effort is needed
Potential Pathways Forward

- Needs greater visibility
- Much greater presence needed in the larger transportation conferences – but not only in the technical sessions
- Greater number of writings/publications in practitioner-oriented journals and magazines
- Curriculum changes to incorporate SDSS – take advantage of impending turnover in older workforce
- Need industry support
- With the support of administrative, political and academic champions, recommend use for specific governmental programs – “bottom-up” approach
- Enabling legislation might be needed mandating use as a part of regulatory compliance – “top-down” approach
Conclusions

- SDSS can play an important role in current transportation planning processes
- Has led to the involvement of a wide variety of stakeholders not typically within the transportation planning process
- Enabled impact assessment of a wide variety of economic and social indicators
- Over time, organizational mindset is changing and the public is becoming more tech-savvy - but barriers still exist regarding perceived lack of transparency and difficulty of use
- Continuing exposure and outreach efforts will be necessary for such systems to be tightly coupled with transportation planning applications
- More importantly, the widespread use of these systems needs the support of public policy to reach the extent of diffusion that transportation planning models did