E-Democracy in Smart Cities

Love Ekenberg
Dept. of Computer and Systems Sciences
Stockholm University
Overview

- Myself
- 3 Cases
  - Road infrastructure
  - Environmental issue
  - City planning
My Background

- Head of DSV
- Professor in Computer and Systems Sciences at Stockholm University
- Professor in Information Systems at the Royal Institute of Technology
- Professor in Computer Science at Mid Sweden University
- PhD in Mathematics
- PhD in Computer and Systems Sciences
- Consultant for EU, World Bank, Sida, WHO, Swedish Ministry of Foreign Affairs, Nuffic, CIHCD, etc
Public Decision Making - How does it look like?

- Too simple analyses
- Often no reliable data
- Few variables
- Over confidence
- Deterministic analyses
- Extreme value analyses
- Many people do not know when it is possible to count
Regional planning

- An estimate for the Stockholm car traffic is that it will increase by approximately 40 percent during the next 15 years.
- The Swedish Road Administration investigated various options for connecting the northern and southern parts of Stockholm.
Three alternatives
Cost

- One of Sweden’s largest infrastructure initiatives
- 2-4 billion Euro
Background material

- 80 different assessments of the three alternatives from 19 different perspectives (criteria)
- ... accessibility, environmental impact, regional development, traffic safety, and economic growth...
Background

Hur uppfyller de olika alternativen målen?

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<thead>
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<th>Måluppfyllelse</th>
<th>Nullalternativ</th>
<th>Förbifart Stockholm</th>
<th>Diagonal Utvunda</th>
<th>Kombinationsalternativ</th>
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Måluppfyllelse (bästa alternativ markeras med skuggring).
Analysis

- Essential factors
- Impossible to analyse this without elaborated analyses
- Such was not utilised at all
Analysis

- Critical with criteria weights
- Was not made at all!
- Totally necessary
Analysis

- Result is totally dependent of this
- ...and how the scales are interpreted
Result

- Despite this, the politicians decided that one alternative was the best!!!
- Based on.... nothing
- Investments of this types need much more analysis than this
Alternatives

- Maybe the problem is too complex?
- Maybe there are no methods?
- Classification and structure might be a support despite all?
- No
- Exists very adequate methods
Decision Analysis

A collection of systematic approaches and formal methods in order to structure and analyse complex decision problems:

- Conflicting objectives/Multiple criteria
- Uncertainties and risks
- Multiple stakeholders

Preference modeling, decision modeling, belief modeling, risk analysis, aggregations, sensitivity analysis.
Decision Analysis (cont’d)
Alternatives
Alternatives

**Left:** Without any weight assessments.  
**Middle:** Accessibility is considered as the most important criterion.  
**Right:** Environmental impact and traffic safety considered as the most important criteria.

Alt 1 is *Förbifart Stockholm*, Alt. 2 is *Diagonal Ulvsunda*, and Alt. 3 is *Kombinationsalternativet*. 
So this is easy

- Decisions and risks are often difficult to handle
- But they must be considered as difficult as they are
- There are methods and methods
- The keys are, not very surprisingly, structure, method and analysis
How it should be

- river Svartån altered to facilitate farming and acquire more agricultural land
- has led to a significant reduction of the purification process of the water
- the municipality has for considerable time coped with problems concerning a poor water quality of the river
The River Svartån

- different stakeholders, such as farmers, industries, citizens, other municipalities
- the decision-makers expressed a strong desire to obtain a sustainable and approved solution
- city council promoted actions with the public’s endorsement
An Iterative Process

- **WS1**: Introduction to the process and the analysis in particular.
- **WS2**: Politicians identified the political (main) criteria collectively.
- **Interview round 1**: Main criteria priority weights elicitation from the politicians.
- **WS3**: Identification of the means criteria of the main criteria by the civil servants.
- **WS4**: Discussion of the appropriateness and slight modification of the means criteria by civil servants and politicians jointly.
- **WS5**: Generation of decision alternatives and assessments of their effects with respect to the means criteria. This work was completed by the civil servants with remote assistance by a facilitator.
- **WS6**: Discussion of different possible measures by civil servants and politicians jointly. As a result of discussions two alternatives were disregarded and seven remained.
- **Individual interview round 2**: Second round of weights elicitation from the politicians to check if their preferences had changed during the project.
- **WS7 and WS8**: Joint workshops to analyze and discuss the alternatives with the objective of reaching a decision.
Alternatives

- **Alt. 1 Attend to single sewers.** The environmental office would continue to make an inventory of single sewers.

- **Alt. 2 Attend to public sewers.** A number of pump stations and public wastewater purification instalments that separate impure wastewater into dikes and water bodies within the watershed exists upstream of the city.

- **Alt. 3 Digestion of stable manure and biogas installation.** By allowing for stable manure to pass through the digestion chamber of a biogas installation.

- **Alt. 4 Rain water measures.** Measures in order to purify the rain water from bacteria may also decrease the nutrient content, heavy metals content, and petroleum content that travels to the river with rain water.

- **Alt. 5 Build wetlands.** By allowing for drainage water from the surrounding fields to pass through larger wetland areas.

- **Alt. 6 Attend to livestock farming.** Shut out livestock grazing by the watercourse.

- **Alt. 7 Vegetation zones and dikes in the fields.** Build vegetation zones along the watercourses and dikes in the landscape.
Evaluation
Stockholm Vision 2030

- City of Stockholm’s ”Vision 2030”
- Construction of ”The Northern Link”
- Burden of heavy and throughput traffic will be reduced on:
  - Valhallavägen (Stockholm’s only ”real avenue”?)
  - Lidingövägen (Good place for new central residential areas)
City Strategy in Brief

- Focusing growth in strategic development areas
- Integrating the city
- Creating a vibrant urban environment
- Consistent with environmental goals and sustainability issues
City Traffic Planning

Managing conflicting objectives and claims upon limited resources

- **Link functions**: the movement of people and goods by different modes
- **Terminal functions**: parking, public transport stops, loading and unloading of goods
- **Place functions**: the role streets play within the urban structure, shaping how a city is perceived by its residents and visitors, possibilities for commercial and social functions
- **Cross-cutting functions**: such as road safety, environmental impact, rubbish collection, maintenance, emergencies etc.
Planning Decision Making

- Prioritise between different functions in different locations
- Evaluating sets of decision problems each involving a set of feasible alternatives which somehow has to be evaluated upon in terms of conflicting objectives/functions
- Care has to be taken to multiple stakeholders and governmental issues
Screening

- A pre-selection phase
- Sorting out a set of *admissible* high-level alternatives that will be subject to a more thorough analysis
- Should end with a clear direction on the kinds of measures to be taken and instruments to be used
  - Communication with decision makers and consultancy/infrastructure companies and the general public
Characteristics of Planning Decision Making

- The objectives can be derived from different levels
- Each alternative option is composed of a collection of both structural and non-structural instruments comprising a portfolio of instruments
  - Generating these portfolios is a design process
- Assessing each alternative’s performance are typically done using rough estimates
  - Imprecision needs to be accounted for
Approach

- Series of workshops with civil servants to identify:
  - fundamental and means objectives
  - a set of thematic alternatives each consisting of a set of consistent instruments
    - Car alternative, bus alternative, basic requirements alternative etc.
Approach (cont’d)

- Assess the effect of each alternative under each means objective
  - Define value scales
  - Account for imprecision by allowing for interval-valued assessments
- Suggest reasonable priorities based upon the city’s vision and strategy
  - Avoid over-interpretation
Result: Objective Structure

- An objective structure with categories as a more formal interpretation of city visions and strategies w.r.t. the traffic administration
  - General objectives
    - Derived from city vision and strategy
  - General domain specific objectives
    - Derived from traffic planning discourse
  - Case specific objectives
    - Derived from/Defined by actors in current decision problem
Result: Objective Structure
Result: Decision Evaluation

- The car-alternative was effectively removed from the set of alternatives
- The remaining four can be further analysed, investigated and communicated
Conclusions

- The perceived value of utilising a decision analysis process in intelligent city planning
  - Formalises many of the informal processes already followed by civil servants in preparing recommendations for decision makers.
  - Provides a flexible tool for analysis
  - Provides the potential for an improved communication with decision makers of the basis for recommendations
  - Decreases the risk of inconsistency of recommendations between projects
  - Prioritization between objectives beyond what can be derived from city strategies is needed
Thx

- www.preference.nu
- www.dsv.su.se/~lovek