Cognitive Rationality, Public Engagement and Quantitative Analyses in Transportation Decision-Making

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background

Decisions related to transportation systems, made by both public and private subjects are difficult to make

- Decisions impact on diverse and contrasting interests
- The complexity of the legal procedures and the fragmentation of the decision-makers system make them time-consuming and non-efficient
- Decision on transportation systems often capture the public attention

Often, decisions on transportation systems do not perform as expected
background

PLANNING FAILURES

Main causes

1. Unpredictable events modifying the scenario (deep uncertainty)
   - Economic crisis 2008-2013, 9/11, oil prices, local changes, unexpected market behaviour

2. Mistakes in forecasting times, costs and effects
   - Implementation times and costs, traffic, revenues, costs, pollution, etc.

3. Inability to implement the project as intended
   - Protests against new infrastructures/services/fares, etc.

Failures in decision-making processes

background

TRADITIONAL APPROACHES TOWARDS DECISION-MAKING IN TRANSPORTATION PLANNING

The decision-making process has some form of “rationality” and quantitative tools, i.e. statistical analyses and mathematical models, play a central role in it, contributing to define the decisions or at least influencing them. (Manheim, 1979; Meyer and Miller, 2001; Ortuzar and Willumsen, 2011; Cascetta, 2009)

Transport system analysis and transportation planning are seen mostly as public-oriented activities, based on the simulation of alternative projects and the assessment of priorities.

...but this is often not the case
1. models of decision-making processes

TRANSPORT-RELATED DECISION-MAKING PROCESS

A sequence of activities performed by several actors (decision-makers and possibly stakeholders) in order to decide on options including not deciding (delaying)

CLASSIFICATION

- A-RATIONAL models
- RATIONAL models
1. models of decision-making processes

A-RATIONAL MODELS

The garbage can model (Cohen et al., 1972; Daft, 2001; Lipson, 2007)

Originally proposed for describing organizational decision-making processes in companies

The variables

- Actors/participants (A)
- Problems (P)
- Solutions (S)
- Decision Opportunities (O)

Applications to public decision-making in transportation can be found in Cascetta and Cartenì (2012) on eco-rationality

Non-efficiency, Instability, Lack of legitimization

Non-efficiency, Instability, Lack of legitimization
1. models of decision-making processes

**RATIONAL MODELS**

**Rationality:** Acting in the best possible way considering the aim (Elster, 1986)

**Minimal Requirements of Rational decisions:** (Cascetta et al., 2013)

- **consistent**
  - both internally w.r.t. the stated objectives and existing constraints, and externally with other decisions (plans, projects) taken in other interacting contexts or at different moments in time

- **comparative**
  - considering one or more alternatives (e.g. not deciding, one of the available options, searching for other possibilities)

- **aware**
  - based on unbiased information about the options (features), the context (physical and decisional) and their likely impacts (costs, benefits, risks and opportunities), for technical, economic and administrative feasibility

- **flexible**
  - open to changes due to new information on alternative options and their effects, to changes in the economic, physical, institutional contexts, and taking into account decision “opportunity costs” (i.e. postponing unnecessary decisions)

**Strongly Rational model**

**Homo oeconomicus** is a utility maximizer relative to his/her choices

- Comprehensive (full enumeration of possible solutions)
- Aware (evaluation of all the impacts)
- Optimization algorithm (chosen solution is the one that maximize objectives and fulfill the constraints)
- Conclusive
RATIONAL MODELS

The cognitive or bounded rational approach

1. models of decision-making processes

Cognitive/Bounded Rational approach

It is loosely consistent with:

- Bounded Rationality Choice Theory (Simon 1957; Rubinstein, 1999; Kahneman, 2003) \((\text{Behavioral Economics})\)
- Learning Theory in Dynamic Decision-Making Models (Brehemer, 1992; Gonzalez et al., 2003) \((\text{Management science/Psychology})\)
1. models of decision-making processes

Application areas of the cognitive/bounded rationality approach

- Multiple (and possibly ill-posed) objectives, also related to non-quantitative variables
- Not exhaustive knowledge of the context variables/available solutions
- Impacts on multiple stakeholders
- Several decision-makers with different agendas
- Significant uncertainty in the simulated impacts
- Opportunity/need to implement decisions in stages

Outline

1. Models of decision-making processes
2. Public Engagement
3. Quantitative Analyses and their roles in decision-making
4. Some indications for quantitative analyses from the new perspective
2. public engagement

- Public Engagement (PE) is the process of identifying and incorporating stakeholders’ concerns, needs and values in the transport decision-making process.
- It is a two-way communication process promoting stakeholder interaction with the formal decision-makers and the transport project team.
- The overall goal of engagement is to achieve a more transparent decision-making process with greater input from stakeholders and their support of the decisions (larger coalitions).
- Stakeholders management is also studied in organization and management sciences (Clarkson, 1999)

THE FIVE LEVELS OF PE

1. Stakeholders identification: e.g. authorities, local communities, etc.
2. Listening and stakeholders management: systematic analysis of the current social, cultural and economic conditions with a direct impact on stakeholders
3. Information communication: information relative to the project provided by the stakeholders
4. Consultation: decision-makers interact with the stakeholders in defining/evaluating alternatives
5. Participation: extension of the consultation level where the groups, directly interested, become joint partners of the project and in the project implementation. They take part in making the final choice
2. public engagement

ENGAGEMENT STRATEGIES

<table>
<thead>
<tr>
<th>POWER</th>
<th>INTEREST/POWER MATRIX</th>
<th>INTEREST</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>Institutional Stakeholder (Identification)</td>
<td>HIGH</td>
</tr>
<tr>
<td>LOW</td>
<td>Marginal Stakeholder (Information communication)</td>
<td>LOW</td>
</tr>
<tr>
<td>LOW</td>
<td>Operative Stakeholder (Active listening)</td>
<td></td>
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Stakeholders Empowerment

2. public engagement

THE ARCH-ENEMY OF PE: THE DAD (DECIDE, ANNOUNCE, DEFEND) SYNDROME
(e.g. Susskind et al., 1983; Walker, 2009)

Administration makes a DECISION (the best project/plan), it ANNOUNCES the project to the population and other stakeholders that have not been involved previously. This produces many oppositions and the Administration is obligated to DEFEND the decision against criticism, accusations and controversy without having the opportunity to change the project (if only marginally)

Limits of the DAD
- It fosters consensus barriers
- It increase costs
- It increases times
outline

1 Models of decision-making processes
2 Public Engagement
3 Quantitative Analyses and their roles in decision-making
4 Some indications for quantitative analyses from the new perspective

3. quantitative analyses and their roles

TRADITIONAL ROLES OF TRANSPORTATION SYSTEM ANALYSIS

1. Understanding and modeling mobility and transport related phenomena (mostly in physical terms)
2. To assist in the design, assessment and evaluation of transport-related decisions:
   - What If
   - What To

NEW ROLES

3. To contribute towards reaching larger consensus through Public Engagement
   (e.g. information-based PE)
4. To provide inputs for economic/financial plans of market operators
cognitive rationality, PE and quantitative analyses

- Quantitative analyses in a-rational decision-making play only a cosmetic role (if any)

- PE and rational decision-making do not necessarily imply each other (e.g., DAD syndrome and PE based on pure “negotiation”)

- Cognitive model has the greater potential for integration with PE, both in public and private contexts

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cognitive rationality, PE and quantitative analyses

- The model proposed here is based on “three legs”:
  - Cognitive or Bounded rational decision-making processes
  - Public Engagement
  - Transportation System Analysis
three-legs model

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Naples, December 4th, 2013
### Outline

1. **Models of decision-making processes**
2. **Public Engagement**
3. **Quantitative Analyses and their roles in decision-making**
4. **Some indications for quantitative analyses from the new perspective**
4. some indications from the new perspective

- To model the impacts relevant to stakeholders and decision-makers (e.g. being informed vs. average travel times)
- To adopt assessment methods allowing the evaluation of both quantitative and qualitative impacts for different actors
- To present results in ways that can be understood by non-experts
- To quantify the uncertainty entailed in the simulation results and in the assessment methodology
- To improve the capability to capture users' willingness to pay for transport services

4. some indications from the new perspective

- Standardization of procedures and DSS
- Third-part assessment and performance comparison with base-rates
- The (neglected) relevance of monitoring and ex-post studies
Thank you for your attention!

basic references (1/4)

Reference papers

Planning failures
basic references (2/4)
Decision-Making in Transportation and Models – RATIONAL MODELS


Decision-Making in Transportation and Models – A-RATIONAL MODELS


basic references (3/4)
Decision-Making in Transportation and Models – PUBLIC ENGAGEMENT


The role of quantitative methods in transportation decision-making


