Broadening quantitative appraisal in transportation decision making processes through effective stakeholders engagement

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1. Risks and failures of transportation planning
2. The role of assessment in transportation planning
3. A model of Cognitive and participative decision-making process with different uncertainty levels
4. An application to the Regional transport plan of Veneto (Italy)
5. Conclusions and recommendations
1. Risks and failures of transportation planning

Transportation planning: \textit{the decision-making process on public actions, including regulation and financing, related to transportation infrastructures and services in order to reach societal objectives}

“Desirable properties of transportation planning”: 

- decisions addressing problems/needs widely recognized as such;
- decisions solving the problems/addressing the needs as much as possible and making reasonable use of limited resources;
- decisions having a large consensus among decision makers and stakeholders;
- decisions based on information, as accurate as possible, about their consequences and those of possible alternative courses of action
1. Risks and failures of transportation planning

Transportation Planning is a complex problem. *Multiple decision makers and impacted stakeholders with different and often contrasting values, objectives and interests. Some with veto or quasi veto rights.*

“The kinds of problems that planners deal with – societal problems - are inherently different from the problems that scientists and perhaps some classes of engineers deal with. Planning problems are inherently wicked” (Rittel and Weber, 1973).

Problems essentially unique, every wicked problem can be considered to be a symptom of another problem, it do not has an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan and solutions to wicked problems are not true-or-false, but good-or-bad” (Rittel and Weber, 1973)
1. Risks and failures of transportation planning

Level 1 Planning

Central Decision maker process

Project Founding

Level 2 Planning

Plan (P) Project (PR) 1

Local objectives
Decision Maker process

Proposed Projects

P, PR n

Local objectives
Decision Maker process

Proposed Projects
1. Risks and failures of transportation planning

Several types of “planning failures” in transportation planning and design:

- underestimation of implementation costs and times
- errors in demand/revenue forecasts
- miscalculation of direct effects, and of environmental and other external impacts
- the inability to carry through the planned actions due to lack of consensus or new governance cycles

Striking difference between demand forecasts and actual value for rail and road projects (Flyvbjerg et al., 2007)
1. Risks and failures of transportation planning

Example of errors in demand forecasts and miscalculation of direct and external impacts

Copenhagen-Malmö Oresund Bridge

- 2000: the bridge comes into service
- after a few months observed traffic is lower by about 50% w.r.t. forecasted traffic (*overestimating the real utility in the short term... it costs too much*)
- 2008: observed traffic is greater than about 33% respect forecasted traffic (*underestimation of long-term effects*)
1. Risks and failures of transportation planning

Example of errors in demand/revenue forecasts

The Channel Tunnel

Moreover, the expected revenue from passenger and freight transport through the Channel Tunnel was vastly overestimated from the outset. Fierce competition from existing ferry operations resulted in a lower market share for the tunnel and Eurotunnel needing to reduce tariffs.

In its first year of operation (1994–95), the company reported a loss of GBP925 million (about USD1.4 billion) because of disappointing revenue from passengers and freight, together with heavy interest charges on its GBP8 billion (about USD12.2 billion in 1994) of debt. In light of its financial difficulties, Eurotunnel was at serious risk and sought to refinance the project with a scheme based on debt-for-equity restructuring legally enforced using French legal protection with a ‘procédure de sauvegarde’ (safeguard procedure), effectively pausing all debt repayment processes for six months and enabling Eurotunnel to bank in some of its operating revenue to finance the restructuring effort. The refinancing plan was completed in 2007 with Eurotunnel turning a net profit of EUR1 million (about USD1.4 million) for the first time in that year.

When asked the question of what made the Channel Tunnel model withstand economic difficulties, a representative from the Getlink Group interviewed for the purpose of this case study replied that the Treaty of Canterbury...
1. Risks and failures of transportation planning

Example of errors by lack of consensus

TAV Turin-Lyon
1. Risks and failures of transportation planning

Example of errors by lack of consensus

Congestion Charge in London

In Edinburgh more than 74% of residents voted against a charge

Edinburgh council refuses to rule out congestion charge
1. Risks and failures of transportation planning

Example of error of inability to carry planned actions due to new governance cycles (“Penelope" syndrome)

Detroit Light Rail Shut

- 2009: the US DOT allocated $ 600 million for the construction of light railroad in Detroit
- 2011: Municipality declared the project not feasible (the costs are not sustainable) and proposed the construction of a rapid bus network
- 2012: the municipality turns back and decides to build Light Rail Shut
1. Risks and failures of transportation planning

Uncertainty in transportation planning

Demand uncertainty (e.g. socio-economic variables related to travel demand, users’ travel behavior, traffic levels)

Supply uncertainty (e.g. supply performance, construction times and costs, technological disruptive innovations)

Context uncertainty (e.g. political cycle, stakeholders interested, decisions of other interfacing Transport Agencies, regulatory constraints).
1. Risks and failures of transportation planning

4 levels of uncertainty

<table>
<thead>
<tr>
<th>Context (X)</th>
<th>Complete determinism</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4 (deep uncertainty)</th>
<th>Total ignorance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A clear enough future</td>
<td></td>
<td></td>
<td></td>
<td>Many plausible futures</td>
<td>Unknown future</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Graph for complete determinism" /></td>
<td><img src="image" alt="Graph for Level 1" /></td>
<td><img src="image" alt="Graph for Level 2" /></td>
<td><img src="image" alt="Graph for Level 3" /></td>
<td><img src="image" alt="Graph for Level 4" /></td>
<td><img src="image" alt="Graph for Total ignorance" /></td>
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</tbody>
</table>

(Head, 2010)
Outline

1. Risks and failures of transportation planning
2. The role of assessment in transportation planning
3. A model of Cognitive and participative decision-making process with different uncertainty levels
4. An application to the Regional transport plan of Veneto (Italy)
5. Conclusions and recommendations
2. The role of assessment in transportation planning

Assessment in planning and design

Technical activity aimed to (define and) compare alternative options on the basis of related impacts.

Assessment techniques, to be effective, should be consistent with the overall decision-making approach followed.
The strongly rational approach

2. The role of assessment in transportation planning

Consistency with the decision-making process

Gap between problem complexity and assessment tools “planning models” in the technical community

It is assumed that decisions are taken following a strongly sort of rationality decision-making with well-defined aims, constraints and future scenarios, and that Decision Support Systems - DSS (e.g. quantitative methods/tools/models) and assessment techniques such as cost-benefit analyses, play a central role in the overall process.
2. The role of assessment in transportation planning

CLASSIFICATION OF PLANNING MODELS

- **RATIONAL models**
  - strongly rationality
  - satisficing or bounded rationality
  - cognitive

- **A-RATIONAL models**
  - Garbage can model
  - Assessment has a purely formal role (if any)

Actors/participants (A), Problems (P), Solutions (S), Decision Opportunities (O)
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3. A model of Cognitive and participative decision-making process with different uncertainty levels

The main characteristic of the proposed model (1/2):

- The process evolves through **successive decision-making stages**, allowing actors, institutional and otherwise, to learn from previous stages and system monitoring as well as from the definition and assessment of alternative decision sets;
- **at each stage** a number of **decisions are made** involving the implementation of **long-term** non-reversible and **short-term** reversible projects.
- **Decisions include** the need to better define long- and short-term options through **feasibility projects** to be assessed and possibly be included in successive stages of the decision-making process thus reducing demand, supply and context uncertainty levels especially for long term, non-reversible options.
3. A model of Cognitive and participative decision-making process with different uncertainty levels

The main characteristic of the proposed model (2/2):

- The model distinguishes technical assessment, process management and public engagement activities, specifying the interplay among them.
- Stakeholders should be involved at the beginning of the “planning stage”, where problems, objectives, constraints and the “rules of the game” are discussed and agreed before any specific proposal/evaluation is considered.
3. A model of Cognitive and participative decision-making process with different uncertainty levels

(Cascetta et al., 2021)
3. A model of Cognitive and participative decision-making process with different uncertainty levels

Stakeholders participation in the decision-making process Involving stakeholders concerns, needs and values - Two way communication process providing mechanism for exchanging information

5 LEVELS:
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 listen to the different points of view and interact with the stakeholders
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
3. A model of Cognitive and participative decision-making process with different uncertainty levels

Benefits and risks of stakeholders participation

Benefits:
- Improving options and final output of the process
- Legitimate the planning organization and its choices
- Reduce uncertainty levels about stakeholders reactions
- Increase stability of decisions over successive governance cycles

Risks
- Instrumental use for achieving particular predefine objectives
- Distortions in societal representation (e.g. youngs, minorities, vocal interests)
Public Engagement is a technical activity to be explicitly included in the process.

The case of the High-Speed Rail link between Torino and Lyon, where the vivid protest of organized groups of citizens hindered the construction of the infrastructure for several years and induced major changes in the project. In this case, operative stakeholders (e.g., citizens) became the key stakeholders by empowering themselves.

New possibilities for reaching underrepresented groups and improving the assessment of societal preferences, e.g., Participatory Value Evaluation (PVE), via internet and the media.
3. A model of Cognitive and participative decision-making process with different uncertainty levels

Regulation of the feasibility project for transport infrastructure in Italy
(Dlgs, 56, 2017)

**STEP 1**
ex ante evaluation of alternative solutions

- Demand analysis
- Risk analysis
- Cost-benefit analysis

**STEP 2**
project development.

Identification of the best solution (project)

Public Debate

(D.Lgs.228/2011)
3. A model of Cognitive and participative decision-making process with different uncertainty levels

Public Debate regulation in Italy (Art.22 Dlgs 56, 2017 and DPCM n.76, 2018)

Mandatory public debate: projects, with a cost equal to or greater than 100 million euros, which concern the construction of e.g.: motorways, railway lines, port and airport infrastructures, hydroelectric dams, cultural/sporting/scientific/tourist infrastructures, dumps, incinerators, landfills
### Public Debate regulation in Italy *(Art.22 Dlgs 56, 2017 and DPCM n.76, 2018)*

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<tr>
<th>Step</th>
<th>Design (3 months)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I°</td>
<td>Design (3 months)</td>
<td>The project of the decision-making process, drawn up by the person in charge of the public debate, is approved by the proponent of the work after consulting the National Commission.</td>
</tr>
</tbody>
</table>
| II° | Debate (4 months) | The debate formally begins with the publication of the project dossier prepared by the proponent, on the website of the debate. Typically, the debate is characterized by:  
  - information meetings  
  - thematic in-depth meetings  
  - work tables and discussions  
At the end of the debate, the commission presents a report containing:  
  - the description of the progress of the debate  
  - the description of the themes  
  - the description of the open and most problematic issues |
| III° | Conclusion (3 months) | A following the final report of the public debate, the proponent of the project presents his own report in which he specifies:  
  - whether to carry out the project or renounce it  
  - what are the possible changes made to the project  
  - which proposals were not accepted and why |
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An application of participated cognitive planning to the Regional transport plan of Veneto:

al all three components of the proposed process (technical assessment, decision-making process, and stakeholders’ engagement) were implemented, without any significant drawbacks.
4. An application to the Regional transport plan of Veneto (Italy)

**Planning decisions**

**long-term invariants and options**, subdivided into two further categories:

- project/policy reviews: interventions (projects or policies) inherited from past transportation planning, not implemented or still under construction (invariants)
- feasibility studies/analyses: related to actions stated in the new regional transport plan, still without a corresponding project

**short-term invariants and options**: most actions falling within this category are i policies,
4. An application to the Regional transport plan of Veneto (Italy)

An application of participated cognitive planning to the Regional transport plan of Veneto:

The lesson learned (1/2)

1. the overall process was promoted and supported by a very efficient and committed regional administration which was an absolutely necessary condition for the implementation of the proposed decision-making model.
2. Regional community used to public debate (e.g. Venice lagoon protection barriers, big ships etc)
3. stakeholders’ engagement (also via internet/media with feedback) useful also in managing uncertainty (e.g. stakeholders were able to identify additional uncertainty sources in future scenarios related to not easily recognizable social, economic, and environmental "local" variables influencing projects dealt with in the plan).
4. An application to the Regional transport plan of Veneto (Italy)

An **application** of participated cognitive planning to the Regional transport plan of Veneto:

The lesson learned (2/2)

4. The objective distinction between invariants and options was very useful in defusing conflicts about specific choices, especially infrastructures, postponing related decisions after agreed feasibility studies while recognizing the request (whenever consistent with overall strategies) as needing to be addressed.

5. The invariant/options and long-term/short-term framework enabled Veneto Regional administration to be flexible and robust with respect to medium–to–high uncertainty levels explicitly recognized and, at the time of the plan (2019)
Conclusions and recommendations

The new role of quantitative methods for design and evaluation in participated processes: from normative to cognitive

The traditional roles of quantitative methods is to support the analysis of the current system, the design of possible action scenarios, the simulation of their impacts and their comparison.
In cognitive planning there are new requirements:

- identification and modeling of **impacts relevant to stakeholders** and decision-makers;
- processing and presentation of **results for non-experts**;
- assessment methods allowing the evaluation of **quantitative and qualitative impacts for different actors** (e.g. vertical and horizontal equity, levels of consensus);
- **ex-post** analyses as **case studies**;
- new assessment **tools for high uncertainty levels decisions under** (scenario discovery, minimal regret etc);
- estimation of responses to **nudging policies**.
Conclusions and recommendations

**Indications for policies**

- Define transport planning explicitly as a decision-making process
- Introduce public engagement in planning and design regulations
- Introduce and regulate the “feasibility project” as the connection between planning and design
- Enlarge the scope of plans/project evaluation to include qualitative variables such as equity and consensus measures
References

Cascetta, E., Cartenì A. Marzano, V., Henke, I. (2021). A cognitive participative strategic decision-making model for transportation planning under different uncertainty levels, Transport Policy, in printing