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Experiences with transportation models: An international survey of planning practices

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ABSTRACT

Transport planning practice is experiencing rapid transitions. This shifting professional environment is prompting lively and sometimes bitter debates about how transportation models should be used. While these models and their outputs play an increasingly more important function in transport-related decision-making processes, growing concerns emerge about their limitations, assumptions, biases, and usability. This paper addresses the question of how different professionals involved in transportation planning perceive and experience these tensions. For that purpose, we developed an online survey which was completed by 229 European transport planning practitioners, primarily working in the Netherlands, Denmark and Germany. Our findings support the following key conclusions. *First*, and contrary to popular notions on the matter, practitioners are relatively satisfied with the models they use. *Second*, most respondents are confident that they understand the assumptions and uncertainties associated with transport models, but that other important stakeholders do not. However, *third*, the larger the distance that respondents have to hands-on working experience with transportation models, the lower is their trust on model outputs. Respondents who are not directly involved in the operation of the models a) report more negative experiences associated with model use in decision-making processes and b) identify more usability barriers. The overall picture revealed a lack of trust amongst transport planning professionals, which is a problem needing to be addressed. We propose bringing models closer to those who use their outputs as a constructive solution to this trust deficit.

1. Introduction

Transport planning practice is facing several challenges worldwide. Transport professionals are being asked to move away from the classical 'predict and provide' and later 'predict and prevent' rationale (Marvin and Guy, 1999; Owens, 1995) to adopt a more balanced view on mobility and accessibility (Banister, 2005, 2008). These professionals are no longer being invited to undertake their practice in a compartmentalised and disciplinary fashion. Instead, they are being requested to embrace a holistic view on mobility (Bertolini et al., 2008; Ferreira et al., 2013). Their work is no longer about developing and implementing linear solutions for clearly defined goals (e.g. building roads to reduce congestion) in simple institutional contexts with ample budgets. Now they are participants in highly complex decision-making processes taking place in heavily politicized environments with multiple stakeholders concerned with conflicting goals attached to divergent values and with scarce resources (Hull, 2008; Stead, 2008; Willson, 2001). All these transitions set new requirements for transport knowledge to support planning practice: not only different types of knowledge are needed, but also new ways of generating, combining and employing these knowledge types (Handy, 2002, 2008; Healey, 2007, pp. 235–263; Te Brömmelstroet and Bertolini, 2011).

The abovementioned developments put pressure not only on transport planners but also on their toolkit. Their technical instruments need to be constantly upgraded so that they can cope with the emerging challenges and criticisms. This holds especially true for one of their central knowledge instruments: the macroscopic transportation model (Gudmundsson, 2011). The technical limitations of the widely used, and often even obligatory, four-step model (Timmermans and Arentze, 2011), the heavy assumptions models are built on (Timms, 2008; van Exel, 2011), the lack of consensus about how model outputs should be used in transport decision making (Næss and Strand, 2012), the potential biases that models introduce (Ferreira et al., 2012; Naess et al., 2015; Næss et al., 2012; Nicolaisen and Næss, 2015) and their

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limited usability for strategy making phases (Te Brömmelstroet, 2010) are some of the key problems addressed in recent debates.

A special issue of Transport Reviews published in 2011 has focused on the contested roles of transportation models in this changing context (Te Brömmelstroet and Bertolini, 2011). The contributors agreed that planning practitioners fully acknowledge the very high potential that transport models have to support their decision-making challenges. However, they also agreed that the full potential of these models is not yet realised. A general thread emphasized that models need to actively and explicitly facilitate individual and collective learning processes in parallel with supporting decision-making process (Gudmundsson, 2011; Te Brömmelstroet and Bertolini, 2011). The high technical complexity of contemporary models can too easily create a black-box effect where the model itself becomes an additional source of incomprehensibility about the (already highly complex) real-world issues at stake. Not surprisingly, such excessive complexity and disregard for the individual learning processes of each decision-maker has resulted in severe reproaches against transport modelling. For example, Flyvbjerg (2007) and Bain (2009) have both criticised project proponents for using the so-called 'black-box effect' in order to manipulate demand forecasts in their favour. The fact that in many countries model-based demand forecasts are mandatory inputs for cost-benefit analyses and environmental impact assessments aggravates tensions and concerns about models. This means that trust in travel demand forecasts as a decision-support tool is at serious risk, at least among some professional classes. Indeed, Næss et al. (2014) found that the perceived objectivity of model-based forecasts is significantly higher among the private consultants who operate the models than it is among planning practitioners, civil servants, and elected officials. In addition to this, the perceived impact of model forecasts on decision-making was also significantly higher among model operators than other professionals.

In this paper we seek to further investigate the relationship between different types of planning participants and the perceived usefulness of transport models as decision-support tools. To achieve this goal, and inspired by the tensions and concerns discussed above, we tested the following hypotheses:

- Practitioners perceive that transportation models are ill-suited to address and respond to the challenges and questions they are confronted with in their professional practice;
- The distance of planning participants to model output (operationalized as by whom the model is operated, see Table 1) correlates negatively with their level of trust in model outputs;
- The distance to model output correlates positively with seeing the communication of uncertainty as problematic;
- The distance to model output correlates negatively with considering model outputs useful for decision-making; and finally

- The more operational is the task that the model is used for, the higher is the trust in the model outputs.

The paper is structured as follows. First, it briefly discusses the research design choices and setup of the data-gathering and analysis instruments. Then, in Section 3, the relevant characteristics of the sample (survey respondents) are presented. Section 4 describes the experiences of the respondents regarding their use of transportation models and their outputs. A discussion of significant differences between countries and between different professional roles is included. Section 5 follows the same structure in discussing the perceived usability of the transportation models. The paper ends presenting the conclusions and a discussion on improvements for the usability of transportation models in planning practice. Future research steps are also proposed.

Table 1
Characteristics of respondents.

Contexts Total		NL 123	DE 48	DK 26	Other 32	Total 229
Professional role* see Table 2 below	Model specialist	36	10	5	20	71
	Planner	11	27	12	9	59
	Strategist	28	0	6	1	35
	Evaluator	6	9	1	1	17
	Designer	3	0	1	0	4
	Policy operator	17	0	0	0	17
	Advisor	15	0	0	0	15
	other	7	2	1	1	11
Expertise	Transport and mobility	110	46	25	31	212
	Land use	4	2	0	0	6
	Environment	7	0	1	0	8
	Integrated	2	0	0	1	3
Employer	Local authority < 50 K	24	1	0	0	25
	Local authority 50 K to 100 K	12	3	1	0	16
	Local authority 100 K to 300 K	17	5	3	4	29
	Local authority > 300 K	10	3	0	2	15
	A province	13	1	0	0	14
	A national government	4	0	6	1	11
	A regional government	9	0	2	1	12
	A consultancy firm	29	30	9	21	89
	A knowledge institute	2	2	4	2	10
	Other	3	3	1	1	8
Transportation model	Omnitrans	79	0	0	0	79
	Visum	2	40	11	9	62
	Don't know/prefer not to say	10	1	8	0	19
	Cube	11	0	0	7	18
	Questor	9	0	0	0	9
	Emme/2	0	0	2	6	8
	OTM	0	0	4	0	4
	PSV	0	4	0	0	4
	Other	12	3	1	10	26
Model is operated by...	...me.	38	33	6	9	86
	...people employed within my organisation.	47	9	5	20	81
	...people working outside my organisation.	31	5	8	3	47
	...people within and outside my organisation.	6	1	7	0	14
Experience	short (< 2 years)	8	3	1	2	14
	Middle (2–5 years)	19	5	7	4	35
	long (> 5 years)	96	40	18	26	180
Types of questions	1 - Very operational	6	9	1	1	17
	2	36	19	3	5	63
	3	25	10	2	2	39
	4	24	8	9	7	48
	5	14	1	7	9	31
	6	15	1	3	6	25
	7 – Very strategic	3	0	1	2	6

2. Research design

2.1. Data gathering

The research is based on survey responses from stakeholders in the