Transport Policy 38 (2015) 8–18

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Accounting for the inaccuracies in demand forecasts and construction cost estimations in transport project evaluation

Kim Bang Salling [a,*], Steen Leleur [b]

[a] Technical University of Denmark, Department of Transport (DTU Transport), Building 115/Office 030, Bygningstorvet 1, DK-2800 Kgs. Lyngby, Denmark
[b] DTU Transport, Building 115/Office 005, Bygningstorvet 1, DK-2800 Kgs. Lyngby, Denmark

ARTICLE INFO

Article history:
Received 19 February 2014
Received in revised form
25 August 2014
Accepted 24 November 2014
Available online 3 December 2014

Keywords:
Transport appraisal
Decision support modelling
Monte Carlo simulation
Reference Class Forecasting
Cost overrun
Benefit shortfall

ABSTRACT

For decades researchers have claimed that particularly demand forecasts and construction cost estimations are assigned with/affected by a large degree of uncertainty. Massively, articles, research documents and reports agree that there exists a tendency towards underestimating the costs and overestimating the demand for transport infrastructure projects. It is therefore claimed that ex-ante evaluations of transport-related projects are often based on inaccurate material, which ultimately can lead to severe socio-economic misperformance. This paper seeks to bridge the gap between the inaccuracies in demand and cost estimations and hence the evaluation of transport infrastructure projects. Currently, research within this area is scarce and scattered with no common agreement on how to embed and operationalise the huge amount of empirical data that exist within the frame of Optimism Bias. Therefore, a full version of the UNITE-DSS model, which contains an integrated approach to socio-economic analysis, risk-based simulation and database information, will be presented. The procedure is based upon quantitative risk analysis and Monte Carlo simulation and conventional cost-benefit analysis converting deterministic benefit-cost ratios (BCRs) into stochastic interval results. A new data collection (2009–2013) forms the empirical basis for any risk simulation embedded within the so-called UP database (UNITE project database), revealing the inaccuracy of both construction costs and demand forecasts. Accordingly, the UNITE-DSS approach is therefore tested and further explored on a number of fixed case examples to investigate the performance and robustness of the traditional CBA results. Ultimately, a conclusion and perspectives of the further work will be set out.

1. Introduction

For decades researchers have claimed that particularly demand forecasts and construction cost estimations are affected by a large degree of uncertainty (i.e. Mackinder and Evans, 1981; National Audit Office, 1988; Pickrell, 1990; Fouracre et al., 1990; Flyvbjerg et al., 2003; Bain, 2009; Parthasarathi and Levinson, 2010). The latter articles, research documents and reports all agree that there exists a tendency to underestimate the costs and overestime the demand for transport infrastructure projects (ibid.). Therefore ex-ante evaluation of transport-related projects is often based on inaccurate material, which ultimately can lead to severe socio-economic misperformance. This paper intends to "bridge the gap" between the alledged inaccuracies in demand and cost estimations and the evaluation of transport infrastructure projects, i.e. to include the uncertainties with regard to the general understanding of cost overrun and demand shortfall by the use of a newly developed decision support model, the UNITE-DSS model. Moreover, a selection of case studies looking into all types of mode choices as well as varying infrastructure projects seeks to qualify the series of reference classes compiled and assessed within the Unite Project database. To the authors' knowledge, the inter-linkage between a decision support model and a dynamic database which contains uncertainty-related information as concerns infrastructure costs and demand inaccuracies has not yet been outlined.

In many countries, evaluation and assessment of transport infrastructure projects are primarily based on Cost-Benefit Analysis (CBA) which forms the basis for decision support and decision making (Vickerman, 2000; Grant-Muller et al., 2001; Odgaard et al., 2005; Haezendonck, 2007; Van Wee, 2011). In spite of widespread acknowledgement of the limitations and uncertainties in the use of the CBA methodology (see e.g. Ackerman and Heinzerling, 2004; Mackie, 2010; Næss et al., 2012; Mouter, 2014), it remains one of the most popular ex-ante appraisals. A recent

* Corresponding author. Fax: +45 4593 6412.
E-mail addresses: kbs@transport.dtu.dk (K.B. Salling), sl@transport.dtu.dk (S. Leleur).

http://dx.doi.org/10.1016/j.tranpol.2014.11.006
0967-070X/

study in Norway (Kjerkreit and Odeck, 2013) sought to understand and benchmark how inaccurate ex-ante based CBAs were in Norway by investigating 22 recently approved road projects. This study, however, illustrated that 20 out of the 22 projects had higher benefits than expected, pointing against the common belief that the inaccuracy related to infrastructure projects tends to misrepresent the benefits in terms of overestimation, but also that 13 out of the 22 projects had higher costs than expected, pointing in favour i.e. supporting the general belief that there exists a general tendency to underestimate the cost ex-ante. Moreover the study most importantly showed that it is very difficult to assess and estimate benefits and costs related to transport projects. It actually turned out that, remarkably, 17 out for the 22 projects returned a higher net present value than expected. Evidently, even though do not specifically conclude upon the uncertainties in CBA, they still conclude that *a system for ex-post evaluation of CBAs may be of importance to increase the accuracy of the estimated impacts* (*benefits and costs*) *presented to the decision makers* (ibid, p. 1).

It is therefore of great importance to be able to validate and assess the uncertainties present in the current CBA approach. It is therefore suggested to apply quantitative risk analysis (QRA) to depict and make use of a large empirical database existing within the area (see Nicolaisen (2012)) and hence instead of receiving single point results produce interval results in terms of output probability distributions to represent the evaluation criteria associated with the CBA. Presently, no attempts have been made to include such stochastic procedures in transport project evaluation, partly due to the lack of data and partly due to communication issues concerning output and results from such analysis (Mouter, 2014). The empirical basis, however, has been developed through a current database, the UNITE project database (UP database), which was compiled during the five-year period 2009–2013 and contains information on approximately 200 transport related projects from the Scandinavian countries and the UK (Nicolaisen, 2012; Ambrasaite et al., 2012). The present paper elaborates and displays the final version of the UNITE-DSS model for assessment extending information on cost-benefit analysis, quantitative risk analysis and the information from the UP database with regard to the inaccuracies of construction costs and demand forecasts, respectively.

The paper is disposed as follows. Section 2 introduces the software and decision support model, UNITE-DSS, consisting of a deterministic and stochastic part, respectively, facilitating the overall frame of feasibility risk assessment (UNITE: Uncertainties in Transport Project Evaluation, which is a five-year research project funded by the Danish Strategic Research council) together with the UNITE project database (Decision Support System: DSS). Moreover, Section 3 presents a set of four different case studies with reference to previous results and conclusions to validate the decision support system together with a historical perspective of

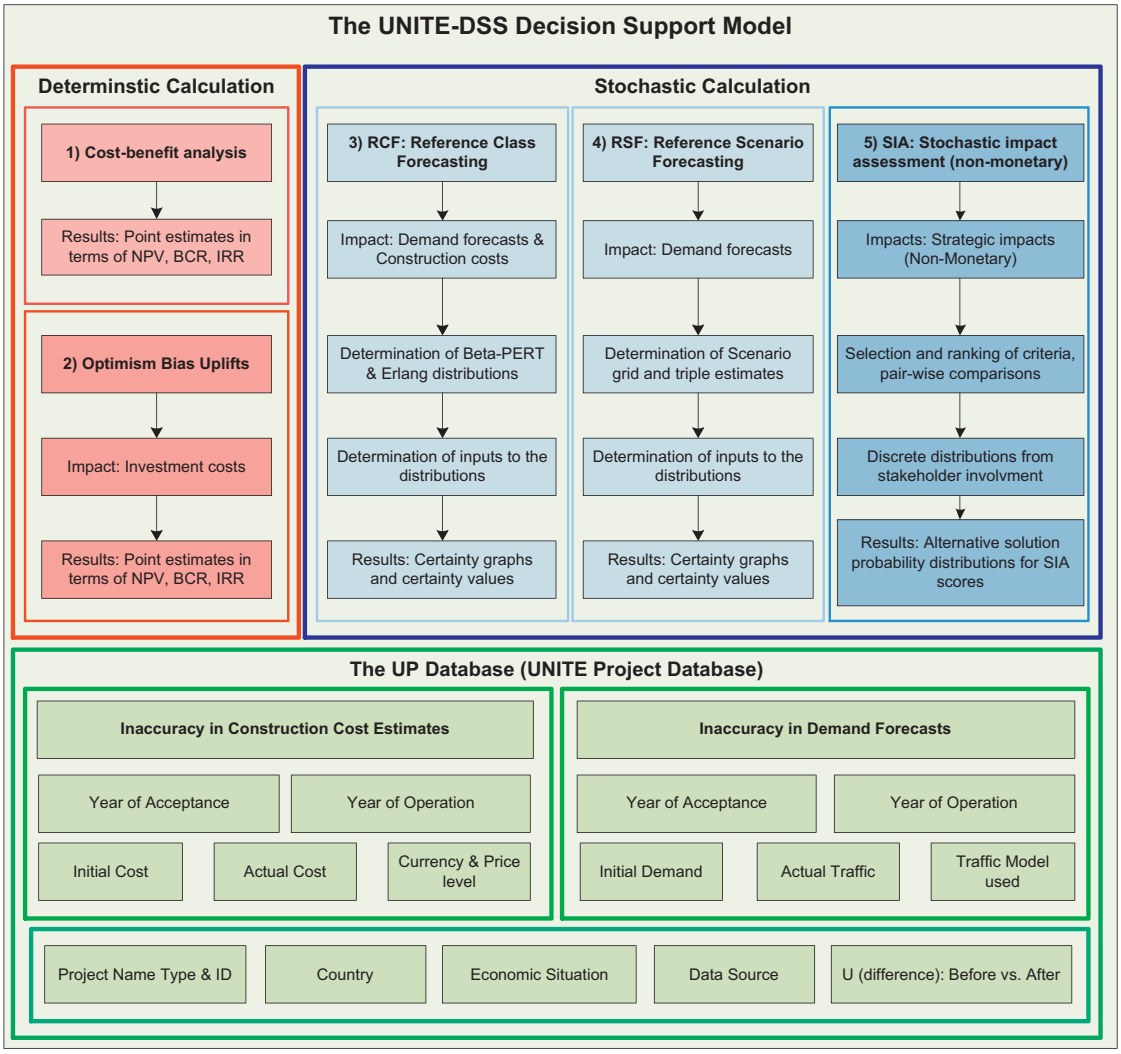

Fig. 1. Illustration of the set of modules within the UNITE-DSS. decision support model.