Transport Policy 35 (2014) 286–294

Contents lists available at ScienceDirect

Transport Policy

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

Needs and priorities of road safety stakeholders for evidence-based policy making

Eleonora Papadimitriou*, George Yannis

National Technical University of Athens, Department of Transportation Planning and Engineering, 5 Heroon Polytechniou St., GR-15773 Athens, Greece

ARTICLE INFO

Available online 1 July 2014

Keywords:
Road safety
Evidence-based policy
Needs
Data
Tools

ABSTRACT

The objective of this research is the analysis of needs and priorities of road safety stakeholders for evidence-based policy making, on the basis of a broad consultation of road safety stakeholders at international level. Needs and priorities concern both the data to be collected or made available and the tools to be developed or made available to support science-based policy-making. An on-line survey was addressed to more than 3000 stakeholders, mostly from European countries, in which participants were asked to assess the importance (high, medium or low priority) of more than 50 items reflecting data and resources for all stages of road safety policy making—from fact-finding and diagnosis, to programme development, to implementation and monitoring/evaluation. A principal component analysis technique was applied, and 6 components of data and tools were identified, concerning implementation of measures, statistical models, costs and safety impacts of measures, road infrastructure and accident analysis, common definitions and under-reporting, and crash causation. Then, cluster analysis was carried out for profiling the stakeholders, revealing 4 groups of stakeholders with similar needs and priorities in road safety data and tools: a "low priorities" group, a "need data and models group", a group mainly interested on "implementation" and an "in-depth analysis" group. Further analysis of the cluster characteristics suggested that the 4 clusters are adequately – and often similarly – represented in all groups of countries, and in all types of organization (e.g. national administrations, universities, interest groups, road safety organizations etc.). It is also found that national/regional administrations and research institutes/universities reported practically the same needs in data and tools, not confirming the common belief that these two types of stakeholders have different needs. Finally, the "policy-makers" group within the stakeholders was found to put particular emphasis on implementation issues.

1. Background and objectives

Road safety management implies systematic work to ensure continuous improvement in road safety (Elvik, 2008), or acting to prevent accidents and to mitigate the consequences of those that still occur (ETSC, 2006). The need for effective road safety management, preventability of major parts of road fatalities and severe injuries, and the availability of knowledge on measures and interventions that can be applied, is widely recognized today due to the global burden of road trauma for society and public health (ERSO, 2008).

Nevertheless, little is known about which data, knowledge and methodologies are used in – or would be needed for – road safety related decision making. Likewise, there is little evidence-based knowledge on good practices in the road safety management process (Allsop, 2003; Muhlrad, 2005; Bliss and Breen, 2009). In times of "shared responsibility" in road safety, with around 1000 individuals contributing to the European Commission's action programme consultation exercise and nearly 2000 signatories to the European Road Safety Charter, it was obvious that there were many (non-policy-making) road safety stakeholders whose views should be considered (Machata et al., 2011).

Within this context, the DaCoTA research project, whose overall objective is the further enhancement and development of the European Road Safety Observatory, aimed to assess the views and demands of stakeholders across Europe, and build a good practice model for road-safety management investigation (Muhlrad et al., 2011). For that purpose, a broad consultation of European stakeholders was carried out, on the basis of an extensive on-line questionnaire.

In this research, the stakeholders' survey data are analysed in order to identify profiles of stakeholders sharing common needs and priorities in data and tools for evidence-based policy making. More specifically, a two-stage analysis is carried out. In the first stage, a grouping of road safety data and tools is attempted, by means of

* Corresponding author. Tel.: +30 2107721380; fax: +30 2107721454.
E-mail addresses: nopapadi@central.ntua.gr (E. Papadimitriou), geyannis@central.ntua.gr (G. Yannis).

http://dx.doi.org/10.1016/j.tranpol.2014.06.006
0967-070X/

principal component analysis. In the second stage, a grouping of stakeholders is carried out on the basis of their scores in the 'components' of needs and priorities. Hierarchical and *k*-means clustering techniques are used, in order to identify 'clusters' of stakeholders with similar priority scores in the various 'components'. The results are further analysed in relation to country characteristics, type of organization (e.g. research institute, national administration, industry etc.) and type of stakeholder (e.g. policy-maker or other type), allowing the identification of stakeholders' profiles.

2. Data collection and handling

2.1. Survey questionnaire and procedures

In view of the large number of stakeholders to be approached, an on-line questionnaire was set up. The questionnaire comprises 7 sections:

- Sections 1–3 concern the background information of the stakeholders (e.g. country, field of work etc.).
- Section 4 concerns the data and resources for "fact finding and diagnosis" of road safety issues (e.g. information on crash causation factors, information on road users' behaviour and attitudes, a common definition of a fatality, exposure data (e.g. kilometres driven, numbers of trips), data on the under-reporting of road traffic crashes (i.e. underestimation of the true number of accidents), statistical methods for priority setting (e.g. to rank road safety measures), information on the socio-economic cost of crashes, information on frequent crash scenarios and patterns, results from in-depth crash investigations etc.).
- Section 5 concerns the data and resources for "development of road safety related programmes" (e.g. costs and benefits of a road safety measure, information on the safety impacts of combined road safety measures, good practice catalogue of measures—including implementation conditions, information on the public acceptance of a road safety measures, comparisons of safety rules and regulations etc.).
- Section 6 concerns the data and resources for "implementation" of road safety related measures (e.g. common methodology for identifying high risk sites, good practice collection on how countries have implemented specific road safety measures, digital road maps for mapping crashes, information from road safety audits and road safety inspections, common methodology for in-depth crash analysis, information on potential funding sources for road safety measures, good practice and methodologies for monitoring implementation, costs of road safety measures across Europe, tools for simulating road user behaviour etc.).
- Section 7 concerns data and resources for "monitoring and evaluation" of road safety measures (e.g. methods for evaluation of safety impacts of road safety measures, statistical methods for following trends, statistical methods for isolating effects of specific policies or measures, crash prediction models for various road types and layouts etc.).

In section 4 through 7, the survey participants were asked to rank the priority level of each one of the proposed items in a scale as follows: (3) high priority, (2) medium priority, (1) low priority, (0) not relevant to my work. In this 4-point scale, the '(2) medium priority' point aims to reflect a middle point, corresponding to a 'neutral' answer, while the '(0) not relevant to my work' point aims to reflect a 'don't know' answer. Such an odd-size scale aims to force respondents to make up their opinion about the question investigated, but also has potential drawbacks, as it may result into relatively extreme answering patterns. On the other hand, it was preferred over e.g. a 5-point scale, which may have resulted in more uniform answering patterns, in order to minimize the overall workload for the interviewee (i.e. large number of questions and large number of answering options in the questionnaire).

The list of items to be ranked by the survey respondents is presented in Table 1, together with their main descriptive statistics, i.e. mean, variance and number of missing values. For the complete version of the questionnaire, the reader is referred to (Machata et al., 2011).

Stakeholder contacts were collected from several sources:

- The European Commission's stakeholder list—collected e.g. during the consultation for the European Road Safety Action Programme 2011–2020.
- The contact database of the ETSC—European Transport Safety Council and the national contacts from members of the ETSC PIN (Performance Index) Panel.
- National contacts from members of the FERSI, the Forum of European Road Safety Research Institutes.

2.2. Data imputations

A set of 3150 individuals to be addressed was obtained in EU Member States and associated countries, as well as further countries in the European Region and overseas, such as the USA, Canada, Australia and New Zealand, and 512 responses were eventually obtained. From the 512 responses of the stakeholders' questionnaires, there were only 189 responders who answered all the questions. Moreover, 107 respondents did not answer any of the questions in the examined sections.

Apart from these 107 respondents, in the remaining 405 respondents, there were a few missing responses in various questions. In fact, these ranged from 5 to 35 missing responses per questionnaire item (see Table 1), which is a rather small proportion. These missing responses were imputed, so that they would not be excluded from the statistical analysis. Most statistical software exclude observations with any missing variable values (i.e. incomplete cases) from the analysis. Although analyzing only complete cases has the advantage of simplicity, the information contained in the incomplete cases is lost. Moreover, with this approach, possible systematic differences between the complete cases and the incomplete cases are ignored, therefore the resulting inference might not be applicable to the population of all cases.

The imputations were done using a multiple imputation (MI) procedure with the SAS v.9.2 software. More specifically, in single imputation procedures, each missing value can be imputed with the variable mean of the complete cases, or it can be imputed with the mean conditional on observed values of other variables. This approach, however, does not take into account the uncertainty about the predictions of the unknown missing values, and the resulting estimated variances of the parameter estimates will be biased toward zero (Rubin, 1987). Instead, multiple imputation (MI) (Rubin, 1996, 1987) replaces each missing value with a set of plausible values that represent the uncertainty about the right value to impute. In fact, MI draws a random sample of the missing values from its distribution. For data sets with arbitrary missing patterns, a Markov chain Monte Carlo (MCMC) method (Schafer, 1997) that assumes multivariate normality is used to impute all missing values or just enough missing values for continuous variables to make the imputed data sets have monotone missing patterns (for which several imputation methods exist, see SAS Institute Inc., 2008). Often, as few as three to five imputations are adequate in MI.