Barriers To The Use Of Efficiency Assessment Tools For Road Safety Policy

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Synopsis

It is well known that economic resources dedicated to the implementation of road safety measure are very often limited. In this view, the availability of efficiency assessment tools (EAT) that help decision makers to identify and to rank the most suitable safety measures, in terms of less money invested and more lives saved, is fundamental to optimize the use of the available resources.

Traditionally, EAT, such as cost-benefit and cost effectiveness analysis, are commonly applied for physical road safety measures within larger infrastructure investments, while their use for "minor" investment as road safety measures is less common.

In this paper are described the results of a specific study aimed at assessing the real use of EAT in road safety measures planning and implementation in European countries, and, mainly, at identifying the barriers that limit their application are described. The study has been performed within the EU funded project ROSEBUD, a thematic network, started in year 2002 and currently going on. The project is being conducted by several European road safety research institutes (e.g. DITS, BAST, SWOV, TOI, TRL), also involving political representatives and decision makers.

The use and the barriers reducing the use of EAT have been assessed through specific surveys to road safety decision makers at different level (e.g. urban, regional, national). In order to have reliable information and not influenced answers , the questionnaire has been developed with "open answers". Moreover, to increase the reliability of the results, all the interviews have been conducted personally, so that the interviewer could guide the interviewees throughout the questionnaire.

The sample is represented by a total number of 83 interviews; 6 of them carried out at European level, 50 at national and 27 at local/regional level. The total number of countries involved is 7; in addition representatives of the European Commission have been interviewed.

The analyses of the most interesting results are reported in the paper. The comparisons have been performed among Italy, European average values and the Northern European Countries; these are Norway, Netherlands and Germany that have been gathered together being the most experienced countries in road safety issues.

Results obtained stressed that in Italy CBA and CEA are still not part of decision makers' cultural and technical background, and not having a clear definition on responsibilities seems to have hindered its spread among the experts. Moreover, another big constraint to their application is related to the lack of knowledge and data about the impacts of road safety measures. At present, the analysis performed are characterized by a detailed costs analysis while impacts are only estimated in a qualitative way.

Barriers To The Use Of Efficiency Assessment Tools For Road Safety Policy

Introducion

It is well known that economic resources dedicated to the implementation of road safety measures are very often limited. In this view, the availability of efficiency assessment tools (EAT) that help decision makers to identify and to rank the most suitable road safety measures, in terms of less money invested and more life saved, is fundamental to optimize the use of the available resources.

EAT, such as Cost-Effectiveness Analysis (CEA) and Cost-Benefit Analysis (CBA), provide input to complex decision making based on clear rational-choice models, enabling ranking of options/measures with different degrees of effects. EAT is compatible with democratic principles, the analyses are founded on individuals' own values. EAT follows the housekeeping principle of getting the most out of limited resources and should provide a transparent structuring of society's own wants.

In most EU countries EAT are regularly applied for physical road safety measures, and also for this component within larger infrastructure investments. The UK and the Scandinavian countries have gone furthest in using CBA as an integrated tool in the decision-making process. No country has implemented the priority according to CBA to achieve a large potential of reduction in accidents [3]. For many types of safety measures neither EAT are applied and, if applied, the results from these methods are often disregarded when it comes to final political decisions.

In Italy, the overall responsibility for road safety issues is hold by the Ministry of Infrastructures and Transports (previously named Ministry of Public Works). To achieve the objectives foreseen by the European Commission's White Paper "European Transport Policy for 2010: time to decide", in terms of road accident fatalities and serious injured reduction, a specific Road Safety National Plan (*Piano Nazionale della Sicurezza Stradale - PNSS*) was designed in year 2000 by the Ministry of Infrastructure and Transport. The development of such plan was cast in national legislation; precisely law n°. 144 of 17 July 1999. [4]

The PNSS can be considered the national *strategic planning tool* for road safety, it provides directions and measures to promote plans and programmes aiming at improving road safety standards. It mainly focuses on: infrastructure design; accident prevention and control and legal, regulatory and management issues. Moreover, it provides the resources allocation criterion used by the Ministry of Infrastructures and Transports to divide economic resources among the different National territorial areas (e.g. Regions) [1].

General Guidelines for setting up specific interventions programmes and plans have been drawn up and published by the Ministry of Infrastructures and Transports. They also provides a detailed description of the methodology to be used in order to perform *preventive* road safety analyses. It distinguishes two different types of analyses:

-    the Road Safety Audit (referred to roads to be build);
-    the Road Safety Review (referred to existing roads),

Both instruments represent preventive processes aiming at identifying potentially dangerous situations, before accidents occur.

It is worth to notice that PNSS "General Guidelines" do not provide any indication on the usage of EAT to define the most suitable road safety measures. It means that actually, the use of tools such us the CEA and CBA to choose the most cost-effective countermeasure is not requested. The only tool that is usually applied is the CBA but only when the intervention is related to a major road network investments (e.g. highways)

Methodology

Several types of barriers to the use of EAT can be put forward. According to Elvik's definition [2], these may be philosophically based, with a *fundamental* rejection of the principles of EAT. The barriers may also be related to *institutional* settings – the organisation of policy making – with decision making based on rationality-principles and trade-offs incompatible with EAT. Further, barriers may be related to inherent methodological or *technical* deficiencies of EAT. Finally, the barriers may be related to the *implementation* of policies.

To assess the real use of EAT for road safety measures and to identify those barriers that are limiting their application in European countries, a specific study has been carried out. It has been performed within the EU funded project ROSEBUD, a thematic network, started in year 2002 and currently in its final phase (it will end in 2005). It has being conducted by several European road safety research institutes (e.g. DITS, BAST, SWOV, TOI, TRL), also involving political representatives and decision makers.

The methodology adopted is based on a specific survey's campaigns that have been carried out by all the European countries involved in the Project. These surveys were focused on road safety decision makers and political representatives, at different levels (e.g. urban, regional, national).

A specific questionnaire was designed and used. It contained approximately thirty questions structured in such a way that both use and barriers could be assessed; therefore, the following sections can be highlighted:
- Use of EAT for road safety measures
- Barriers of a philosophical nature (or fundamental barriers - A)
- Barriers related to the organisation of policy making (or Institutional barriers - B)
- Barriers related to efficiency assessment tools (C)
- Barriers related to the implementation of cost-effective policy options (D)
- Comments

Barriers in categories A and B are related to characteristics of policy making in general, barriers in category C are inherent to EAT and identify weaknesses of these tools, and barriers in category D may not prevent formal efficiency assessment of road safety measures, but will prevent the results of those analyses from serving as an important basis for actual policy priorities.

Although put into fairly fixed forms the questions were open-ended to enable the interviewees to broaden their opinions. Moreover, to increase the reliability of the results, all the interviews have been conducted *face-to-face*, so that the interviewer could guide the interviewee throughout the questionnaire.

It is to be remarked that the introduction to the questions stressed the confidentiality of responses and that the interviewees would be asked about personal opinions and personal knowledge – not be confronted primarily with quizzes and knowledge tests. Respondents were told that the purpose of the interview was to learn more about the use of formal methods for impact assessment in planning and priority setting for road safety measures. It was also explained what was meant by impact of safety measures, by CEA and by CBA.

However, different approaches to the application of the questionnaire were taken in the different countries. In some cases an early-stage (pre-test) draft of the questionnaire was applied, and in many cases the questionnaire was mailed to a respondent for self-administered filling-in, instead of conducting a personal interview.

Efficiency assessment tools: comparing Cea and cba

Traditionally, EAT, such as cost-benefits and cost effectiveness analysis, are commonly applied for physical road safety measures within larger infrastructure investments, instead their use for "minor" investment as road safety measures is less common.

Within this paper, the two most used methods for efficiency assessment, cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA), have been considered. They are closely related to each other. Both represent economic evaluations of alternative resource use and measure costs in the same way. They differ in the analytical questions that can be answered.

Within the CBA all relevant cost and benefit categories are measured in monetary terms. Also the benefits will be monetized. On the contrary within the CEA the costs will be measured in monetary terms as well, but the benefits are expressed in non-monetary terms (e.g. number of saved lives). While the CBA can be used to assess the absolute efficiency of a measure (by monetizing all costs and benefits), the CEA can only be used to ascertain the effectiveness of a measure in accomplishing a particular objective (e.g. increase in road safety).

CEA is affected by three main limitations. The first one is that the definition of cost-effectiveness becomes a problem if accidents of different severities are to be considered. It may then be necessary to estimate a cost-effectiveness ratio for each level of accident severity and then compare ratios across levels of severity. The second one, is that CEA does not include a criterion stating when a certain measure should be regarded as cost-ineffective, that is as giving too small safety benefits compared to the costs of the measure. It can only be used to rank order measures by cost-effectiveness. The third one is that it cannot be used to make tradeoffs against other policy objectives. It seeks to maximize a single objective only : to prevent accidents or injuries.

CBA seeks to overcome these limitations; accidents or injuries of different severities are made comparable by estimating the benefits to society (stated in monetary terms) of preventing them and safety measures are classified as inefficient if benefits are smaller than costs (CBA ratio <1). The value principle in CBA broadens out that of CEA. Tradeoffs against other policy objectives are made possible by converting all policy objectives to monetary terms. Thus, theoretically a CBA may include all relevant economic aspects and provide a comprehensive, holistic ranking of options. As far as road safety policy is concerned, the most important potentially conflicting policy objectives are those related to: travel time, costs of transport (vehicle operating costs), and the quality of the environment (noise, air pollution).

CEA is, conceptually, the simplest method to apply. It fits relatively well to an engineering, financial and layman approach to costs and prices related to budgeting. Actually it can be applied without fundamental comprehension of economic theory. If physical impacts of alternative safety measures are known, the needed data will consist of market prices of relevant inputs. However the mere minimization may involve a

complicated modelling if it includes many interrelated factors in addition to the time dimension. Certainly, such a minimization will also enter into CBA.

CBA may be as 'straight' to perform as CEA, but it may also involve more demanding elements, e.g., survey-based estimation of new values of time saving, life saving and noise/pollution reduction are to be included. A CBA should principally include all costs and benefits of a specific measure/project, and everything measured on a common monetary unit of measurement. The most difficult part of a cost-benefit analysis is often to obtain theoretically correct and empirically valid and reliable monetary valuations of all relevant impacts. Literally hundreds of studies have been made to determine the value of goods that do not have market prices, like the reduction of environmental pollution and reduced crash risk. Indeed, the theoretical attraction of CBA does not by itself make it easy to implement in practice, nor does it ensure that the results of CBA are always accepted.

The results

In this section are reported the main results of the survey campaigns. A comparison among European average results, Northern European Countries (NEC) and Italian results has been performed and main results are reported. NEC are represented by Norway, Netherlands and Germany; they have been gathered together being the most experienced countries in road safety issues.

Within the first section a general overview of the sample is provided while clear figures of national situation compared with both average European results and NEC is reported into a specific section.

The sample

The sample is represented by a total number of 83 interviews; 6 of them carried out at European level, 50 at national and 27 at local/regional level. The total number of countries involved is 7; in addition representatives of the European Commission (EC) have been interviewed; in detail the countries are: Norway (No), Netherlands (Nl), Germany (De), Italy (I), Hungary (Hu), Czech Republic (Cz) and Israel (Il). The detail of the interviewed' sample by country is given in Table 1.

All interviews were performed in the period May – November 2003.

Table 1 Interviews sample

source	European	National	Local	total
EC	6	-	-	6
No	-	10	4	14
Nl	-	6	4	10
De	-	6	3	9
I	-	12	6	18
Hu	-	5	3	8
Cz	-	7	3	10
Il	-	4	4	8
total	6	50	27	83

Although some tendencies can be identified, this is not meant to be a quantitative analysis of limited categories. The samples are somewhat small and unbalanced to enable well-founded statistical analysis. These represent small convenience samples of experts. Further, the samples from the bigger countries are not larger than samples from the smaller countries, and no attempt of a weighting procedure has been made. Since some questions asked for several possible reasons or points, a further unbalance is introduced by some respondents listing several reasons while others list only one.

A simple weighting procedure was then performed in order to balance each interview sample with its country's population; in detail, the following steps have been carried out
- first levelling the sample weights (i.e., applying the largest sample, the Italian sample, as a basis for levelling-up the other samples),
- then weight with respect to the respective country's population (or another similar criteria, e.g., representatives in the EU Parliament).

In general it should be stressed that such weighting by population size, giving relatively much more influence to (especially) single German responses and (also) Italian responses, still do not alter considerably the overall pattern or ranking responses as shown in Figure 1. Data refers to the whole sample and represents answers the major reasons (type of barriers) why EAT are not always performed.
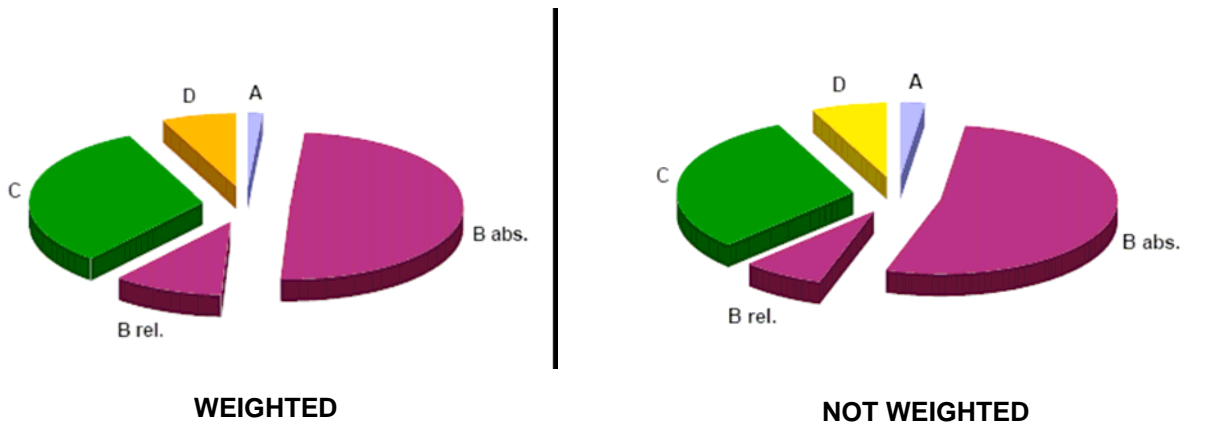
| WEIGHTED | NOT WEIGHTED |

Figure 1 Comparing weighted and not weighted answers

As it can be seen, the weighted distribution (by population size) provides nearly identical representation of the responses given to the question on "barriers to the use of EAT" as the non-weighted case. We will therefore use the non-weighted responses.

Analyses of the results
As already mentioned, some of the most interesting results will be depicted. A comparison has been performed among Italian answers (18 interviews), European average values (EU), obtained as results of all the given answers (83) and the Northern European Countries (NEC) situation, obtained adding Norwegian (14), Dutch (10) and German (19) interviews (up to a total of 33 interviews).
In terms of the use of EAT for road safety measures (Figure 2), Italian sample is characterized by the lowest application of these tools (some 20%); this is almost 20% less then the average value and more then 40% less of NEC.
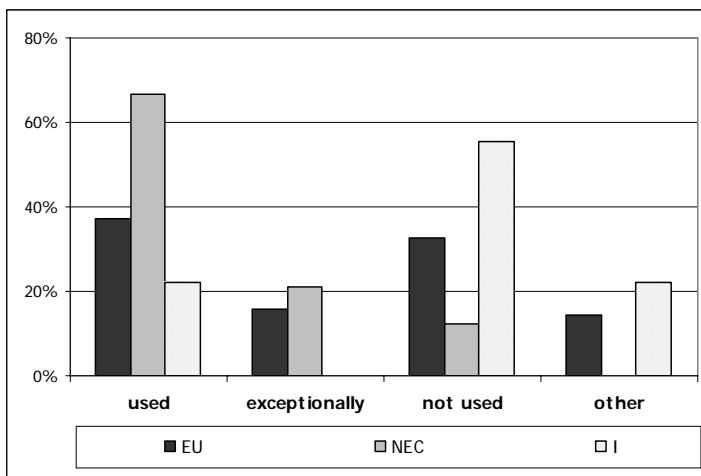
Figure 2 Use of EAT for road safety measures

The main reasons why EAT is used (or not used) for RS measures are summarized in Figure 3 where it is shown that in Italy they are not applied mainly due to both lack of data (in terms of measures' impacts) and lack of knowledge (some 65% of the interviewed). In detail, referring to the former it can be seen how the lack of data on measures impacts represents a major problem in Italy, more than 45%, while it is not in NEC, some 25%, and in Europe, with an average value of less then 30%. This differences are related to the longer experience on the application of EAT to road safety measures evaluation.
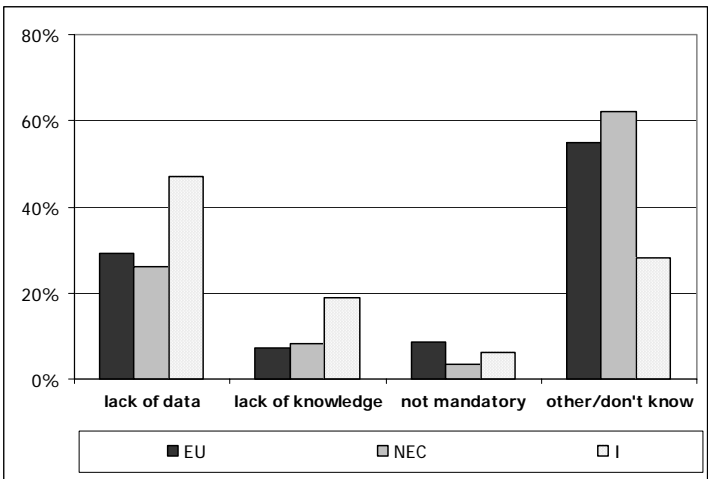
Figure 3 Reason why EAT are not used

A specific set of questions was developed to assess the barriers limiting the use of EAT for road safety measures; according to the "type of barriers" previously defined the most interesting results are depicted in following sections.

A) Fundamental Barriers

"Cost-benefit analysis is based on normative economic welfare theory, which embodies a set of principles intended to ensure that welfare is maximised" [7]. Therefore, specific questions were drawn to assess if decision makers, experts see any *philosophical* barrier to the use of EAT due to the valuation of accident reduction and human life in Euro.

Results in Figure 4 show that in Italy the valuation of reduced fatalities/injuries is considered to be helpful ("also helpful" plus "may be helpful") by almost all the interviewed and that just some 5% answered that it is not helpful at all. Comparing those answers with the European average and NEC values, it can be seen how average values indicates that more then 20% of the respondents consider the economic valuation of reduced fatalities/injuries being "not helpful". This values rise up to some 40% in NEC, showing that in countries with the longer experience there is the highest disregard toward monetary valuation.
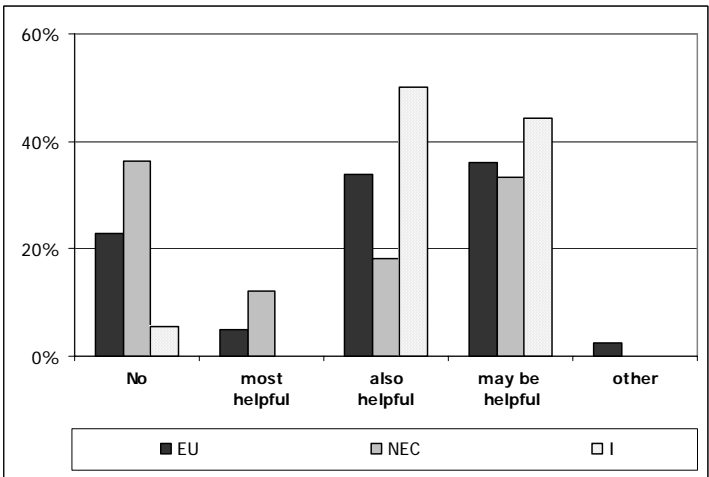

Figure 4 "Is it helpful to value reduced fatalities/injuries in €?"

Differences between Italy and EU flatten out regarding the "ethical objection to valuation in € of reduced fatalities/injuries" while they still remain compared to NEC; in any case for most of the respondents there is not any ethical objection in monetary valuation of reduced fatalities/injuries. In detail, NEC is the one characterized by the highest percentage of respondents (40%) seeing ethical objection, while average values are of some 25% and Italian less than 20%.
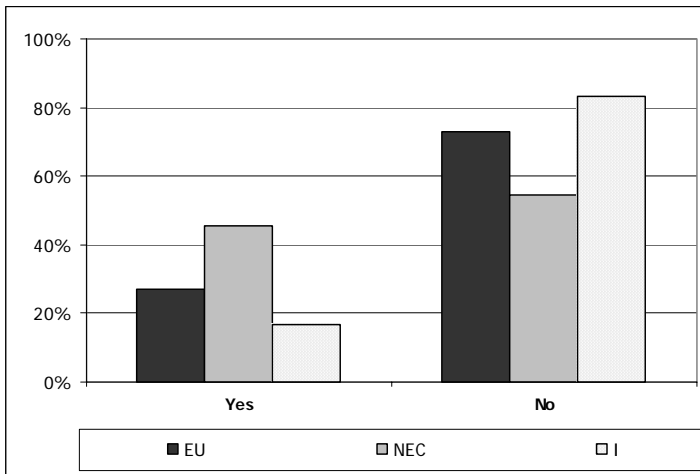
Figure 5 "Do you see ethical objections to valuation in €of reduced fatalities/injuries?"

B) INSITUTIONAL BARRIERS
Institutional barriers can be divided into "absolute barriers", if related to the political framework ,and "relative barriers", if related to the perception decision makers have of the existing tools.
In Figure 6 results depicting details of the former are given, while in Figure 7 details on relative barriers are shown.
In detail, it was asked if the obscured responsibility for performing CBA is a hindrance for doing CBA. Answers (Figure 6) shows that it represent the main problem in Italy (100% - "yes" plus "sometimes"), while average EU are of some 70% and for the 50% of NEC's representative that consider this being "sometimes" a problem (none perceived it as a problem – "yes").
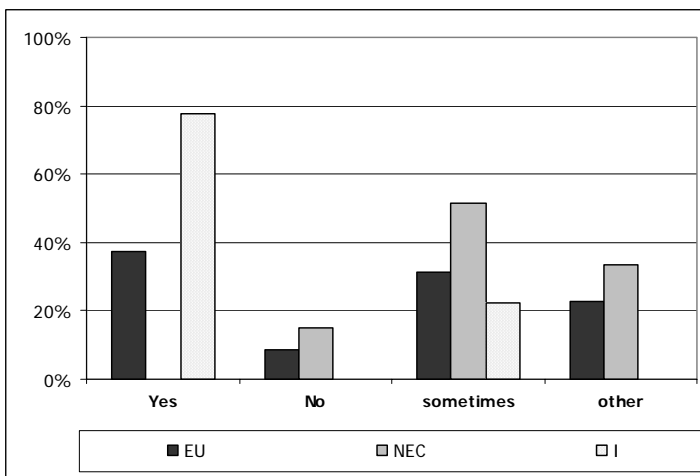

Figure 6 "Is obscured responsibility for performing CBA a hindrance for doing CBA?"

Referring to relative barriers (Figure 7), no major difference can be assessed among the references interviews. However, focusing on Italy an NEC answers, the reasons leading to consider current tools inadequate are substantially different. In Italy interviewees perceived that tools, such us existing guidelines, necessary to perform CBA are not adequate while for NEC's representative they are inadequate due to the lack of knowledge on measures' impacts.
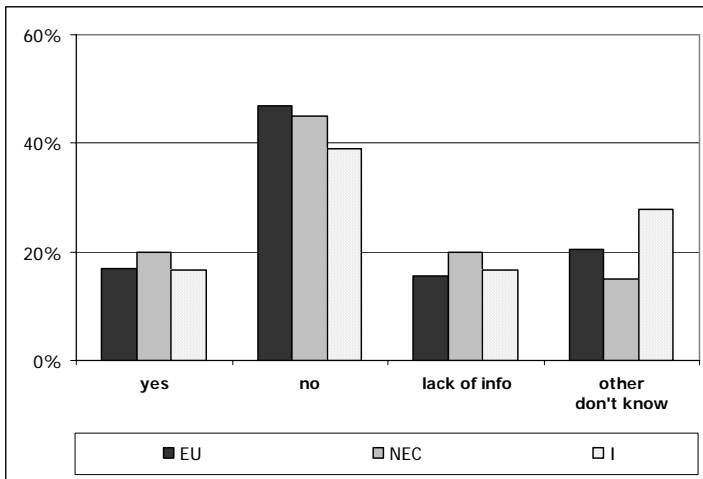
Figure 7 "Are the current tools for performing CBA adequate?"

C) Technical barriers

Technical barriers are the ones that, according to the sample, limit the use of EAT to RS measures and are mostly related to *technical* problems as measure impacts and economic valuation of reduced accidents/fatalities.

In Figure 8, results regarding the knowledge of RS impacts during planning activities are depicted. They show that in all cases most of the respondents perceive that RS impacts are not sufficiently known. Moreover, major differences can be drawn among Italy, EU and NEC; for the first one almost 80% of interviewed answered that impacts are not sufficiently known, while average value (EU) is some 55% and NEC is 45%. Another difference is that some 30% specify that the lack of knowledge is mainly related to users-related measures, average value do not exceed 15% and for Italy it drops dawn to 5%.
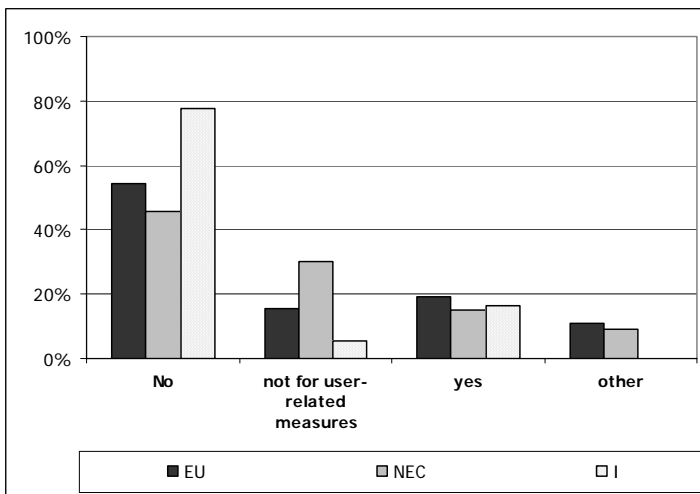

Figure 8 "Are impacts of Road Safety measures sufficiently known during planning?"

About economic valuation of reduced fatalities/injuries (Figure 9), major differences arose among the sample. Italy is the country characterized by the lowest confidence ("yes" plus "yes, conditionally) on those data with some 30% trusting current economic valuation; it is way under the EU and NEC values with, respectively, 50% and more then 65%. Major differences also exist among the reasons why respondents perceive no confidence on those data ("poor data quality" and "unreliable methods").
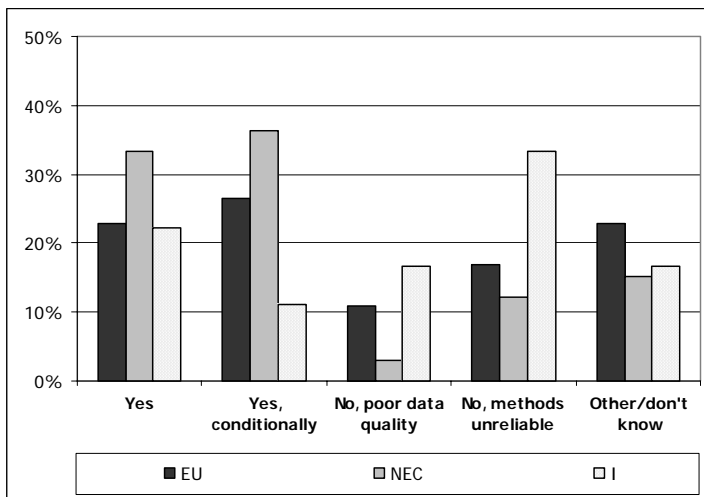
Figure 9 "Can we trust economic valuation of reduced fatalities/injuries?"

D) Implementation barriers

These are barriers that even if EAT are performed to evaluate a road safety measure, final decision will always be made by politicians that are often effected by "political reasons" instead of "technical reasons" (e.g. most popular instead of most efficient).

According to this assumption, answers reported in Figure 10 show almost the same values for EU, Italy and NEC. In detail, it can be seen that considering answers "yes, live saved" and "yes, definitely", more then 50% of all respondents perceived that politicians give bigger importance to the numbers of fatalities/injured.
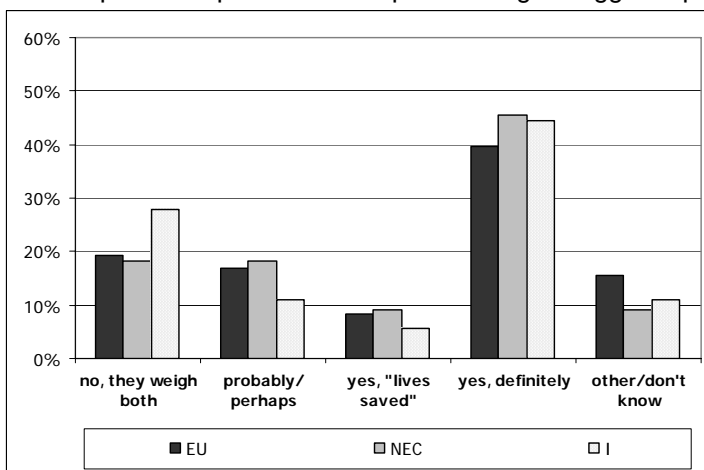

Figure 10 "Do politicians weigh numbers of fatalities/injuries more than €?"

Conclusions

To assess the barriers to the use of efficiency assessment tools for road safety policies a specific survey was performed; it focused on road safety decision makers and political representatives, at different levels (e.g. urban, regional, national) in order to have a detailed overview on EAT applications on road safety measures.

To collect these information a specific questionnaire was defined and applied within the thematic Network ROSEBUD, co-funded by the European Commission.

Main results of these surveys have been reported within this paper, comparing the Italian situation with average figures (all questionnaires collected) and Northern European Countries (Norway, Netherlands and Germany) results. NEC represents those countries having a longer experience in road safety area.

In terms of the use of EAT for road safety measures, Italian sample is characterized by the lowest application of these tools; it resulted to be almost 1/2 of the average European value and 1/3 of NEC's usage. The main reasons of why EAT seem to be mainly related to both lack of knowledge (on EAT applications) and lack of data (in terms of measures' impacts). Another interesting result is that in Italy just a very small percentage of the sample (5%) perceives as "not useful" accidents' monetary valuation while in NEC this value rise up to 40%.

These and all the other differences stressed within this paper show that in Italy CBA and CEA are still not part of decision makers' s cultural and technical background, and not having a clear definition on

responsibilities seems to have hindered its spread among the experts. Moreover, another major constraint to their applications is related to the lack of knowledge on the impacts of road safety measures. At present, the analysis performed are characterized by a detailed cost analysis while impacts are only estimated in a qualitative way.

References

[1] Aloia P., Atzori A., Persia L. (2004). "Cost-benefits analysis as a tool to improve road safety". *Proceeding of SIIV 2004*, Firenze (CD-ROM). Article n° 57.

[2] Elvik R. (2001). "Cost-benefit analysis of road safety measures: applicability and controversies". *Accident Analysis and Prevention*, n°33, pg. 9-17.

[3] Elvik R. (2003). "How would setting policy priorities according to cost-benefit analyses affect the provision of road safety?". *Accident Analysis and Prevention*, n°35, pg. 557-570.

[4] Ministry of Infrastructure and Transport (2001). "National Road Safety Plan".

[5] Ministry of Infrastructure and Transport (2002). "Annual Implementation Programme 2002 for the National Road Safety Plan".

[6] ROSEBUD – WP1 (2003) Report: "State of the art". Federal Highway Research Institute, BASt, Germany

[7] ROSEBUD – WP2 (2004) Report: "Barriers to the use of efficiency assessment tools in road safety policy". Federal Highway Research Institute, BASt, Germany.

[8] Varian, H.R. (1992). "Microeconomic analyses". Norton&Company Inc.