Amitran

CO_2 Assessment Methodology for ICT in Transport

D2.1: Framework Requirements Definition

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Work package	WP2: User needs and use cases
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Authors	Axel Wolfermann, Eline Jonkers, Joke Kort, Txomin Rodriguez, Dick Mans, Thomas Benz, Kay Gade
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Abstract	This deliverable contains the description of the user needs assessment and the conclusions drawn for Amitran. The user needs assessment is based on a workshop, an online survey, and interviews with selected stakeholders. Derived requirements are summarised and related to the subsequent work packages.

IP Coordinator	Gerdien Klunder, TNO
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Executive Summary

The aim of Amitran is to develop a framework for evaluation of the effects of ICT measures in traffic and transport on energy efficiency and CO_2 emissions. By doing so, Amitran will contribute to the development of ICT solutions that allow more efficient multi-modal transport of goods and passenger mobility.

In order to make Amitran a useful and successful methodology, the needs of potential users have to be identified. This is the objective of Work Package 2 and its outcome is described in this deliverable. Amitran methodology will be developed in WP4 and WP5 along the conclusions drawn from this user needs assessment. Amitran will be validated in relation to the user needs (WP 6).

Three methods were used to identify the user needs,: an initial workshop with selected stakeholders, a broad stakeholder survey, and interviews with stakeholders of particular relevance. Furthermore, a project analysis was carried out. In a final analysis, these four sources were combined to derive the stakeholder requirements.
The workshop served as the foundation for further user needs assessment. The Amitran outline underwent the first screening in order to identify crucial issues. These had to be assessed in more detail later on.
A broad audience of potential stakeholders had been addressed with the use of an online survey. 58 completed questionnaires were received and evaluated. The results were analysed for the following three stakeholder categories, because for these groups we received sufficient responses for a separate analysis: Public authority or legislative body (17 respondents), ITS manufacturer or developer (7 respondents) and Research and Consulting Organisations (22 respondents).
Following the online survey, interviews were conducted with selected stakeholders. The main aim of the interviews was to gain deeper insight into specific topics from the questionnaire [3]. Additionally, the stakeholder groups underrepresented in the online survey were addressed more thoroughly.

The user needs assessment tackled five topics of key importance to Amitran:

- Stakeholders: Who are the major stakeholders and what are their major needs for Amitran?
- Importance of CO_2 impacts: In which context does Amitran have to be seen? Should Amitran focus on CO_2 only, or could it be advisable to make the methodology open for extensions and highlight potential synergies to issues like traffic quality and economic appraisal?

- ITS (present and future): Which ITS are of particular relevance for the CO_2 assessment? Are any changes expected that should be considered by Amitran?
- Important impacts of ITS, mechanisms and models: Which mechanisms leading to CO_2 emission are changed by the deployment of ITS and how are they reflected in the Amitran methodology?
- Output, application, and importance of Amitran: The result of Armitran and its application has to be presented in a useful way for the users. What should the output look like and how should tools be designed to meet the users' demands?

The user needs assessment identified three categories of stakeholders:

- Stakeholders requiring the use of Amitran (e.g. public authorities).
- Stakeholders influenced by the output of Amitran (e.g. ITS End Users).
- The actual users of the methodology (mainly research and consulting).

Some stakeholders can belong to several of these categories (e.g. ITS Developers).
High level decision makers in policy and ITS development and deployment are expected to benefit most from Amitran. They will use the Amitran output to compare different measures involving ITS or to compare competing systems. These decision makers will most likely not conduct the assessment themselves, but grant contracts to consultancies or research facilities for the application of the methodology. All geographical scales (from local to European) and all categories of ITS are of potential relevance to these decision makers and have to be addressed by Amitran. Cooperative systems and intermodal systems will gain importance.

The greatest benefit of Amitran would be to achieve wide recognition as an accepted assessment methodology which provides comparable, scalable, transparent and accurate results. CO_2 is not the only concern of the stakeholders, but one of growing importance. Traffic quality (efficiency) and safety will continue, though, to play a major role in decisions on system development and deployment. Hence, the Amitran framework should be seen in the context of other assessment tools. The opportunities emerging from the assessment approach should be exploited not only with respect to CO_2 effects, but also, for instance, regarding indicators affecting the traffic quality.

The limitation of existing models and the combination of them will be a major challenge for Amitran. The interfaces developed in Amitran (WP 5) have to take into account the shortcomings, data needs, and the particularities of different models with differing granularity. The achievable accuracy of Amitran has to be underlined, and future improvements of models should blend into the methodology.

The user needs assessment stressed the relevance of Amitran to the stakeholders. This was supported by the outcomes of the user needs assessment. The requirements such as the comparability of results, the broad scope in geographical scale and covered systems, and the relevance of flexible, transparent and sound interfaces between models incorporated in the methodology were identified as particularly important.

Evaluation of on-going and finished projects in the area revealed that most projects include at least some validation of developed functions. However, a comprehensive evaluation in terms of an impact assessment for a larger horizon, like the whole of EU, is out of scope of almost all projects. Not only are the tools used in such projects applicable to only smaller scale effects, but the vast amount of information required for proper scaling-up is out of scope of such projects which focus on function development.

From the user needs assessment summarised above requirements for the further development of Amitran were drawn, which are assigned to different working packages in the deliverable:

- Amitran should become a standardised and accepted CO2 assessment methodology.
- Amitran needs to have a broad scope concerning geographical scale and transport modes.
- Particular attention has to be given to cooperative systems and intermodality.
- Interfaces have to be transparent and flexible in order to support best use of available and future models used for the assessment.
- The achievable accuracy of models and possible gaps in the assessment due to insufficient assessment tools have to be considered.
- Different stakeholder needs have to be addressed in a dedicated manner.
- Opportunities from secondary output (e.g. traffic quality) should be seized.
- Providing information for areas where no sufficient data is available (scaling-up)

One of the results of the user needs analysis is the generation of Amitran use cases. The use cases illustrate in which context and for which purpose Amitran might be applied, having two different roles: in the development of the methodology, providing better understanding and specific requirements for each different situation of use, and also for validation purposes as a basis for the scenarios definition. Use cases are defined upon the profile of the relevant stakeholders in terms of environment of use (final users, research, policy makers), scale of use (large, small) and also because they have been found to cover the broad range of all potential users and stakeholders of Amitran. The resulting use cases have been defined according to the following profiles: national authorities, local authorities, logistics companies and research and consulting companies. The use-cases will be detailed further in WP 3.

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Acronyms

Acronym	Description
ICT	Information and Communication Technology
ITS	Intelligent Transport Systems

1.Introduction

The aim of Amitran is to develop a framework for evaluation of the effects of ICT measures in traffic and transport on the energy efficiency and CO_2 emissions. By doing so, Amitran will contribute to the development of ICT solutions that allow more efficient multi-modal goods transport and passenger mobility.
The objective of WP2 in Amitran is to identify user needs in relation to the modelling framework. The identified user needs will build the basis for the development of requirements towards the modelling framework, and they will be reflected in the use cases that will be defined for the development and validation of the modelling framework and the ITS typology. This ensures the development of a modelling framework and, in consequence, research results that ensure maximum added value to the users, namely ITS developers, ITS practitioners, public authorities and related research groups.
This deliverable describes the outcomes of WP2.

1.1 User needs assessment approach

The following steps were undertaken to assess the user needs for Amitran:

1. Identification of users and stakeholders of the methodology and modelling framework, i.e. the "end users". This step served as a support step for the other steps (see below). In the description of work some stakeholders were already identified, and this list was complemented at the start of the project and during the stakeholder workshop.
2. Organisation of a workshop with selected key users and stakeholders to identify user needs. This step comprised the first Amitran stakeholder workshop (the user needs workshop), which was held on the 1st February 2012 in Berlin. For this workshop key users and stakeholders were invited, to discuss user needs together with the Amitran consortium. The results of this workshop were also used to develop a survey (step 3).
3. Preparation and realisation of an online survey. This survey was sent to a broader group of stakeholders and users (e.g. the Amitran Forum). A limited number of respondents of the survey was identified and approached for more detailed interviews (step 4).
4. Interviews with stakeholders. Interviews were performed to gain a more detailed insight in specific survey topics and underrepresented stakeholders groups.
5. Desk research and evaluation of related projects. To complement the identification of user needs, desk research and an evaluation of related projects was carried out in this step.

Steps 1 to 4 were carried out one after the other; step 5 was carried out in parallel with the other steps. Finally, all steps were analysed and synthesized together in order to derive the stakeholder requirements for Amitran, as reported in chapter 8.

An additional result of the user needs analysis in WP 2 was the outlining of use cases which will be used to further develop the methodology and validate the Amitran approach. The use cases illustrate in which context and for which purpose Amitran might be applied, having two different roles: in the development of the methodology, providing better understanding and specific requirements for each different situation of use, and also for validation purposes as a basis for the scenarios definition.

1.2 Deliverable overview

The structure of this Deliverable is as follows. The results of the user needs workshop are given in Chapter 2. The results are concisely summarised. Detailed minutes and the list of participants are presented in the workshop mintues, [1]. The objectives, set-up, distribution, response and analysis of the online survey are described in Chapter 4. Chapter 5 contains the interview results. Chapter 6 and Chapter 7 provide the link with other projects. Conclusions from other projects concerning user needs assessment relevant for Amitran are drawn in Chapter 6,. Use cases are defined in Chapter 7.
Each chapter contains its own summary and, in addition to this, the overall conclusions are given in Chapter 8. The Annexes contain information on the questionnaire tool, the detailed survey results, list of interviews conducted and project references. Finally, references to the source literature and related deliverables are given.

2. Stakeholder needs analysis

2.1 Initial stakeholder grouping

To ensure the consideration of all possible stakeholders of Amitran, i.e. organisations who will in any way influence Amitran or be influenced by Amitran, including the direct users of the methodology, stakeholders have been categorised into groups. These groups were presented to the workshop participants and discussed with them. During this discussion, the role the different groups might play in the context of Amitran has been examined further. The first outline of the stakeholder groups is shown in Figure 1 and discussed below.

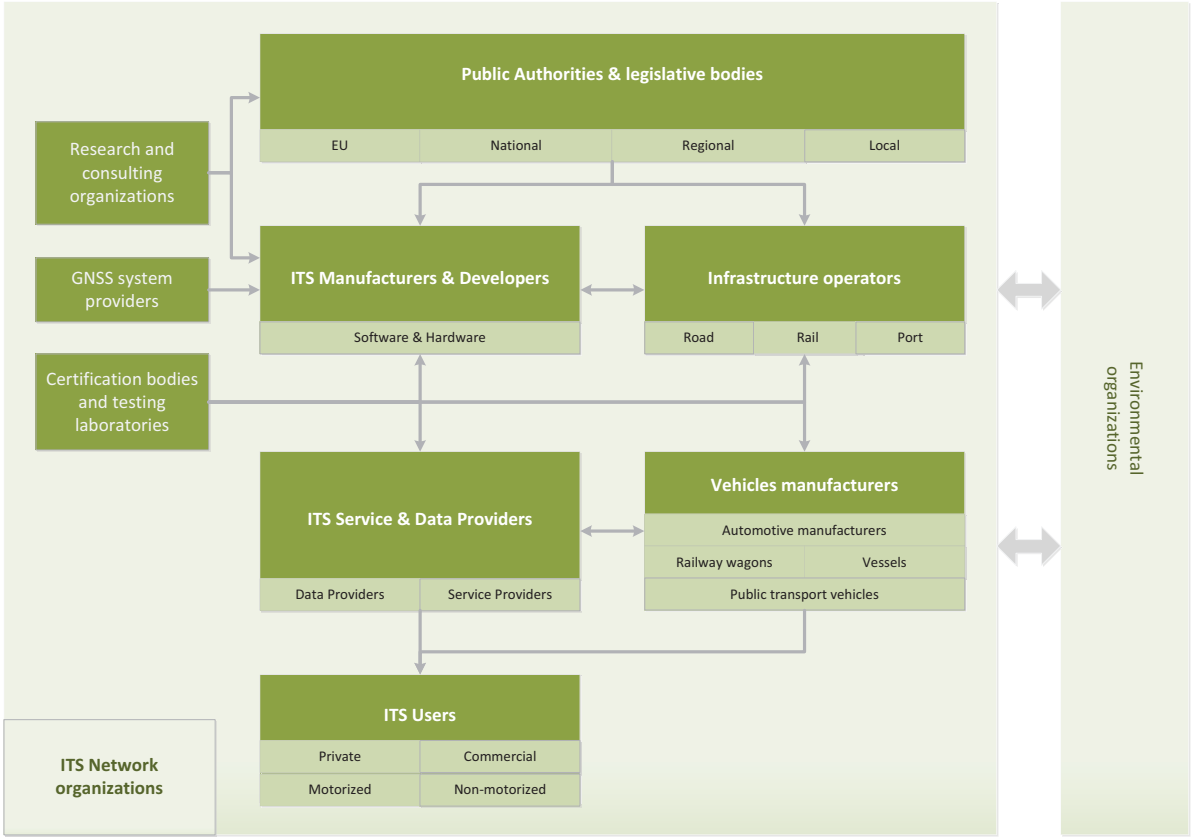


Figure 1 Initial separation of stakeholders into groups

- Public authorities and legislative bodies;
  Public authorities and other bodies with legislative or executive powers exist on European scale, national scale (e.g. ministries, federal agencies), regional scale (e.g. regional planning bodies), and local scale (e.g. metropolitan authorities). As representatives of the general public and important decision makers, they play a major role for CO_2 emission mitigation.

- Infrastructure operators;
  Infrastructure operators are involved in ITS deployment, they also provide data used by ITS and provide the means for traffic and transport. Infrastructure operators can be public authorities and ITS users at the same time. They might also be involved in ITS development.
- ITS manufacturers and developers;
  Companies developing systems for ITS users, e.g. vehicle manufacturers, ITS system manufacturers and infrastructure operators.
- ITS service and data providers;
- ITS users;
  ITS users can be private persons making use of ITS systems, but also public transport companies, logistics providers, or the like.
- ITS network organisations;
  ITS network organisations are lobby groups bundling the interests of other stakeholder groups in ITS development or deployment. Because they do not develop or use systems themselves and might represent stakeholders from different other groups, they have been defined as a separate group.
- Vehicle manufacturers;
- Environmental organisations;
  Amitran serves a CO_2 assessment and thus facilitates the reduction of CO_2 emissions, which is in the interest of environmental organisations.
- Research and consulting organisations;
  Research and consulting organisations can work for all other stakeholder groups. Because they are specialists in their representative fields, they play an important role in the successful application of Amitran.
- GNSS providers;
  Global navigation satellite system (GNSS) providers represent a special group related to ITS development and service provision. GNSS are an important part of many ITS. Thus, these organisations have been listed as a separate group.
- Certification bodies and testing laboratories;
  Certification bodies and testing laboratories can have a major part in establishing standards, as Amitran aims to be. Validation and acceptance of the methodology of Amitran can consequently be influenced by these organisations.

2.2 Discussion

A distinction can be made between ‘users’ (i.e. applying the methodology) and ‘stakeholders’ (i.e. interested in the output or contractors, which include ‘users’). In this deliverable we will

use the term ‘stakeholder’ when we mean the total group of organisations/people with an interest in Amitran.

The initial stakeholder grouping was discussed in the user needs workshop (Chapter 3). Missing groups have been identified and the role of the different groups has been highlighted. The resulting stakeholder groups served as the basis for identifying interview partners and online survey participants. The final identified stakeholder groups are presented in the analysis and conclusions in chapter 8.

3. User Needs Workshop

3.1 Context

After the identification of stakeholders, the workshop was the next step in the Amitran user needs assessment. The user needs assessment combines different methods to understand what the stakeholders of Amitran expect from the methodology. An online survey provided feedback from a broad basis of stakeholders. Interviews allowed a discussion of selected topics, where the questionnaire could not give answers in the desired depth. The workshop served as preparation for the survey. It also provided the first opportunity to discuss Amitran with stakeholder groups not represented in the consortium and partners from related projects. The small group in the workshop ensured intensive and productive discussions from different vantage points.

3.2 Methodology

The workshop participants discussed the following two topics in small groups after an introduction to Amitran was given:

- What does Amitran have to take into account (stakeholders, systems and services, CO_2 emission mechanisms, models)?
  Discussion highlighted the most important points of the methodology. The participants made sure that no stakeholders, systems, etc. crucial for the methodology to be successful are omitted.
- What requirements have to be fulfilled by the output generated following the Amitran methodology?
  This topic focused on the usability of Amitran. To become a recognised and accepted methodology, not only has Amitran be technically sound, but also it has to address the needs of its users. This applies not only to the content itself, but also to the way it is presented. In this part of the workshop, the handbook, checklist, Amitran Forum etc. have been discussed by the workshop participants.

The emphasis of the workshop was put on intensive discussions. The discussions were initiated by short presentations. Splitting the stakeholders into groups ensured the diversity of outcomes without mutual bias.

3.3 Results from the Stakeholder Workshop

The workshop was documented by detailed minutes, which can be found in [1]. The major conclusions are described in the section below.

3.3.1 Stakeholders' roles

After discussing the different stakeholder groups during the workshop, the stakeholders to be taken into account by Amitran were divided into three categories: stakeholders requiring the application of Amitran (e.g. public authorities); stakeholders applying Amitran (e.g. research and consultancy companies); and stakeholders using the output of the application (e.g. ITS end users). Furthermore, insurance companies were added as a stakeholder group. Following the distinction of roles for Amitran, the stakeholder groups are illustrated in Figure 2. The three sides of the triangle represent the role (requiring the use of Amitran, application of Amitran, and influenced by results of Amitran). Categories of groups with similar role are framed. Certification and standardisation bodies and testing laboratories are separated to highlight their slightly different focus.

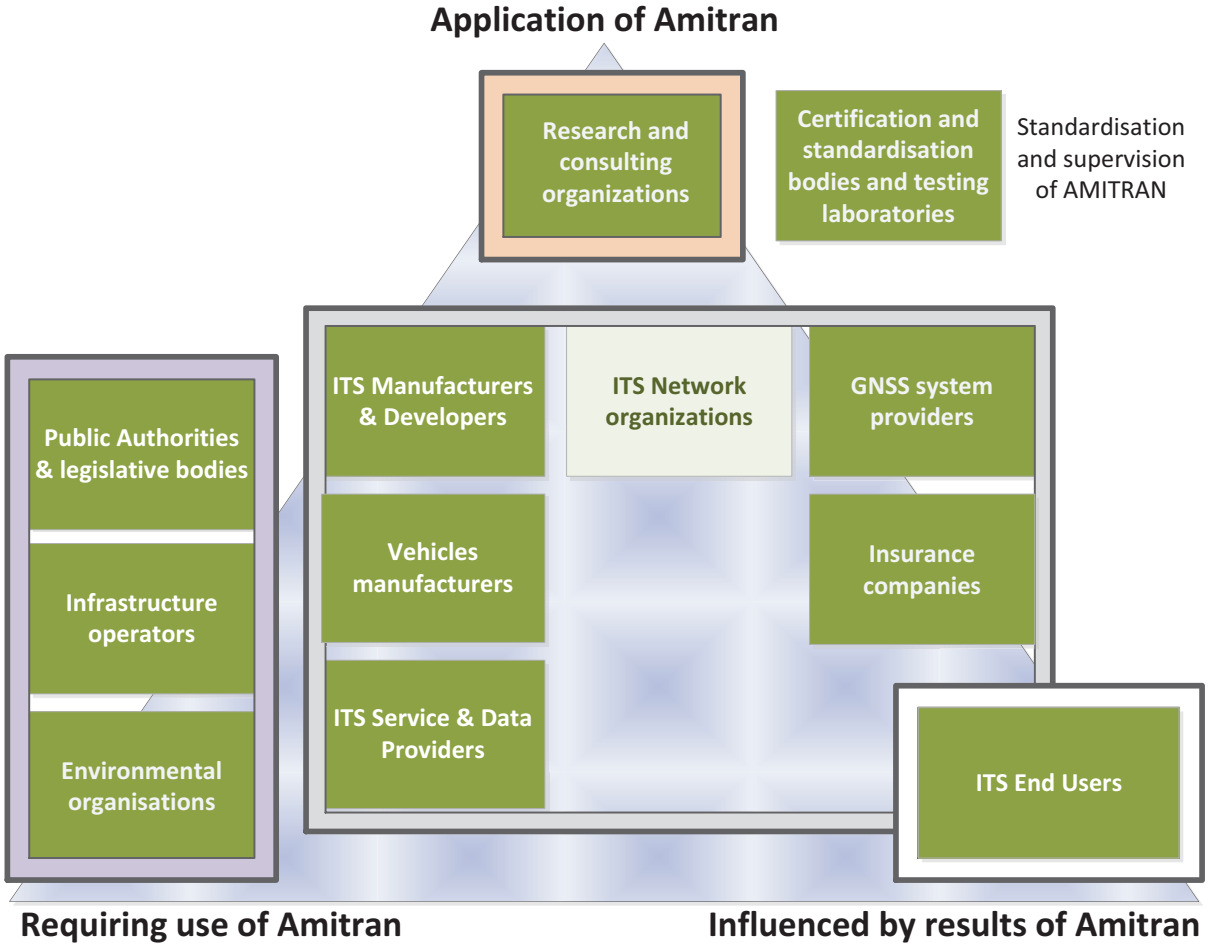


Figure 2 Illustration of stakeholder groups and their role for Amitran

3.3.2 Scope of Amitran

During the workshop the stakeholders discussed the scope of Amitran. All fields of ITS are seen as important ones. It became clear that Amitran will not be able to cover all possible systems, services and CO_2 impacts, but it is important that all major kinds of ITS are represented. ITS which influence driver behavior and access and demand management were mentioned as being of particular importance for CO_2 emissions. Besides this, the possibility to model certain mechanisms plays a role. For example, predicting behaviour on travel demand is very difficult but relevant.

It is expected that cloud computing, 'internet of things' (uniquely identifiable objects and their virtual representations in an Internet-like structure), cooperative systems automated driving and multimodal systems will gain importance in the future. Amitran has to be flexible enough to deal with trends like these.

3.3.3 Requirements on the methodology

It is important that Amitran is transparent and methodologically sound, the output is easy to understand, and that Amitran enables the decision makers to prioritise alternative measures to fulfil the requirements of the stakeholders. This last requirement means that when a user uses the Amitran methodology for different systems, the results are accurate and comparable. This will increase the acceptance of decisions and investments made.

3.3.4 Requirements on documentation

It the end of the project, Amitran will deliver a handbook and a check list for carrying out assessments with the Amitran methodology. According to the stakeholders, this documentation should offer the experts a detailed explanation of the methodology, and it should offer the users of the output a concise description sufficient to understand the output. Experts should be guided by a step-by-step approach and should be able to look up the descriptions of models. Online availability of the handbook and the check list are seen as very important. Case studies, references, and regular updates should be provided.

4. Online Survey

4.1 Objectives and topics of online survey

In order to make Amitran as successful as possible, the user needs have to be identified. A first step was achieved by the User Needs Workshop, which paved the way for further steps. While the workshop was limited to a small group of participants to ensure intensive discussions, the aim of the online survey was to broaden the focus, but limit the depth of the addressed topics. Thus the questionnaire had been kept short to achieve a high response rate. Issues identified in the workshop were presented to a variety of stakeholders to ensure that Amitran is designed with the opinions of all stakeholders considered. The objectives of the survey were to:

- Identify the relevant stakeholders of the Amitran methodology and analyse their role in ITS development and deployment;
- Assess the importance of CO_2 emission impacts of ITS in relation to other criteria (e.g. economic, financial, social) , and prioritise ITS with respect to CO_2 emission assessment;
- Acquire knowledge of the technological developments and other drivers that may affect ITS development and deployment;
- Identify the mechanisms and models the stakeholders deem to consider important in the methodology;
- Get insight into the basic needs & requirements of the stakeholders with respect to the application of Amitran, analyse the desired output of the methodology;
- Identify the interview partners for the system assessment (WP 3).

These objectives have led to the identification of five main topics (Figure 3) that were addressed by the online survey and served as the basis for the interviews conducted subsequently (cf. Chapter 5).

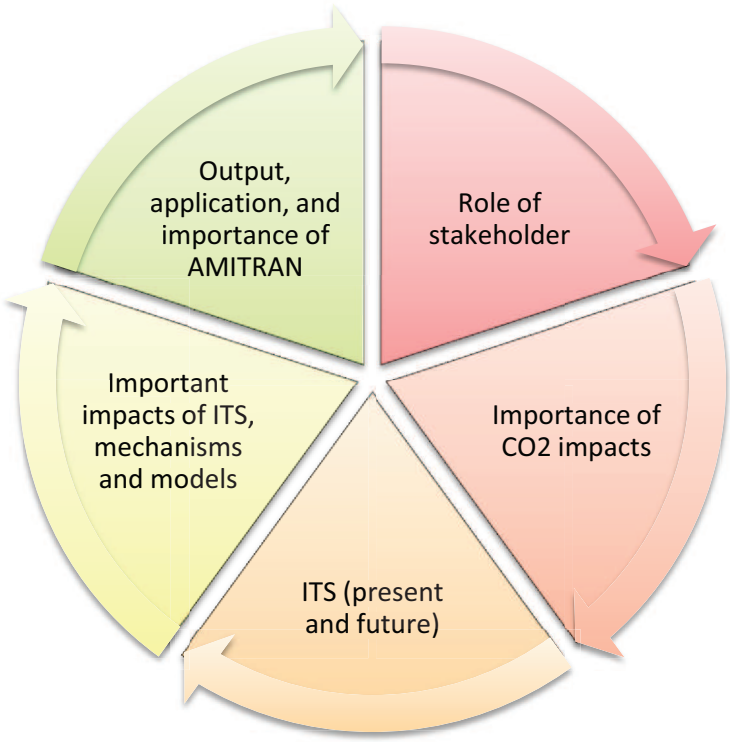


Figure 3: User needs assessment topics

1. **Role of stakeholder**

This objective is aimed at determining the role of different stakeholders; their involvement in ITS; kinds of traffic; do they already use some method to analyse CO_2 emission impacts of ITS, and if so which? Etc.

2. **Importance of CO_2 impacts**

The second objective is aimed at the importance of knowledge of the CO_2 emission impacts: what role does the knowledge play in relation to other aspects (such as economic and safety impacts)? What scale of the emissions is of importance for the stakeholders and why? What expectations do the stakeholders have with respect to this role in the future?

3. **ITS (present and future)**

This objective was focused on the role of different ITS; what systems are relevant now and in the future? What changes can be expected in the future; separation from other measures, changing conditions for deployment and use, which trends? Etc.

4. **Important impacts of ITS, mechanisms and models**

This objective aims to clarify the importance of the different impacts of ITS, the mechanisms involved and the evolvement of models and assessment tools.

5. **Output, application, and importance of Amitran**

The final objective is to assure the usefulness of the Amitran tool: what output should be provided with the assessment following the Amitran methodology; which role should it play for the stakeholder; who will be the primary users; how important is the scaling up to European level; what requirements should there be for the handbook and the checklist?

4.2 Questionnaire distribution and responses

4.2.1 Questionnaire and distribution

The questionnaire was established to identify the most important requirements Amitran should meet. In a second step selected participants of the survey were asked more detailed questions in telephone interviews. This was done after the receipt of their accord (information obtained through the questionnaire) (cf. Chapter 5).
The questionnaire contains 30 questions. This includes a question and request for contact data with respect to receiving further information about Amitran and accord on the telephone interview. This information was not required to complete the questionnaire, should the participant choose to stay anonymous.
Details on the online tool used for the survey are given in Annex A.
The questionnaire was distributed by mailing lists and contacts of the partners, through distribution channels of ITS networks and through partners of other projects. In this way several hundred potential stakeholders have been addressed.

4.2.2 Responses

In total 329 participants opened the questionnaire. The number of respondents that actually answered is not constant for all questions. This means that a number of participants did not answer several questions in the survey.
The first page with questions (page 2 in the questionnaire) was opened by 192 people (43% of all the ones that opened the questionnaire). Between 76 (40%) and 82 (43%) answered the questions on the first page.
The second page with questions was opened by 121 participants (37% of 329) and answers came from 65 (54% of people reading the page) to 67 (55%).
The next page was read by 98 people (30% of 329) and answered by 63 (64% of readers). These numbers remained almost constant for the rest of the questionnaire, even if some respondents did leave out one or the other question.

Only the fully completed questionnaires were chosen for evaluation, because only these were considered sufficiently reliable, which was done by 58 respondents.
The answers are analysed both for the total of all respondents as per stakeholder category. Since this is only meaningfull if there is a sufficient number of respondents for such a stakeholder category, the results are only given for the stakeholder categories with sufficient respondents. As explained in the next section, these are: Public authority or legislative body (17 respondents), ITS manufacturer or developer (7 respondents) and Research and Consulting Organisations (22 respondents). The remaining respondents are taken together in the category 'Others' (12).
After deleting all the contact details, the file was made available to project partners for evaluation. The contact details were forwarded only to the partners carrying out telephone interviews or setting up a contact database for interested parties, e.g. for receiving newsletters.

4.3 Survey results

4.3.1 Stakeholder's role

The first topic in the questionnaire considered the stakeholder's role. Most responses have been received from research organisations, public authorities, and ITS manufacturers, with respectively 38%, 29% and 12% of all respondents. All the responses from other stakeholders constituted below 20% of the overall answers. These include mainly agencies and branch organisations. Not all stakeholders could uniquely identify themselves with one group. Infrastructure operators, for instance, could also be a public authority. Furthermore, most responses were received from people holding high level positions (CEO, senior researcher etc.).

The ITS categories were well covered by the survey. The range of involvement of the organisations who responded with ITS is very broad (Figure 4).

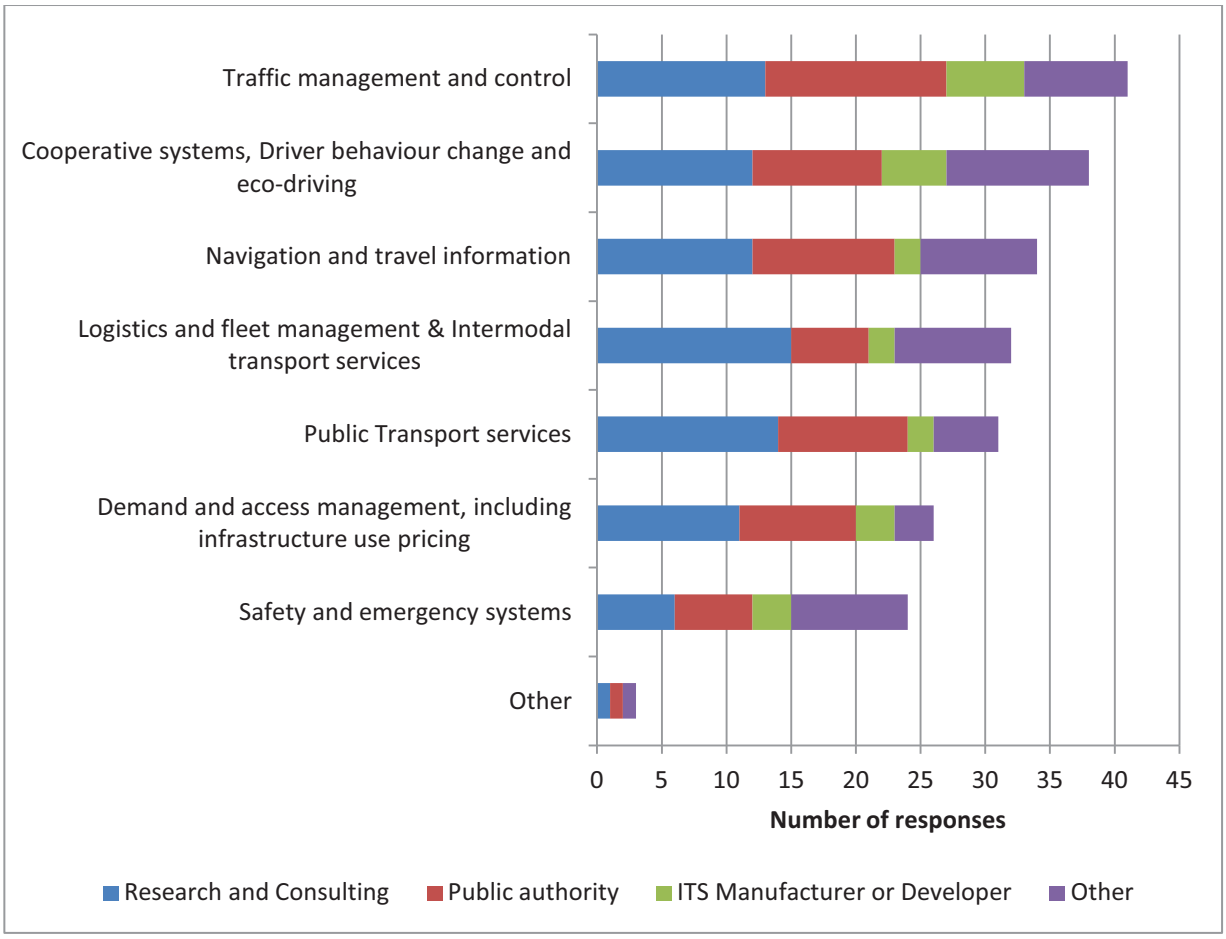


Figure 4: Which Intelligent Transport System is your organisation involved in (in any way)?

The same applies to the type of work in relation to ITS (development, application etc.; Figure 5).

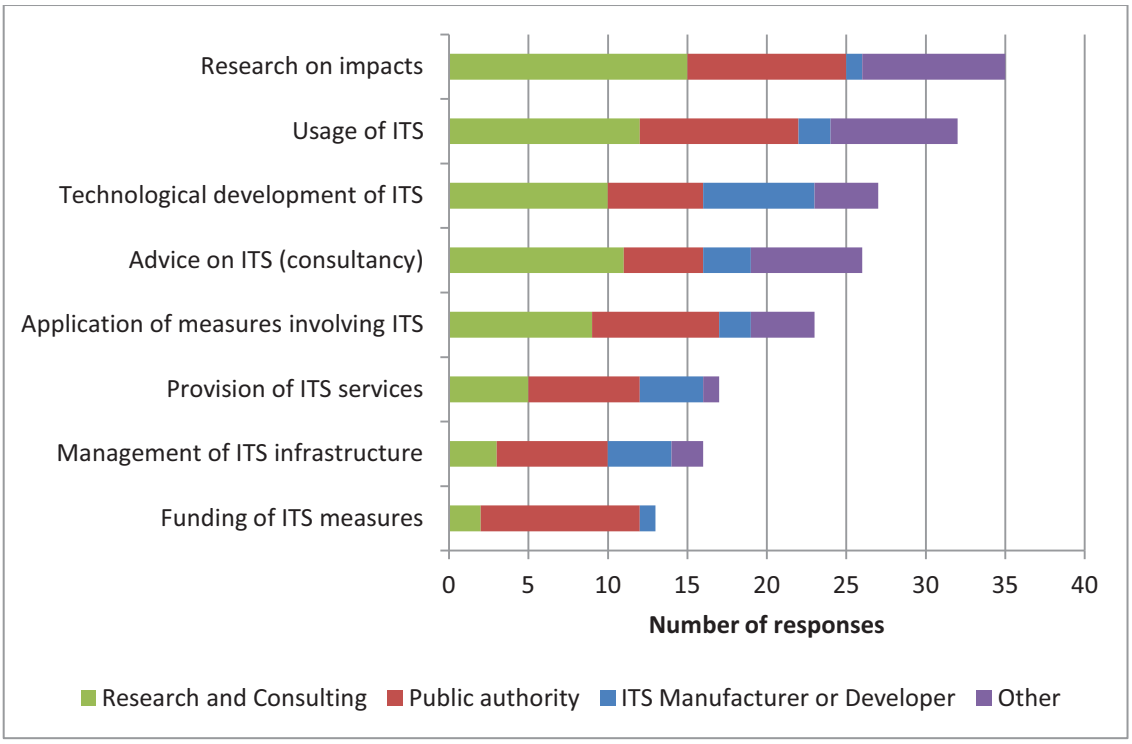


Figure 5: Which type of ITS work are you involved in?

All transport modes and categories addressed by Amitran are covered by the responding organisations.

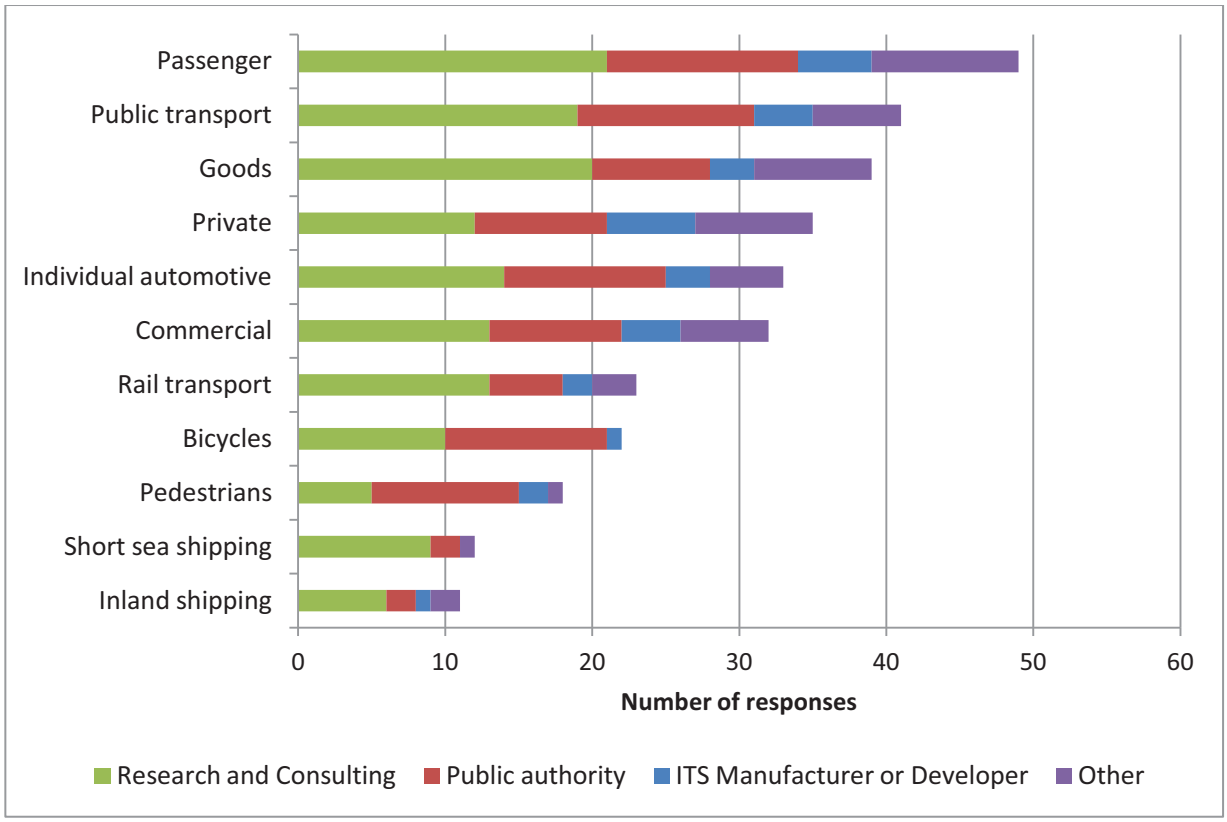


Figure 6: Which types of traffic and transport modes is your organisation involved in?

It can be observed that most respondents are involved in passenger transport, public transport and freight transport (N.B. rail transport can include both freight and passenger transport). Only few respondents are involved in inland shipping and short sea shipping. This is particularly relevant for the stakeholder group research & consulting, where almost all entities deal with both freight and passengers. ITS manufacturers, however, are mainly focused on passenger transport and private customers, while public authorities are mainly focused on passenger transport and pedestrians.

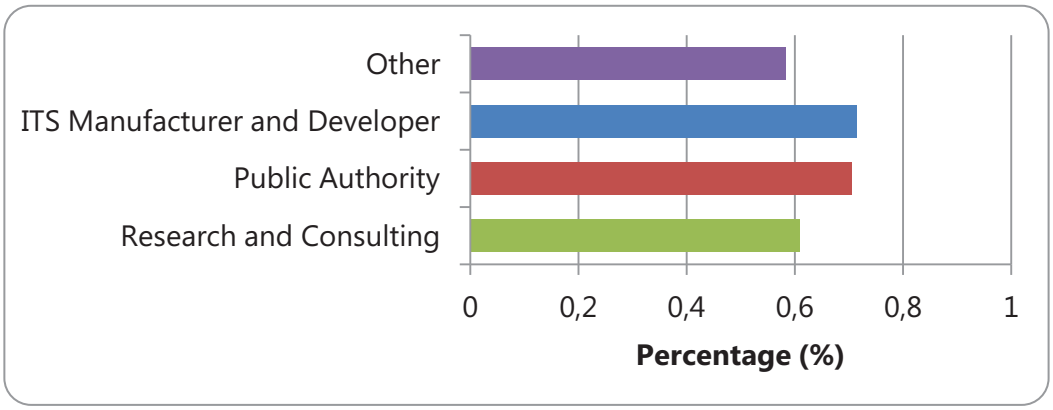


Figure 7: Is your organisation involved in estimating the effects of ITS measures on CO_2 emissions? (Yes)

The figure above indicates that the majority of stakeholders is involved in estimating the effects of ITS measures on CO_2 emissions. This is the case for the three main groups of stakeholders.

4.3.2 Importance of CO_2 impacts

The importance of CO_2 and other impacts was investigated by asking the respondents to classify the importance of several aspects (i.e., costs, macroeconomic effects, safety & security, local emissions, globally relevant emissions, social impacts, traffic quality and marketing value) on a scale from 0 to 100, see Figure 8.

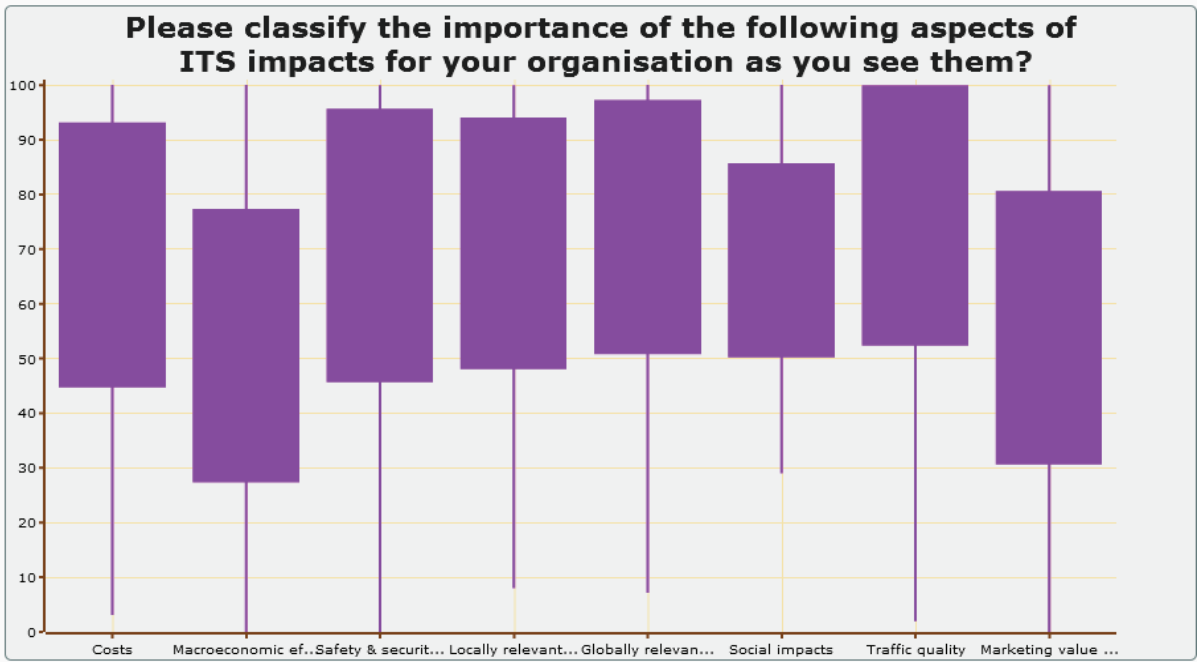


Figure 8: Please classify the importance of the following aspects of ITS impacts for your organisation as you see them.

There was no clear identification of very important or less important aspects. All of them received importance marks from very low to very high. This leads to the conclusion that not only the CO_2 aspects but also other impact areas are regarded by the stakeholders as important. This has implications for the methodology to be developed. The possibilities to evaluate also other impact areas should be taken into account.

Comparative analysis of stakeholder groups

Figure 9 shows the averages for the major stakeholder groups.

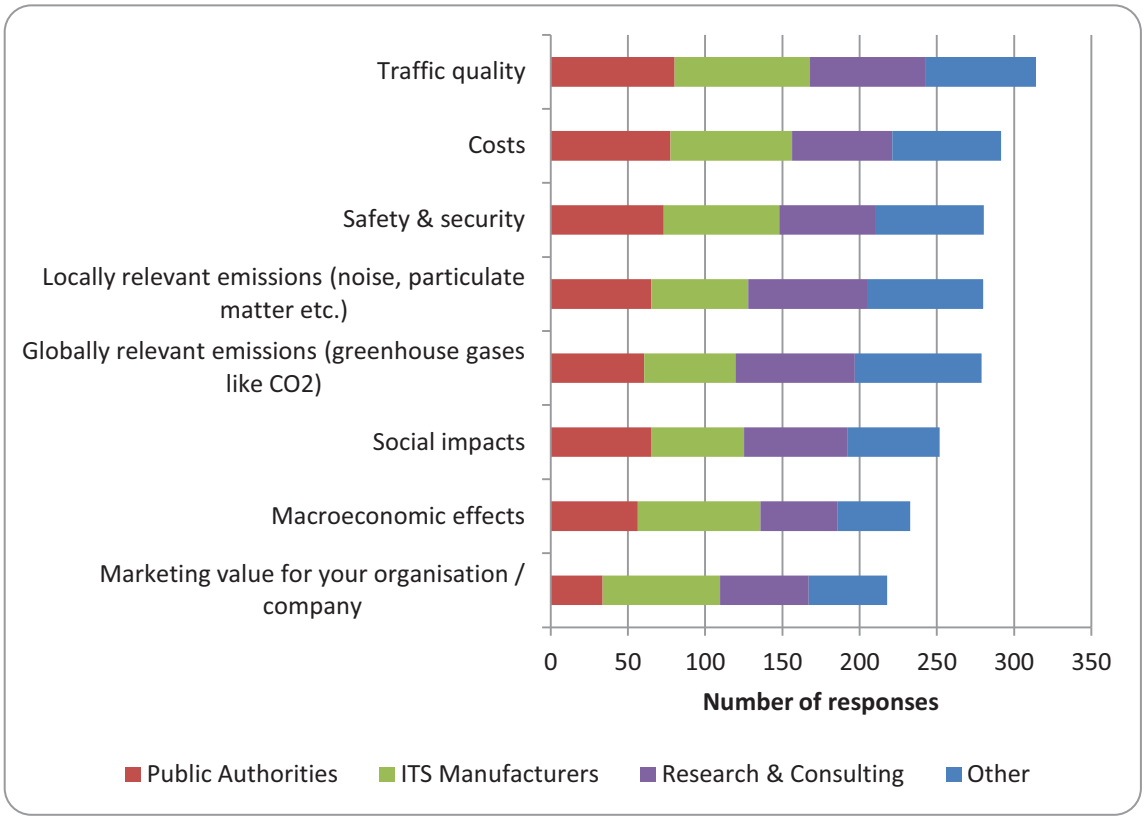


Figure 9: Importance of CO_2 emissions as compared to other effects

In more detail, the following conclusions can be drawn:

- For public authorities, the aspects of "Safety & Security" and "Traffic Quality" (e.g. Level of Service) are most important. The emissions, macroeconomic effects and societal impacts are all on the same level of importance. Marketing value is considered least important of all aspects.
- For ITS manufacturers, traffic quality is most important; marketing value a little less. All other aspects are less important and on the same level.
- Research & Consulting organisations, the largest group, shows no clear profile in the deeper analysis – in contrast to the profile of mean values. The only clear statement is that "Locally and Globally relevant emissions" do not receive low importance values (this leads to the higher means than the other aspects have). This group shows the largest spreads (mostly from 0 to 100), except for the two emission aspects.

The next question focused on the importance of the impacts in the coming decade for the stakeholder's organisation.

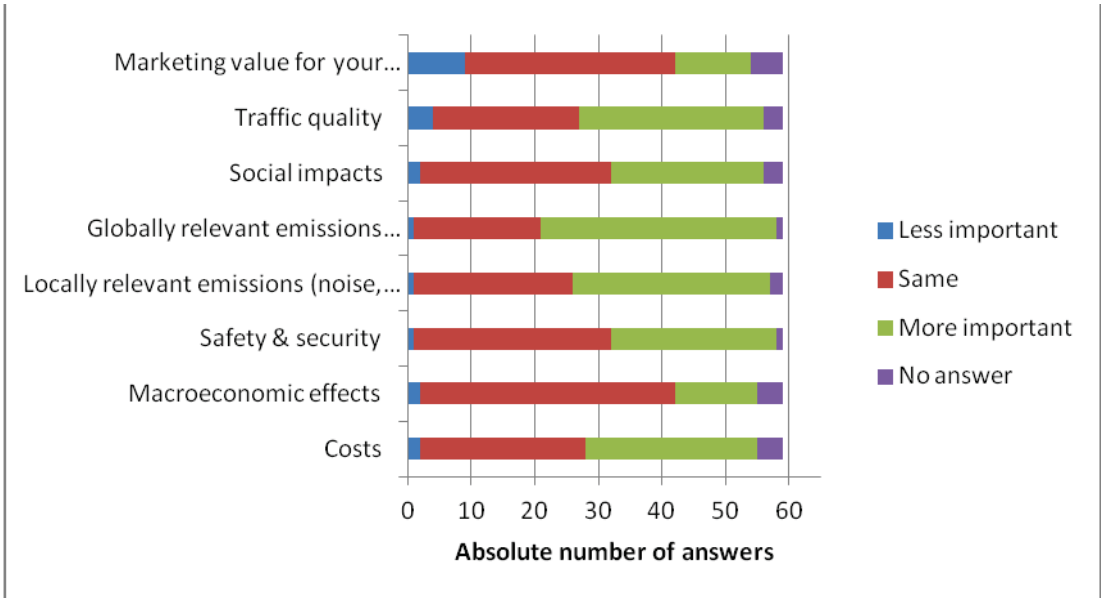


Figure 10 Which impacts will become more and which less important for your organisation in the coming decade?

The answers about the expected trends – the aspects becoming more or less important in the future – are very much in line with the assessments of the current levels of importance. Most interestingly, almost no participant expected any aspect to become less important. The already low ranking "Marketing value" received the highest number of responses to become even less important, though the majority thinks this will stay the same. The globally and locally relevant emissions, already the second most important after traffic quality from the previous question, are expected to become even more important; traffic quality is seen equally. Macroeconomic effects and marketing value are the aspects seen mostly as staying the same – they are ranked lowest in the importance.

When analysing the answers per stakeholder category (see Annex B), it can be observed that public Authorities expect the costs to become more important in the future; other aspects are almost equally distributed between more important and the same. Marketing value is the only one with more than 1 answer for "less important".
Locally relevant and globally relevant emissions are expected to become more important for ITS manufacturers. All other aspects are expected to remain the same.
Research and Consulting organisations expect that only globally relevant emissions will become more important in the future. Marketing value, macroeconomic effects and safety/security are expected to remain at the same level of importance as today. The same is expected for costs, macroeconomic effects and safety & security.

Interestingly, no group can be assigned to the (few) answers "less important" – with the exception of the public authorities, where 4 (out of 17) expect that the importance of marketing value will decrease (even further).
Concluding, public authorities expect further cost pressure. No shift of priorities is expected. ITS manufactures expect, however, more emphasis on environmental issues. The opinions of researchers seem to depend on their field of research.

Furthermore, the vast majority of all respondents (89%) as well as the separate stakeholder groups indicated that assessment of the CO_2 reduction potential of specific ITS in a standardised and generally accepted way would help their organisations. Only in the stakeholder group Research & Consulting, 5 persons indicated that the assessment of the CO_2 reduction potential of specific ITS in a standardised and generally accepted way would not be helpful (out of 6 negative answers in total).

There is no clear indication on the scale on which a generally accepted methodology would help (from local to national to European to global); the answers range from 9 (European level) to 16 (national level). This supports the Amitran approach of a scaling up methodology to provide for answers on all levels.
The most relevant stakeholders for the presentation of CO_2 reduction assessment, according to the respondents, are the national and local politicians. A few answers pinpointed the general public and national decision makers (politicians and infrastructure operators).

4.3.3 Importance of ITS systems

Figure 9 indicates which systems have the highest expected impact for reducing CO_2 emissions in the near future.

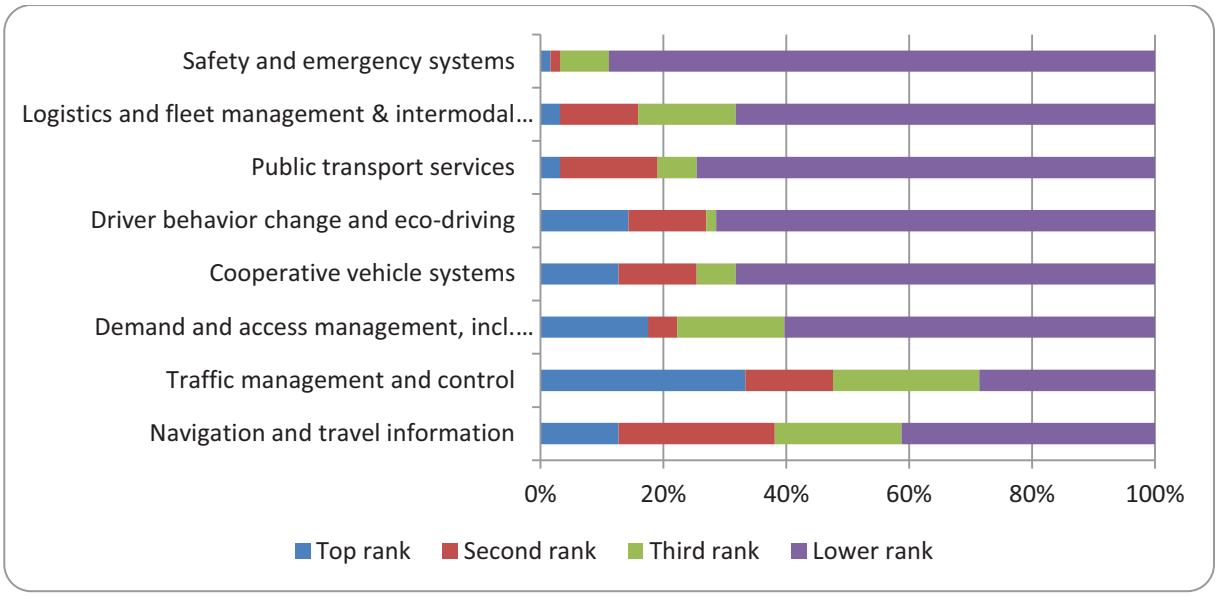


Figure 11: Importance of ITS

The figure above shows that the ITS systems which were mentioned most often as top rank ITS system are 'traffic management and control', 'demand and access management' and 'driver behaviour change and eco-driving'. When the systems ranked at 2nd and 3rd place are also taken into account, it can be noticed that also 'navigation and travel information' is considered as an important ITS. Therefore, these four types of systems should be further analysed in the Amitran project.

4.3.4 Models

Most of respondents (70%) confirm that models for CO_2 assessment are used in their organisations. A total of 83 responses were given with the following distribution by stakeholder category (see Figure 12).

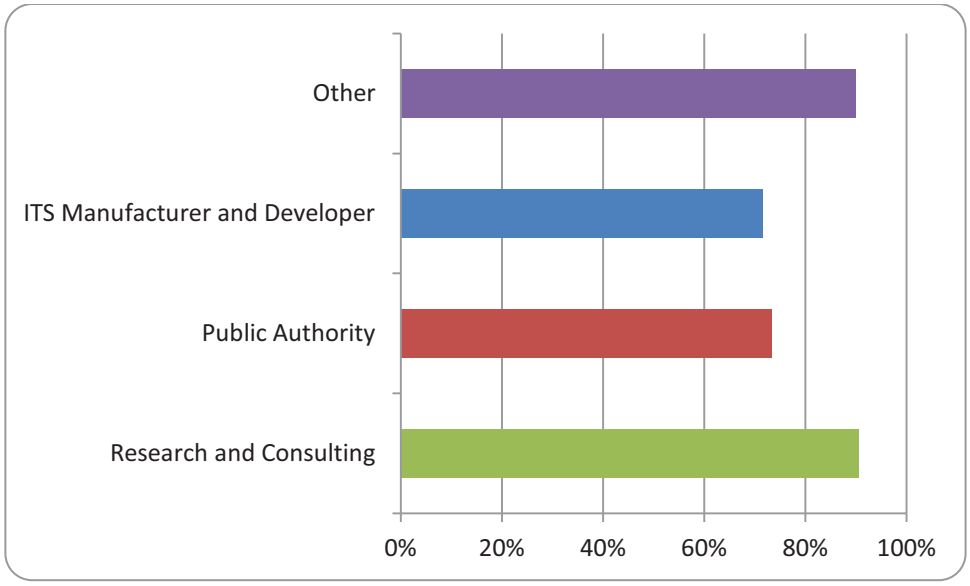


Figure 12: Models used for CO_2 assessment (as % of the total responses)

The models most often used are the emissions models (22%) and the least often used are freight and passenger models (5% each). Stakeholders that use different types of models most often are vehicle manufacturers and research & consulting companies.

Although to the question "What ITS impacts of relevance to your organisation are not covered by the existing models you use?", the amount of responses did not reach the minimum to extract reliable statistics, relevant conclusions can be drawn . Most of the answers can be attributed to public authorities that find it problematic to cover their needs in terms of impacts evaluation. Specific issues have been found when assessing the impact in multimodality and energy efficiency when dealing with electric propulsion systems. An additional issue that should be considered is the primary energy . Estimation of secondary effects in networks is also required. Models, including business models, are thought to require improvements with respect to ITS evaluation.

When asking about the combination of models in their organisations, from a global perspective, 59% of respondents have ever combined models. The answers for the three relevant categories of stakeholders (see Figure 13) show that only ITS manufacturers and research & consulting are above the average. Less than 50% of public authorities uses models.

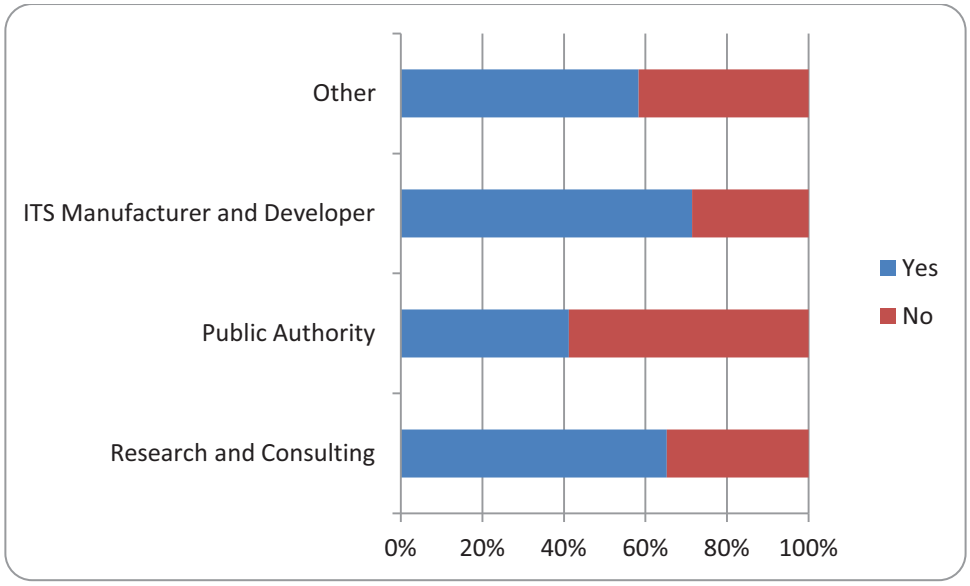


Figure 13: Do organisations combine models for CO_2 assessment? (as % of the total responses)

Out of all respondents that combine models, 20% find problems during this process. Some specific issues were identified. These focus on the required data granularity when using, for example, demand elasticity models or flow models. There are several issues derived from the combination of models coming from “top down" and "bottom up" strategies and also when combining micro and macro models or different ICT models.
Reasons for not using models lie mainly in their high complexity, lack of compatibility , large uncertainty and also high cost.

Subsequently, it was asked whether the respondents see gaps in CO_2 emission assessment of ITS which cannot be covered by the existing models. For about 40 % of all respondents this question is relevant, particularly for Research and Consulting (50 %), less for public authorities

Participants who found this question relevant have given until eighteen descriptions of gaps, that are given in Annex B and summarized below.
One of them is the lack of methods and models to assess the impacts in CO_2 reduction including long term effects of specific ITS, e.g. cooperative systems or systems addressing driver/user behaviour change.
Improvement of models is needed to become reliable enough to be used successfully when taking crucial decisions on ITS (policies, investments). Consolidation and combination of models based in real time traffic simulation, considering suitable driving cycles together with emission estimations is needed. One challenging question is the estimation of changes in emissions due to a specific measure. Accuracy of models should be high enough to appreciably evaluate effects of ITS on emissions, distinguishing between different traffic

environments, different emission sources (particular vehicles, fleet, etc.) or to consider aspects like vehicle conditions.

Models chaining different transport modes are also desired. An issue concerning modelling and calibration is the lack of information about the accuracy of model calibration made by others, as well as a lack of evaluation for different emission sources.

Harmonisation and standardisation of different essential CO_2 assessment resources at the European level is also desired, e.g. methods, models (including Kyoto based models) and scenarios.

Finally, some relevant data related issues have been detected, which concern the difficulties in getting reliable and accurate input data. Since data is often very dependent on the country/region data collection, it is difficult to obtain reliable data and to assess the reliability and accuracy of inputs.

4.3.5 Methodology relevance

The methodology relevance was investigated by asking who the respondents think will be the primary users and stakeholders of the AMITRAN methodology, to rate the relevance of purposes of a CO_2 assessment methodology such as AMITRAN from their organisation's perspective, and to rate the relevance of requirements on the AMITRAN output for their organisation.

Figure 14 shows the ratings about the considered primary users of Amitran.

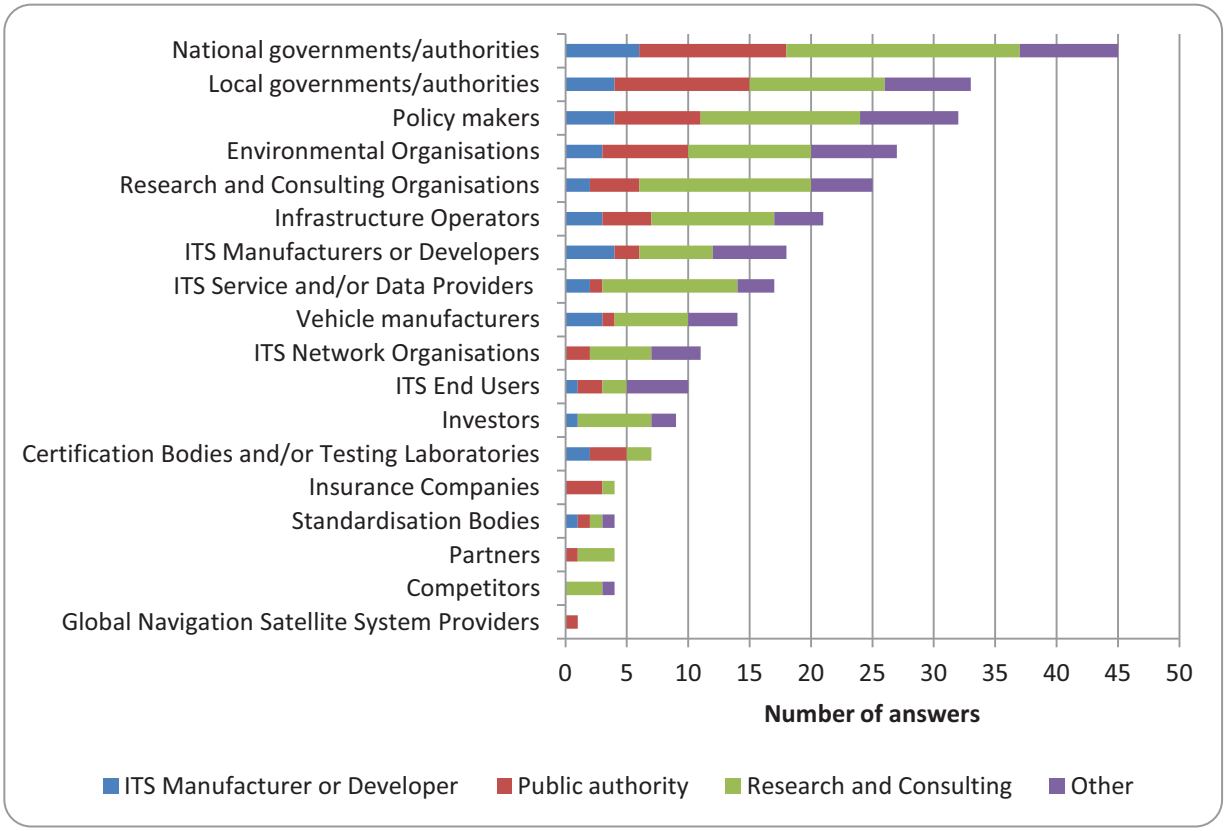


Figure 14: Who do you think will be the primary users and stakeholders of the AMITRAN methodology?

As shown in Figure 14, the primary stakeholders/users, as seen by the questionnaire respondents, are national governments/authorities. In line with this, local governments/authorities and policy makers are also rated as relevant users. Research and consulting organisations and environmental organisations are viewed as reasonably important. The following groups are almost not regarded as stakeholder or user of Amitran: Competitors, Standardisation Bodies, partners and Insurance Companies and Global Navigation Satellite System Providers. Next to the stakeholders asked in the questionnaire, we can assume that European authorities are per se interested in Amitran.
For Amitran, this means that the focus should be put mainly on (European/national) governments and policy makers as key stakeholders.

Figure 15 shows the average rating (between 0% and 100%, divided by four as to sum up to 100%) on the relevance from their organisation's perspective of purposes of a CO_2 assessment methodology.

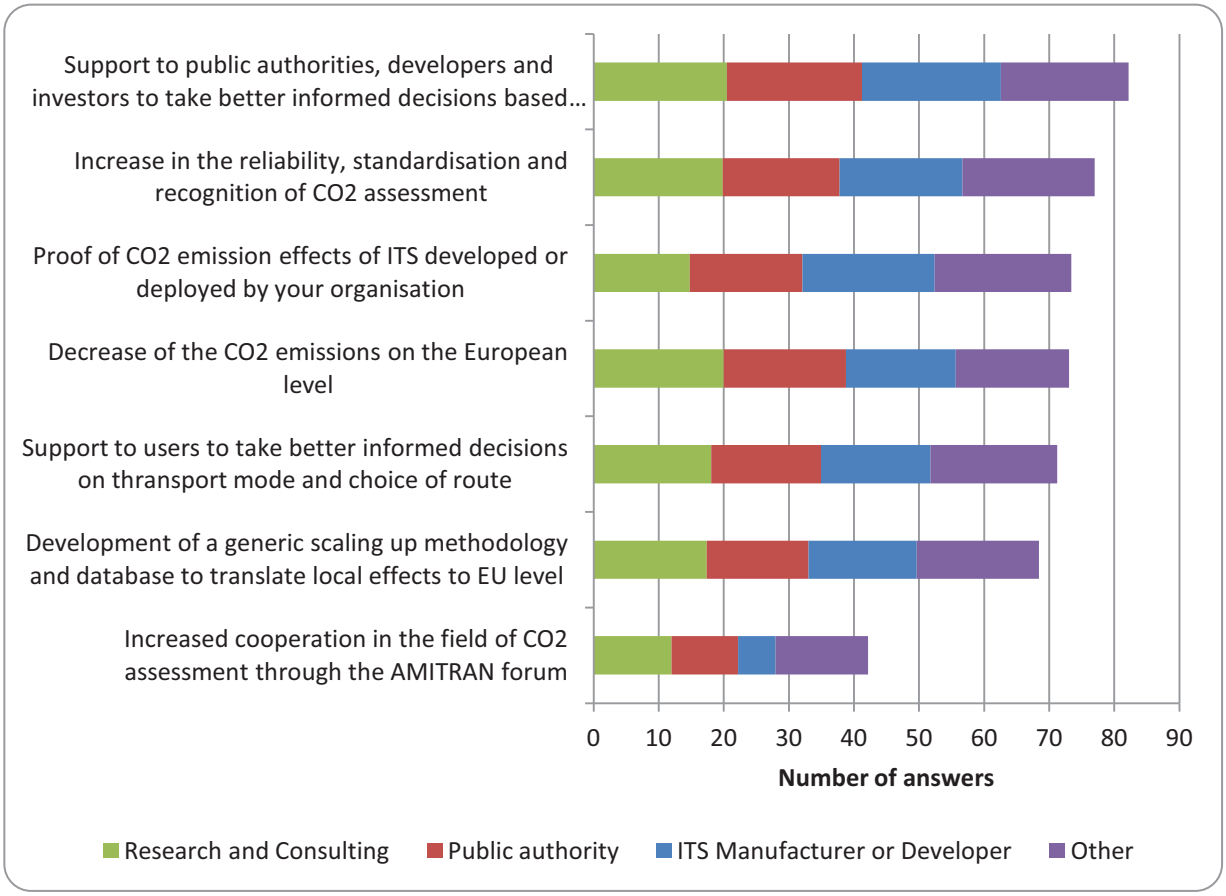


Figure 15: Please rate the relevance of purposes of a CO_2 assessment methodology such as AMITRAN from your organisation's perspective

As shown in Figure 15, clearly the largest relevance of Amitran is seen as to 'support public authorities, developers and investors to take better informed decisions based on reliable impact estimates'. This is one of the main objectives of Amitran, as such it is good that this need is confirmed by the stakeholders. The other suggestions were rated almost equally, though 'proof of CO_2 emission effects of ITS developed or deployed by your organisation', had a large standard deviation in its scores (see Annex B), which means that this aspect was rated differently by the respondents. By far the lowest rate was given to 'Increased cooperation in the field of CO_2 assessment through the AMITRAN forum as a user community'. This could mean that it might be difficult to get stakeholders actively involved in the user community. Expectedly, ITS network organisations (part of 'Other', see Annex B) and research and consulting organisations gave the highest score to this aspect, and ITS manufacturers the lowest.

The final question, about the relevance of different requirements, also involved rating of answers between 0 and 100 by the stakeholders. The answering options and results are shown in Figure 16.

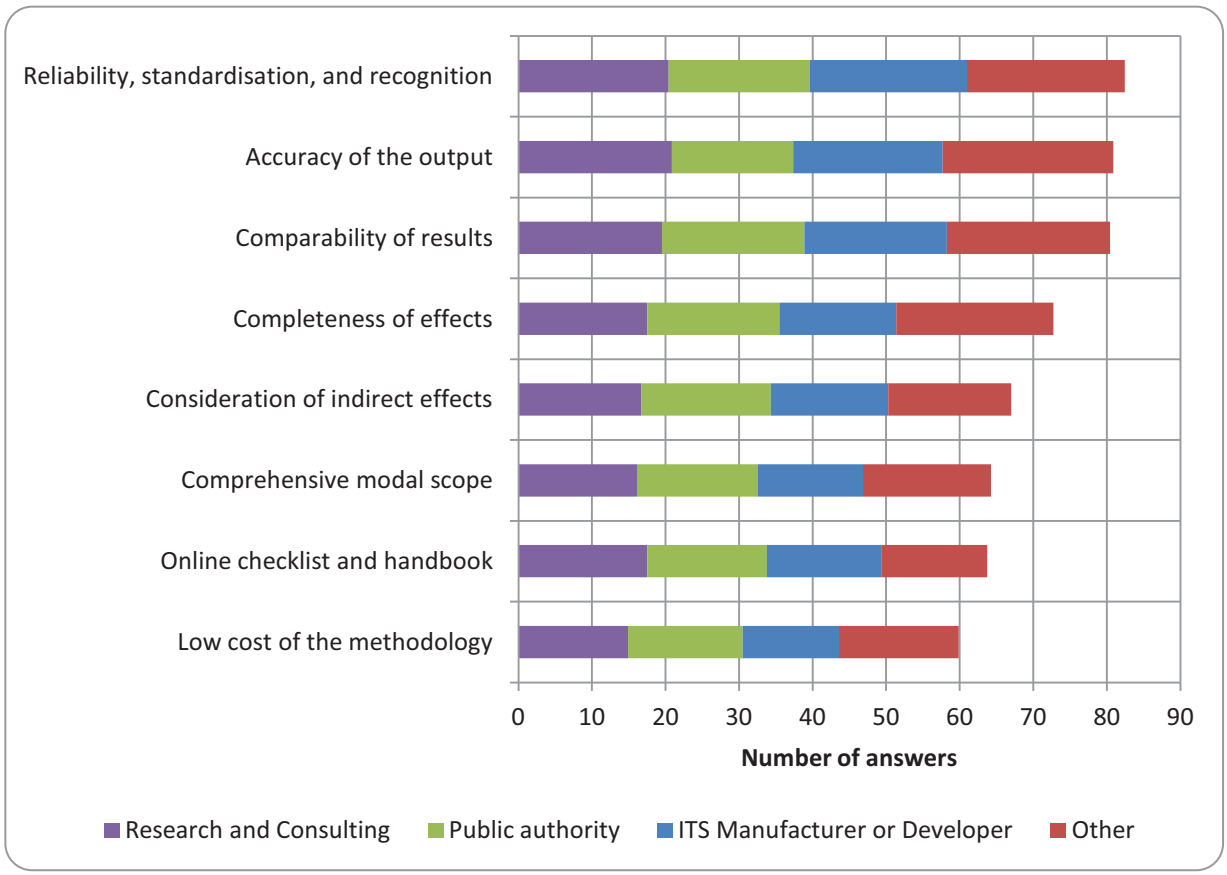


Figure 16: Please rate the relevance of requirements on the AMITRAN output for your organisation

Reliability, standardisation, and recognition of the CO_2 assessment is considered most relevant with respect to the output. Accuracy of the output and comparability of results are considered almost equally relevant . the comprehensive modal scope and online checklist and handbook are considered less relevant (but still > 50). The respondents, however, rated the handbook very differently. Low cost of the methodology is considered the least relevant . This one is rated most important by the vehicle manufacturers, but low by ITS manufacturers.
High attention to reliability, standardisation, and recognition of the CO_2 assessment will be given in Amitran, in line with the highest rated requirement by the stakeholders. Modeling other modalities than road transport in less detail does not seem to be an issue, since the comprehensive modal scope is rated a bit lower. While the accuracy of the output is rated high, Amitran we will not validate or improve the accuracy of existing models. This can be an important recommendation for future projects. Furthermore, it is remarkable that the handbook is rated low. This will, however, not lead to a lower effort to prepare the handbook. Amitran partners consider the handbook as a necessary output to enable the use of the methodology after the project is finished.

4.4 Summary of results from the survey analysis

4.4.1 Role of stakeholders

Most responses have been received from three groups of stakeholders: public authority or legislative body (17 respondents), ITS manufacturer or developer (7 respondents) and research and consulting organisations (22 respondents). From the remaining stakeholders, most of the answers were received from agencies and branch organisations. As in general holds for surveys, it shows the opinion of a sample and as such, the answers of the survey are not representative for all stakeholders, but can be used as directive for Amitran. A large share of responses was received from high and management level employees.
Traffic management systems, cooperative systems and navigation systems constitute the top three of ITS where the respondents are involved in. Most stakeholders are involved in research, usage of ITS, consultancy, technological development and application of measures involving ITS. There were few respondents involved in funding and management of ITS.
Most respondents are involved in passenger transport, public transport and freight transport. Only few respondents are involved in inland shipping and short sea shipping. The majority of stakeholders is involved in estimating the effects of ITS measures on CO_2 emissions.

4.4.2 Importance of a CO_2 assessment methodology

The judgment of the importance of a CO_2 assessment methodology like Amitran differs widely. It is apparent that CO_2 emissions are only one aspect among many important to the stakeholders. Particularly traffic quality is and remains of highest importance. A slight shift in emphasis can be discerned towards environmental aspects. This shift applies both to locally relevant emissions and globally relevant emissions.
Public authorities are not concerned with macroeconomic effects. Only ITS manufacturers care for the marketing value of their organisation supported by an assessment methodology.

4.4.3 Importance of ITS systems

ITS mentioned most often as top rank ITS for CO_2 reduction are traffic Management and control, demand and access management and driver behaviour change and eco-driving. Navigation and travel information is also considered as an important ITS. A wide range of systems is seen as playing a potential role for CO_2 emission reductions. The broad approach of Amitran is, hence, supported.

4.4.4 Role of models

Models for estimating the impact of ITS are already in use by many organisations. Combination of different models including CO_2 emission models is also in use. The survey revealed the perceived limitations of existing models and highlighted the requirements for interfaces between models. The assessment of the impacts of ITS on CO_2 emissions is seen as a highly complex topic. Many existing models do not cover all required aspects of traffic (e.g.

ageing of vehicles), data for calibration is scarce as is the documentation on how models have been calibrated. The scaling up of individual results on higher level is also mentioned as a challenge. No standard has been defined so far in relation with the Kyoto protocol. The interfaces of traffic models and emission models often do not match each other.
Models will become more sophisticated in the future to allow for a reliable CO_2 emission assessment. The increasing complexity has to be taken into account by Amitran. Interfaces which include requirements on the connected models have to be defined. Transparency and standardisation have to be highlighted. Interfaces definition should take into account the combination of different transport process models and the integration among micro, meso and macro models levels. All of this should be done while ensuring the required accuracy levels to avoid any loss of information.
Gaps detected in models for CO_2 assessment cover a wide range of aspects, reflecting in some manner that the different stakeholders have also different needs and procedures in the assessment of CO_2 reduction.
Amitran can contribute to the harmonisation of methods, models and other assessment resources by generating a methodology with a systematic approach applicable from different points of view of use. For that, flexibility in the inputs of the methodology is required as well as in the outputs (different needs in type and level of results).

4.4.5 Relevance of the methodology

All stakeholders confirm the need for a uniform methodology of CO_2 assessment of ITS systems. Such an assessment methodology is seen as a key tool in decision making processes of the development of ITS services and systems, and the subsequent deployment of these services and systems. Particularly high level authorities (e.g. in high management and decision making positions) are perceived as the primary stakeholders. Amitran will be a tool less employed by individual organisations to evaluate specific systems, but it will rather be a decision support tool for the comparison of different options defined on a high level.
The reliability and standardisation of assessment methodologies is seen as more important than the reduction of CO_2 emissions itself. The Amitran Forum is ranked lowest among the given purposes of Amitran.
Respondents require Amitran in the first place to be reliable, standardised and recognised, the results being comparable, but also accurate, which puts very high expectations on such a methodology. Costs are stated to be of less relevance. These high expectations underline the need for a CO_2 emission assessment methodology, but also challenge the results obtainable with the existing models.

5.Stakeholder Interviews

5.1 Overview

In addition to the Amitran User Needs Workshop and the online survey, selected stakeholders have been contacted for interviews. The interviews covered the same aspects as the online survey, but enabled a deeper insight into topics, which could only be broached in the online questionnaire. Furthermore, the stakeholders have been selected from stakeholder groups not well covered by the questionnaire (e.g. inland shipping and logistics).
The conclusions given in this chapter are drawn from 13 interviews. The aim of the interviews was to fill the gaps and get additional information within the topics already addressed by the online survey. The answers reflect the individual opinion of a interviewee and are, hence, not necessarily representative for the overall stakeholder group. In this chapter, what has been said by the interviewees is summarised literally, without drawing additional conclusions. A good indication of the prevalent requirements on the Amitran methodology is given. The interview results are compiled along the stakeholder groups. The interview guideline used by the interviewers is given in [2] while the interviewed organisations are listed in Annex C.

5.2 Interviews with public authorities, legislative bodies and infrastructure operators

Public authorities as the executers of policies see themselves as the main drivers behind ITS deployment. The responsibility for mobility and environment are commonly separated. The main focus is mobility and safety. In order to address environmental objectives, measures are needed that do not compete with the economy, mobility nor safety. "Smart" systems which do not impede the traffic, but make it more efficient in terms of costs and macro-economic effects, safety and security, are high on the agenda.
All categories of IT systems are mentioned by the interviewees as important. The examples are as follows:

- Driver behaviour change (such as eco-driving and early warning systems and information systems providing information about e.g. accidents, RDS TMC, information about paid, garded parking places (for cargo traffic), etc);
- Traffic management systems (e.g. logistic information systems, tunnel and traffic monitoring systems, public transport information systems, etc).

These systems are focussed on the efficient use of the available infrastructure, more efficient and safe driving, better informed decisions and fostering of multimodality. Intermodality information systems are key to achieve the objectives of public authorities. The main problem encountered while providing these systems and information in reality is the time needed for

adoption (RTD TMC took about 15 years before coverage stretched over Europe). This is largely affected by agreements on the responsibilities between network providers, information providers, manufacturers of hardware and legislative bodies, which are often difficult to obtain due to opposing interests. The models integrated in Amitran have to take into account the vehicle conditions. The models (incl. the Amitran interfaces) also have to be robust (not too sensitive for various inputs), reliable, easy to understand and yet not too complex.. It has to be possible to translate the results on the micro to macro level without major loss of fidelity. Intermodal trips have to be considered. Up till now, modelling of locally relevant emissions is of higher relevance than the estimate of CO_2 emissions for the public authorities.
The application and use of nomadic devices (e.g. telephone, car systems, PDA's) in providing and gathering of information will become more and more important. This implies a necessary cooperation between network and data providers (in terms of standards) and discussions on the correctness of the contents, contents ownership, legal issues related to information and its' provision, etc.
Success of ITS is largely dependent on whether the solutions provide advantages against alternative solutions such as building and maintaining infrastructure in terms of costs, etc. Additionally, it is important whether the hardware components, networks, information services and legal issues can be solved and integrated in the solutions.
All categories of systems were mentioned by the interviewee, from driver behaviour change (eco-driving) and traffic management to freight and logistics. The efficient use of the available infrastructure, more efficient driving, better informed decisions and fostering of multimodality and intermodality are keys to achieve the objectives of public authorities.
Concerning Amitran's output, Amitran should provide clear, unambiguous, reliable, and unquestionable results and should be applicable for their own country. Standardisation and recognition of the methodology is important. It is recognised as important to draw from past experience as well as research and demonstration projects. Some authorities stress the relevance of results on European level. Amitran should foster better informed decisions by both decision makers (ITS deployment) and travellers (mode and route choice).
Public authorities and ITS data, service and system providers are seen as the primary stakeholders of Amitran. Research will be relevant for innovations. ITS End Users have to be taken into account to ensure the acceptance of results. Business and technology parks can provide a platform for pioneer applications. Reconciliation of the demands of technology promoters and pragmatic solutions, and reconciliation of the demands for mobility and the environment will be a challenge. Though Amitran does not address safety and mobility directly, it will be part of holistic system assessments.

5.3 Interviews with ITS Manufacturers & Developers

The focus of the consulted ITS developer is the calculation of an eco-route. The target is to provide travel advice on the travel with the least CO_2 emissions. It is important to calculate CO_2 emissions in a standardised way, especially at the national level (motorways). This would also be an added value for the customers, who are especially interested in the results of CO_2 calculations. The difficulty with the CO_2 reduction models is how to relate the model results to the real measurements of CO_2 reductions in practice. This information is needed for calibration of the model. Most important aspects of Amitran outcomes are comparability, reliability and accuracy of the results. The clients are mainly interested in the improvement of CO_2 emissions and in the absolute values of the calculated CO_2 emissions.
According to the interviewee, cost reduction is now the most important item for most transport organisations in the freight transport sector, in relation to CO_2 reduction. It is expected that besides the cost reduction, other aspects like traffic quality, safety, macro economic effects, and local emissions will become more important in the future. Local and regional emissions are relevant for most clients in particular.
Nowadays, driver behaviour and eco driving offer a high potential of 20% CO_2 reduction in the freight sector.. Demand management leading to modal shift from road to other modalities with lower CO_2 emissions like inland shipping offers even higher potential in the long term.
Most important outputs of Amitran are comparability of results, multi-modal scope, and reliability of the CO_2 assessment methodology. Additionally, indirect effects of CO_2 reduction, like reduced maintenance costs and reduced damage costs of trucks are important.

5.4 Interviews with vehicle manufacturing related stakeholders

5.4.1 Automotive supply organisation

Besides the new challenges in mobility, safety and economic drivers, CO_2 objectives give added value to new and existing components and equipment. Eco-driving, cooperative systems, and autonomous driving are seen as the major fields of development in the future.
So far the incentives and available information on sustainable vehicles is lagging behind the objectives of more environmentally friendly traffic. The main stakeholders of a CO_2 emission assessment methodology are regarded as public authorities and infrastructure operators.
User behaviour models are gaining increasing prominence. The interviewee thinks that awareness and acceptance of ITS by the users should be modelled in Amitran.
Automotive suppliers are interested in identifying high potential systems. The system assessment has, hence, to be recognised by both authorities and OEMs. The interviewee thinks that Amitran could be part of a "guide for future systems". The analysis should be able to address different options and compare them. The results should be suitable for a

demonstration of the advantages of new ITS. This comprises the impact on European level, the incorporation of all transport modes, and both passengers and freight.

5.4.2 Commercial vehicle manufacturer

Since the energy use of a vehicle is directly linked to the operating cost, this is of importance to the customer and a manufacturer of commercial vehicles operating world-wide. Some ITS will become mandatory in Europe (brake assistance). There is a concern that mandatory systems increase the selling price; the costumers do not always pay (additionally) for such systems. ITS are not the first on the wish list of commercial customers.
Emerging markets like China and Brazil in particular request vehicles with less features to keep the prices down. Such markets are, at least expected to, becoming large volume markets, and are as such relevant for Amitran, though they seem to employ less ITS systems. Major focus for ITS is to improve safety and to reduce consumption of energy.
The background for modelling and using traffic models (micro and macro) is available, also applicable to detailed vehicle modelling. There is a genral interest in the overall methodology that encompasses all aspects related to CO_2 and that is in some way standardised. The major interest lies in informing customers on emission reduction and fuel reduction.

5.5 Interviews with ITS Users

5.5.1 Logistics sector

Focus of the Logistics sector is on the monitoring of driver behaviour, position of the vehicles, and fuel consumption (N.B. not mentioned by the interviewee, but relevant according to the Amitran consortium, are return logistics and location of the hubs/inventory of the logistics companies, multi-modal views on planning, real-time dispatching, traffic information integration with planning, real-time adjusting of planning, eco zones, etc.). Fuel consumption reduction is the biggest driver behind ITS deployment and CO_2 emissions reduction for logistics companies. Most vehicle kilometres are covered on motorways, therefore ITS for the logistics sector can best be focused on ITS suitable for motorway driving, such as ACC. It is questionable how further efficiency gains can be realised through ITS . A major efficiency gain could be achieved by using different transport modes according to time and cost. Lack of information on all elements in the supply chain, however, is a big impediment.
Models are used only on strategic level (warehouse simulation, location choice). Slot management could be an application in the future. The existence of a market for CO_2 compensations by the customers is questionable.

5.5.2 Individual motorised traffic sector

Main problems related to ITS are not technical, but rather related to organisational issues. It is expected that online travel information (especially multi modal) will become more available in Europe in the coming years.

It is important that impacts are calculated for all transport modes and this information can be used by route planners. Safety and costs are also important impacts. Issues which are expected to become important in the future are electric mobility/driving, privacy aspects and travellers time.
The ITS that show the highest CO_2 reduction potential (according to the interviewee(s)) are navigation, traffic management and infrastructure use pricing.

5.5.3 Inland shipping organisation

Inland shipping consists of four main subsectors: dry cargo, wet cargo, passenger transport, and special transport. Each sub sector has its own characteristics. Legal requirements for CO_2 reduction in inland shipping are very important for all subsectors. These are often agreed at national and EU level. It is Important for the users to know these requirements in advance, since investments in, for example, new engines are long term investments (20-40 years) for users, compared to road transport.
Navigation and travel information is the ITS with the highest CO_2 reduction potential for inland shipping. Information is now available at different stakeholders and in different applications (for example applications for dry cargo, wet cargo, passenger transport or special transport sector), and should be integrated and available at one point of access. Software for inland shipping is a niche market, with only a limited number of potential clients. The main software developers, therefore, are small companies rather than big ICT companies.

5.6 Interviews with research and consulting organisations

5.6.1 General consulting

Major relevance is seen in eco-driving systems, cooperative systems, and ITS related to hybrid vehicles. To improve the efficiency of the transport system, the available resources have to be used better together. Car sharing and real time public transport information will play an important role. To get reliable impact estimates, long term data (several years) is required. Methods to extrapolate local results to higher level are also needed. Initiatives related to user awareness, user acceptance, user attitude models (including mental limitations, adverse mental states, and similar) will influence ITS development in the future. As the decision makers are currently not always aware of opportunities and limitations of ITS deployment, assessment and suitable presentation of ITS effects is important.
Gaps exist in the current modelling of detailed driver/user behaviour. It is important to accurately depict the influence of user behaviour on vehicle behaviour and, thus, CO_2 emissions. Implementation of more modelling features is needed to obtain more accurate results. A comparison of driver behaviour changes to different options for micro and macro models is needed for an accurate CO_2 estimate. Missing links between models are in: modelling of vehicle conditions (cargo, open windows, air conditioning on/off, truck

with/without trailer), translating of changes perceived in field tests to a macro level without losing information, multimodality in transport.
Most important requirement of the selected research stakeholder for Amitran is the modelling of user awareness and acceptance. It might be useful to standardise the assessment methodology to enable certification of ITS. Amitran should also foster awareness of the effects of ITS for public authorities and OEMs. The output of Amitran should lead to better informed decisions by users and decision makers also in the context of other impacts than CO_2. Amitran could play a role in the harmonisation of the strategies by public authorities, OEMs and infrastructure operators.

5.6.2 Consulting company for public transport

ITS in the public transport sector is mainly related to traveller information. This information is related to travel times, departure/arrival times and safeguarding connections. Such information is distributed over different channels, on- and offline (for pre-trip and on-trip information). The importance of such systems is growing.
The source of such information is generally a central point of access; however, latest developments use vehicle-to-vehicle information in regional systems; e.g. to safeguard connections.
Driver assistance systems are starting to be deployed in the railway sector.. Such systems have a potential to reduce energy consumption.
Energy use and CO_2 emissions are becoming an issue in public transport; mainly from a cost perspective.
The energy used is segregated into operations (energy for moving the vehicles) and energy for buildings (workshop, depot etc.). Some other dedicated aspects for public transport play a special role (e.g. air conditioning of vehicles for passengers and electronic systems).
A "standardised evaluation method" is in use in Germany for public transport ("Standardisierte Bewertung", http://de.wikipedia.org/wiki/Standardisierte_Bewertung). This standardised methodology is being applied in all cases, also in other countries. It takes into account the investment cost and running cost and translates the inputs to a cost-benefit analysis. This example is a very good example of standardisation. Standardisation seems even more important for Amitran than the correctness of results. There is no special impact assessment undertaken on CO_2 as considered in the context of Amitran.
The stakeholders that should be addressed for energy impacts are the public transport operators themselves since they pay for a measure they want to know the (financial) impacts of. Because the operators have to meet many restrictions (e.g. from the political side), savings in energy costs are real savings for them.

5.7 Interviews with ITS Network organisations

The interviewed network organisation is mainly concerned with urban motorised individual traffic. The interview extended therefore the insight to a local view for the road. Factors of relevance for the future of ITS and technologies for ITS and vehicles with high potential in the future have been discussed. Here the major conclusions are summarised.

Safety will remain the top priority. This fact has positive impacts on traffic quality (efficiency). CO_2 is of lesser relevance in the urban context. High potential is seen in cooperative systems, where the future is seen in *ad hoc* short range communication between vehicles and the infrastructure. Demographic change, urbanisation and changes in policy perception ("getting green") might lead to major impacts on the development and deployment of ITS. Hybrid vehicles will become more important and will bring new characteristics relevant for systems and emissions.

Major challenges are seen in the realistic consideration of the framework, in which modelling is embedded, and the aspects considered (e.g. cold starting, temperature influence, dynamics of engine performance). This will be particularly relevant for the new engine types (hybrid vehicles, LNG etc.), which show different behaviour and cannot be easily taken into consideration by the existing driving cycles.

The importance of a transparent and accurate methodology is stressed. It will be important to be able to judge which influences are considered by Amitran, what features are taken into account, and how reliable the output will be. The results have to be plausible and have to fulfil quality standards. It should be possible to test different scenarios also for emerging technologies. The documentation of Amitran has to provide easy access to the effects and features considered, e.g. through flow charts. The Amitran Forum is seen as very useful, but will most likely not be used by the network organisation itself.

5.8 Interviews with other stakeholder groups

5.8.1 Technology park

Technology parks and industrial parks are considered as suitable areas for experimental deployment of ITS (and working areas in general). The interviewee also considers that parks are sometimes characterised by higher traffic density of heavy vehicles or less favourable accessibility conditions. It is found that the CO_2 levels in San Sebastian Technology Park are not a real concern for park managers, since it is in a green area with higher altitude than the city of San Sebastian.

Electric vehicles and user information and parking advice systems are seen as relevant ITS in a technology park area with a major focus on mobility. There is no doubt that these systems, when implemented, also have an important role in the reduction of CO_2 emissions. It is

expected that people will use these services wherever the ITS are implemented, provided they help to organise their lives better.

A highlighted innovative approach is the autonomous driving technology, specifically personal rapid transit systems (PRT). This is thought to be a complement to local bus transport service that will allow people to reach their exact destination in a more sustainable way. In general, last mile services for people and freight are considered to bring significant improvement of mobility in future. New initiatives can also be aimed at fulfilling the gaps in these experimental services.

If the benefits are noticed quickly, user behaviour can be more influenced in an easier way. Reductions in CO_2 are hard to observe as users don´t experience directly the benefits, at least not immediately. They have to believe in the information given by the third parties. This information should be easily accessible and reliable. Besides, users are subject to different types of messages on this matter, some of them being contradictory. For example, OEMs publicity related to emotion and freedom while driving a car can lead to counter-productive effects on CO_2 reduction.

Amitran methodology is expected to support the main ITS stakeholders in a better decision making by providing them with comprehensive scope and entailing different transport modes for freight and passenger transport. Amitran methodology will also enable a better and easier use of models by providing relevant interfaces. All of these aspects aimed at implementation of ITS are expected to help users take better decisions on the transport processes. Public Authorities, ITS system providers and ITS Users organisations are identified as the most relevant stakeholders for the use of the methodology.

5.9 Summary of the Stakeholder Interviews

The interviews with stakeholders from the different groups reveal certain general tendencies:

- The relevance of CO_2 is seen differently, and usually is ranked lower than the relevance of safety and mobility. Potential is seen primarily in systems that do not impede mobility, but make traffic more efficient. Consequently, Amitran will only be an assessment tool next to other tools focusing on mobility, safety, and economy. This observation underlines the results obtained in the online survey.
- The efficiency of vehicles is of primary concern for logistics companies. The attractiveness of the Amitran methodology would increase for such companies if the methodology provides for fuel consumption in addition to CO_2 emissions. Thus the opportunities of Amitran for other areas than the environment are stressed.
- Eco-driving and cooperative systems have been frequently named among the prominent ITS of the future. Traffic management, logistics and freight systems, and technology for hybrid vehicles were also mentioned as the ones that have potential to

be important factors contributing to a more efficient transport system. This observation also underlines the results obtained in the online survey.

- The discussion of the modelling approach resulted in conclusions beyond the indications obtained in the online survey. Modelling of driver behaviour and the issue of user acceptance are seen as major challenges in a holistic modelling approach.
- Vehicle conditions (e.g. age, state of auxiliary systems) have a significant impact on CO_2 emissions and should be taken into account in the modelling framework.
- The scaling up of local results to higher level was mentioned by a several stakeholders as a challenge but also as an important requirement for an assessment methodology.
- High requirements on an assessment methodology mentioned are : high reliability, transparency, but also accuracy; incorporation of all transport modes and multimodality; freight and passenger transport.
- Assessment methodologies are frequently used to compare different options. Amitran should support such a comparison. The results should be suitable to raise awareness of decision makers in public authorities and OEMs on the effects of ITS.
- Amitran will be successful only if the outcome is accepted by all stakeholders, including ITS End Users. Only then it can lead to better informed decisions taken by the authorities, ITS manufacturers and users.
- Relevant impacts of the Amitran methodology are focused on final users and public authorities. For both of them it is important to take better decisions in the modal and route choice (final users) and in the ITS to be deployed (authorities).
- Other relevant requirements refer to obtaining a methodology being able to entail different transport modes, and consequently different models. This is a requirement of the more advanced users of the methodology like research and consulting companies and system developers.
- Several stakeholders agree that the Public Authorities are the main actor playing a crucial role in the development and deployment cycle of ITS. Success of Amitran methodology largely lies in satisfying the needs of public authorities.
- In several cases, autonomous driving is perceived as a promising emerging technology. These detected emerging technologies should be taken into account when preparing Amitran methodology.

6.Analysis of related projects

6.1 Objectives and methodology

Existing (either finished or on-going) research projects can provide clues to user needs and requirements for a CO_2 assessment methodology. Experience gained in other projects is also relevant for the assessment of ITS impacts, the development of the methodology itself, and validation of the approach. Several work packages in Amitran, therefore, draw from experiences gained in other projects. Some on-going projects have been directly involved in Amitran either by consortium partners active in these projects, or by inviting members of the project to workshops and the Stakeholder Advisory Council[1].
In this deliverable, the list of projects that have been analysed is presented in Annex D. User needs assessment in other projects is described and requirements on Amitran are derived.

6.2 User needs assessment in other projects

There is a significant number of EC funded projects (>40) in the area of development of cooperative systems applications (see complete list in the appendix) ; practically all these applications will have impacts on the production of CO_2. Some of the projects aim specifically at the applications that reduce the environmental impact (e.g. eCoMove). There is also a number of projects that focus on the validation or the impact evaluation of ITS measues (e.g. eIMPACT OR iTETRIS). In this part some of the most directly related projects are described with their relevance to Amitran.
DRIVE C2X is an Integrated Project (IP) that will lay the foundation for deploying cooperative systems. Apart from building up the technical systems, it compiles data from Field Operational Tests (FOTs) to perform a sound impact assessment. This impact assessment will be based on changes in driver behaviour due to the implemented systems and will, apart from other important aspects like safety and traffic efficiency, include environmental impacts. The scaling up to the European level is explicitly foreseen. In the predecessor project PRE-DRIVE C2X a combined simulation tool set had been developed. This tool set includes various dedicated models dealing with traffic flow, communication between ITS stations and environment. The requirements for interfacing the models had been established, implemented and some cooperative applications had been evaluated to test the integrated models. It can be concluded that DRIVE C2X would be a candidate for the Amitran methodology – however, the two project schedules are not aligned to allow for this. It can be expected that work in DRIVE C2X will give valuable insights to be used in Amitran.

[1] Refer to WP 7 – Dissemination, liaison and exploitation for details.

ECOGEM focuses on cooperative systems applications dedicated to fully electric vehicles (FEVs). These applications are tailored to the specific needs of FEVs and rely on information on (predicted) energy consumption and the status of the power supply. Information on charging locations, points-of interest (POIs) etc. are specifically included. The envisaged validation will test the performance of the applications developed. An impact assessment in terms of environmental implications, especially CO_2, is not foreseen; in this special case, information on the electric energy production would be crucial.

eCoMove specifically intends to reduce energy consumption through the use of cooperative systems. Several applications are developed, driver training is included and a validation of the systems is foreseen. An impact evaluation predicting to the European level, however, is not intended. The effort to compile the necessary data, an important aspect of Amitran in the scaling-up database, would exceed the effort. eCoMove is a typical "consumer" for the Amitran methodology; current project schedules will not allow to interact during the application development phase, however, the results obtained from eCoMove could be used as a basis for testing the Amitran methodology.

eCompass has commercial transport as its application area. It develops multi-modal route planning services to lower overall energy consumption.

FESTA was a support action for the European Commission. It has developed a methodology for conducting Field Operational Tests (FOTs). The FESTA project has delivered a Handbook, and the main purpose of this Handbook is to provide guidelines for conducting of FOTs, from planning and preparing to executing, analysing and reporting. The Handbook gives information about aspects especially relevant for a study of this magnitude, such as administrative, logistic, legal and ethical issues. Another aspect of the Handbook is to pave the road for standardisation of some aspects of FOTs, which are helpful for cross‐FOT comparisons. In the **FOT-Net** project (support action for networking in FOTs) the FESTA Handbook has been updated. Seminars were and are organised to deploy the FESTA knowledge, results and experiences with using FESTA.

iTETRIS was a project integrating simulation models for traffic and communication of mobile stations. The goal was an overall assessment of the cooperative systems in terms of traffic effects (from microscopic traffic flow simulation) and communication aspects (e.g. message loss). Impact evaluation focussed on traffic flow; scaling-up was not part of the project.

Apart from these projects dealing with impact evaluation, other activities like **ECOSTAND** or the EU-US Cooperation Task Force, specifically look at a global exchange of information and experiences in the field of cooperative systems evaluation. It can be expected that these on-going activities will feed directly into Amitran; however, concrete requirements can not yet be established from them.

The goal of **ICT-EMISSIONS** is to develop a novel methodology and software tools to evaluate the impact of ICT-related measures on mobility, vehicle energy consumption and CO_2 emissions of vehicle fleets at the local scale by means of real world tests with selected

applications. While AMITRAN aims to develop a 'global' methodology suitable for all ICT measures within the scope, ICT-EMISSIONS develops more specific methodologies for selected applications. The latter can be integrated into AMITRAN's methodology.
2DECIDE's objective is to develop an "ITS Toolkit" to assist transport authorities in the deployment of Intelligent Transport Systems (ITS), to help them solve traffic and transport problems and address policy objectives. The aim is to help authorities to best exploit ITS to address problems such as congestion, accidents or environmental pollution, as well as to improve user services, promote inter-modality and access to information, enhance safety and security aspects, etc. The Toolkit shows results from previous projects and studies, but is not able to do a customised assessment.
As a conclusion it becomes obvious that the impact evaluation in general and also on CO_2 aspects has constituted an important part in past and on-going projects. Due to the lack of a standardised methodology for such an evaluation, either dedicated methods were developed that fit the purposes of the individual project or in some cases approaches to comprehensive methodologies were developed.

6.3 Summary of Project Analysis

On-going projects as well as the finished ones include some kind of validation within which the functioning of developed applications is checked. Additionally, the impacts on traffic flow are determined at least in some projects. An impact in CO_2 production goes hand in hand with an impact on traffic flow, be it on the operation of vehicles (different driving styles) or the vehicle mileage of different transport modes. Not only specific tools but also a vast amount of information describing the whole of the European Union is required in order to establish such an effect on a wider horizon. Such an effort is out of scope of individual projects; they are "natural customers" of the Amitran methodology.
It is desirable that the Amitran methodology can make use of the results of these projects which include impact evaluation (most of them include it to some extent, partly with very dedicated tools for their applications). It should be, therefore, foreseen to have "side entries" into the impact evaluation flow and to avoid imposing a general methodology disregarding project specific aspects. The individual building blocks for the Amitran methodology are foreseen to have well-described interfaces to account for this.

7. Use Case Definition

7.1 Objectives and methodology

Use cases are developed as a basis for the development of Amitran (WP 4 and WP 5) and for validation purposes (WP 6). Use cases illustrate in which context and for which purpose Amitran might be applied. Use cases consist therefore of a setting in which Amitran is used, a defined purpose, what results are to be obtained, and who are the relevant users and other stakeholders in this context. Use cases make the requirements on Amitran easier to understand and more specific. They also elucidate its potential. The use cases, as defined in WP 2 and described below, will be amended by specific ITS in WP 3 and elaborated as part of the validation process in WP 6. The development of the use cases follows four steps as illustrated in Figure 17.

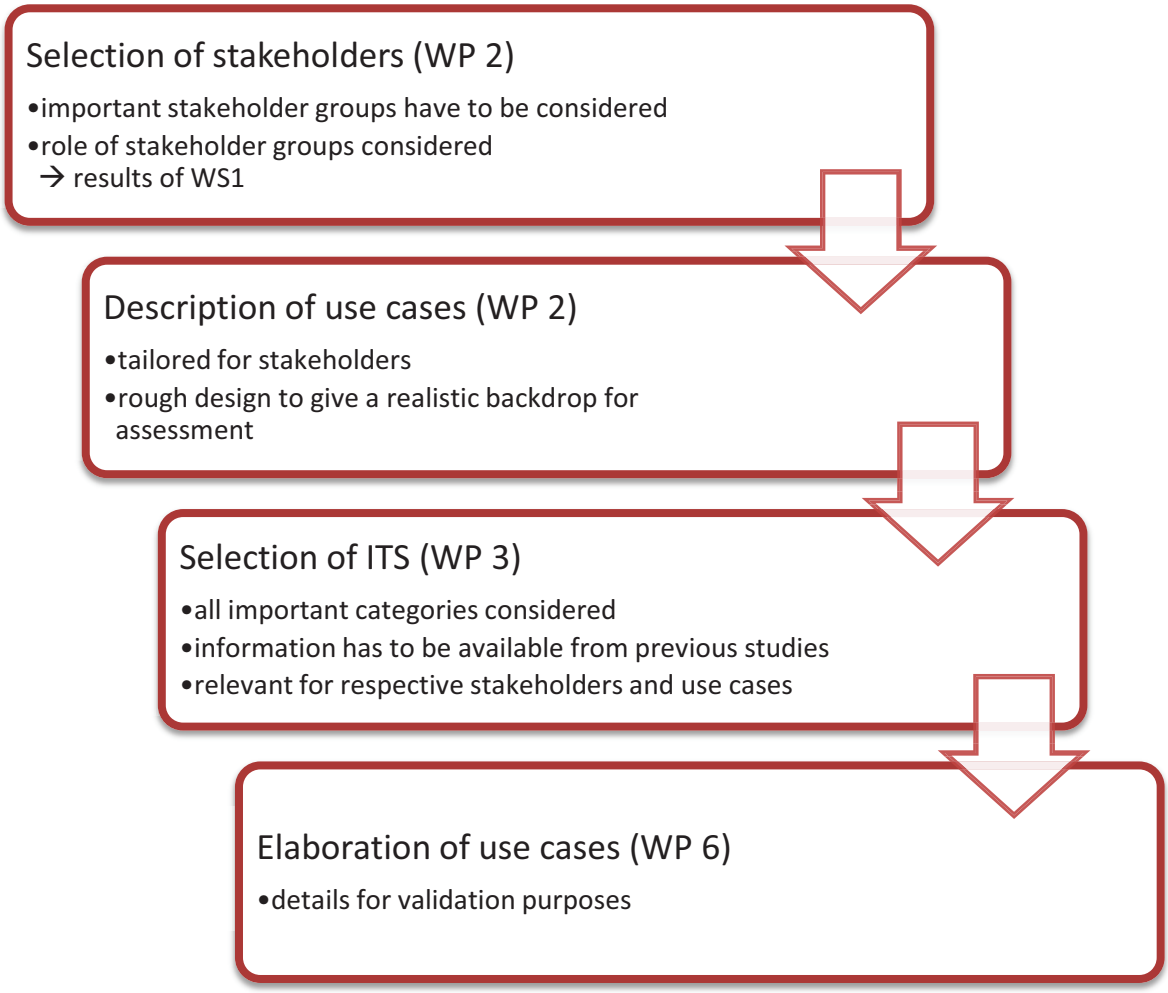


Figure 17: Illustration of use case development

Four use cases are defined to cover the broad range of possible uses of Amitran. They are selected following the stakeholder grouping (cf. Figure 1 and Figure 2) and under

consideration of the discussion in the user needs workshop. Different roles of stakeholders relevant for the development of Amitran are considered in these use cases (cf. results of the user needs workshop, Chapter 2). The use cases cover also different scales of Amitran from local to national (the European scale is sufficiently covered by other projects, Chapter 6, and the input from the EC). Finally, the use cases are suitable to consider the range of ITS applications (categories and modes) covered by Amitran. Also, data available from other EU projects should be taken into account for validation of the use cases in WP6.
The use cases in this deliverable provide only a framework and are foreseen to be detailed in later steps of the project. Descriptions in the following section provide the idea behind possible future applications of Amitran.

7.2 Description of use cases

7.2.1 Use case 1: National Authority

This use case follows National Authorities decision making process for major objectives and policies matching. The description of proposed use case is as follows (see also Figure 19):

- ITS are fostered to ensure national CO_2 emission reduction objectives.
- Different areas have to be waged against each other:
    - Subsidies and research grants for technology development of C2I or vehicle based systems
    - Deployment of highway systems
    - Employment and economic growth effects
    - Cost and benefit
- Experiences from other countries should be taken into account

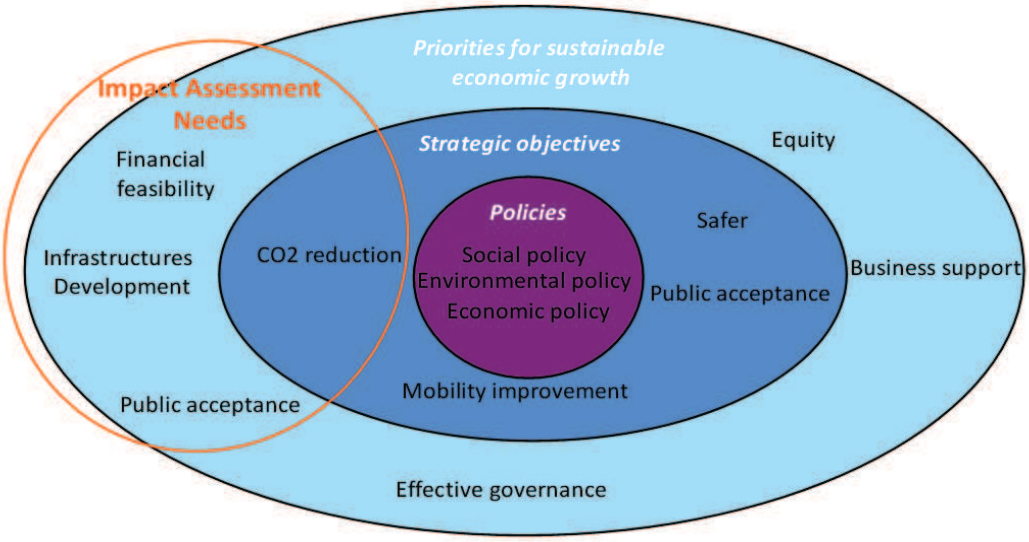


Figure 18: National Authorities policies and priorities diagram and impact assessment needs for CO_2 reduction

7.2.2 Use case 2: City Public Authority

This use case envisages the city authorities to follow Amitran methodology when taking decisions. The description of the proposed use case is as follows (see also Figure 20):

- City technicians detect a need of reducing CO_2 levels.
- Several solutions with different costs are presented to city authorities.
- City authorities need to know which of existing CO_2 measures works better before implementing it. The technology maturity of the solutions should be high enough to ensure robustness in city environment.
- Due to budget restrictions, a limited number of measures can be implemented and a decision has to be made based on all presented possibilities.
- There is a need for a simple and easy method supporting the decision making.

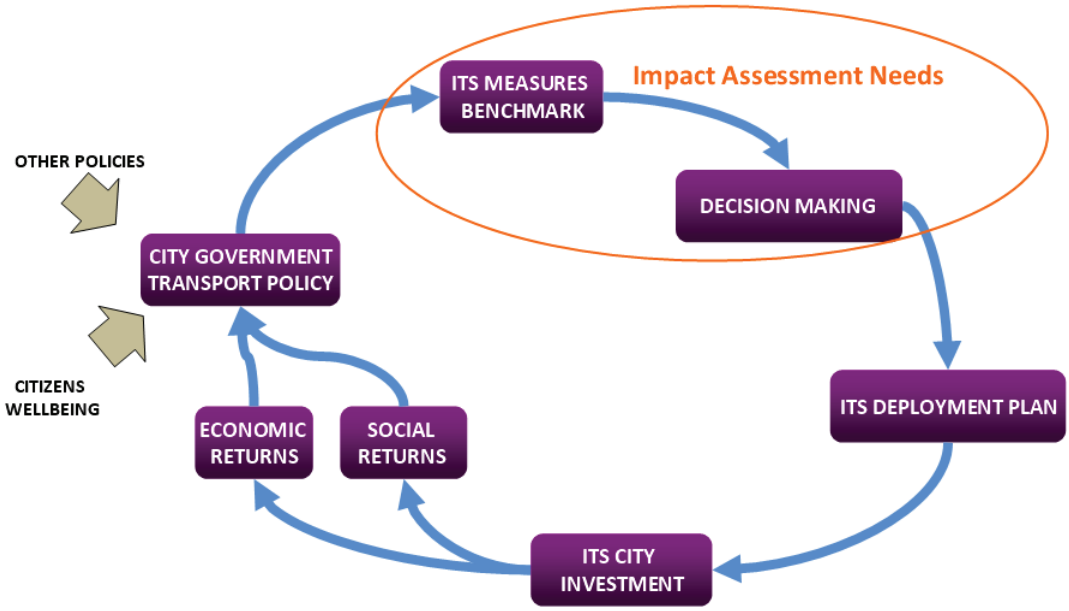


Figure 19: ITS implementation decision process for City Public Authorities and impact assessment needs

7.2.3 Use case 3: Logistics company

This use case addresses the decision cycle followed by logistics managers when implementing new equipment or vehicles in their companies. The description of proposed use case is as follows (see also Figure 21):

- A transport company has to implement CO_2 measures, since local laws require the reduction of emissions. Otherwise, the transport company will be charged. This might contradict with minimisation of costs for the transport company.
- Fleet manager needs a study presenting the state of the art of in-vehicle systems (incl. costs) to be integrated in order to reduce the CO_2 emissions and to make a cost benefit analysis.
- Fleet manager might not be an expert in this matter and he needs to know where the break-even point is in order to take the decision on which ITS to implement in his fleet.

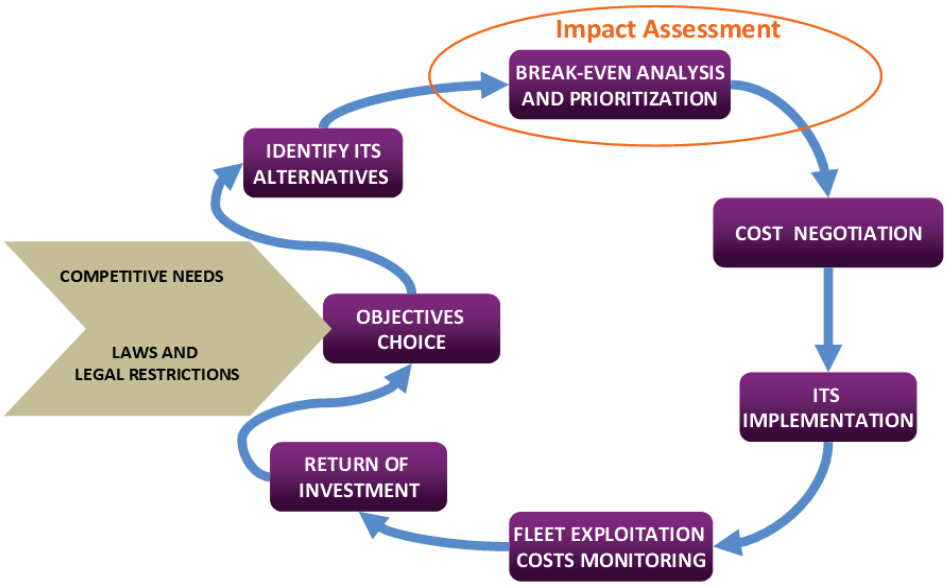


Figure 20: ITS implementation decision process for Fleet Manager and impact assessment needs

7.2.4 Use case 4: Research and Consulting

This use case addresses the typical process followed in research projects to validate new applications and systems. The description of the proposed use case is as follows (see also Figure 22):

- Research project in collaboration with several companies.
- A validationtest plan exists, which includes an impact assessment plan according to the Amitran methodology.
- After development of the application and services, tests for evaluation of hypotheses will have been done.
- With the hypotheses evaluation results available, , the impact assessment will be performed.

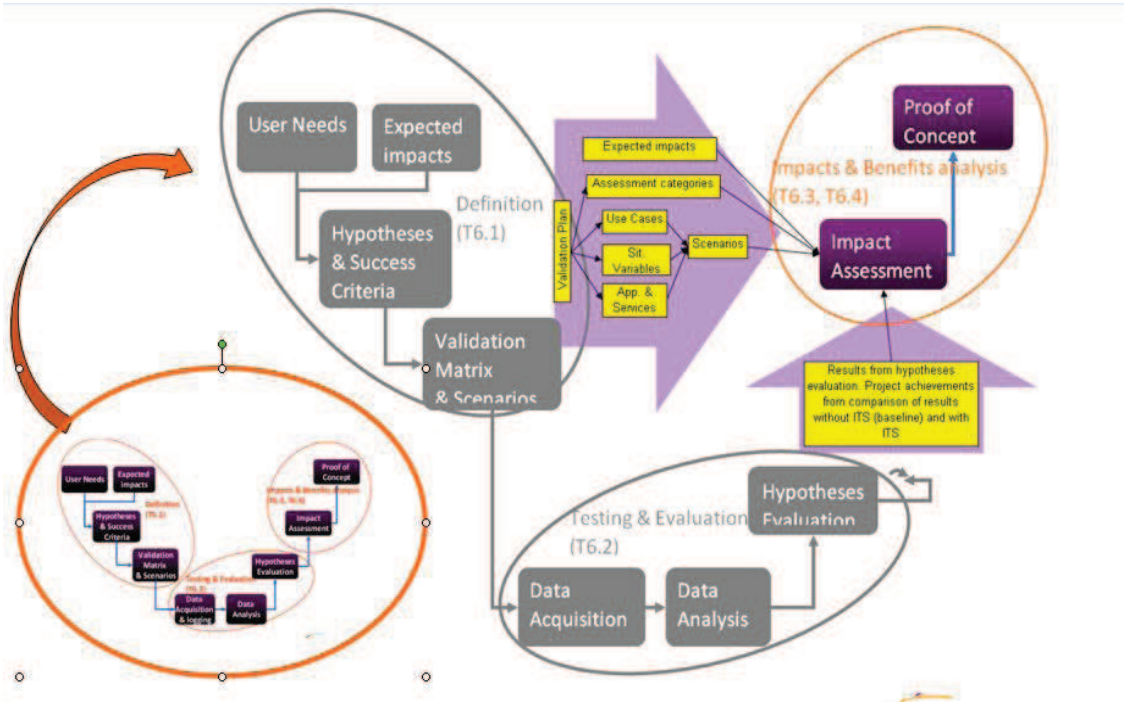


Figure 21: Validation process for Research and Consulting and focus on impact assessment needs

8.Overall conclusions for Amitran

8.1 Identified users and other stakeholders of Amitran

Three major categories of stakeholders have been identified: stakeholders requiring the application of Amitran (e.g. public authorities); stakeholders realising this requirement (e.g. research and consultancy companies); and stakeholders using the output of the application (e.g. ITS End Users). Stakeholders related to the development and production of ITS can play different roles: they might ask for the application of Amitran to test their systems (similar to authorities), they might conduct the assessment themselves, and they may be influenced by the results of Amitran (at least indirectly by either legislation, subsidies, or the end users). The identified stakeholders including the users are grouped in the figure below.

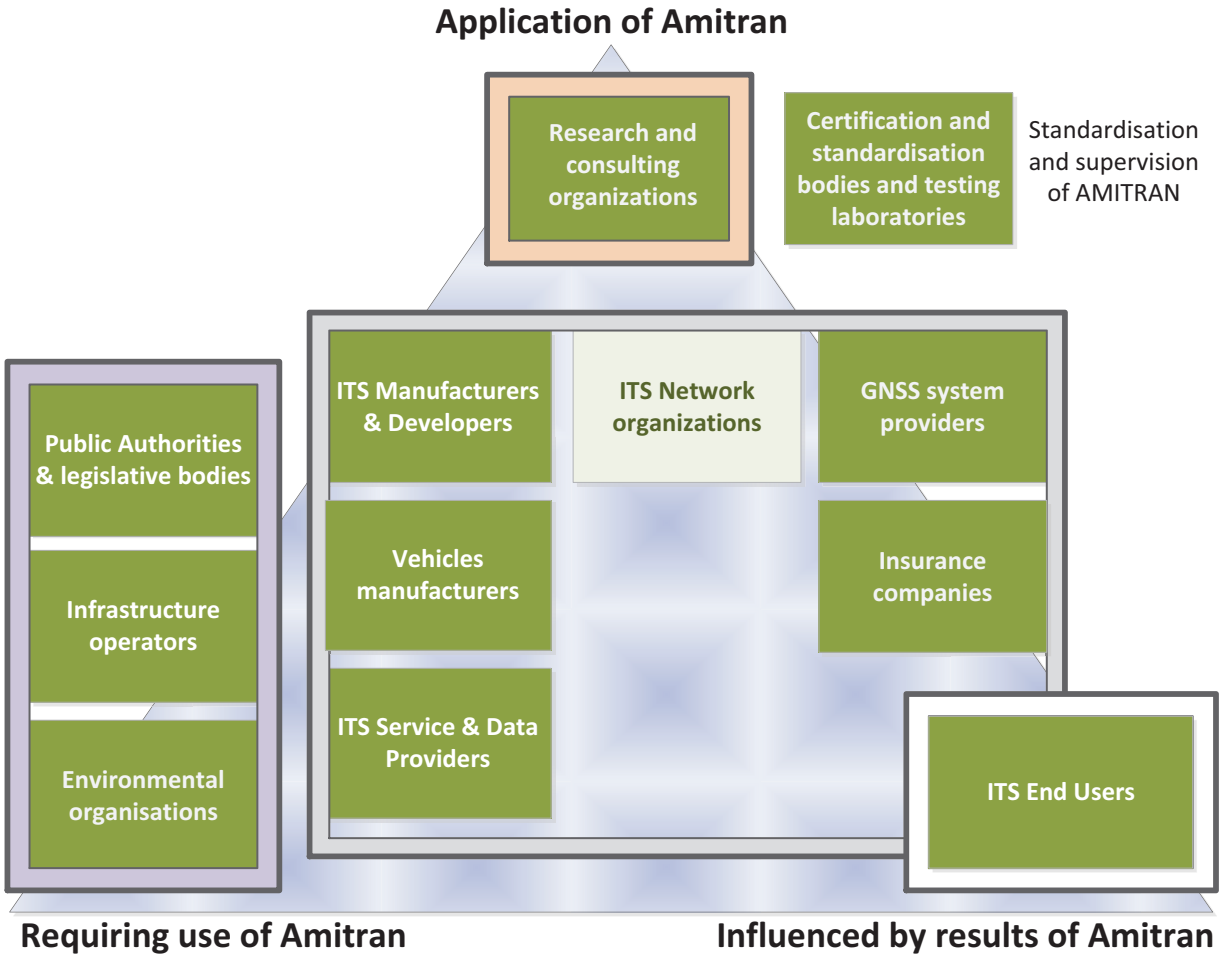


Figure 22: Overview of the Amitran stakeholder groups

8.2 Amitran framework and methodology requirements from the users' perspective

The variety of stakeholders participating in the user needs assessment (workshop, survey and interviews) resulted in varying emphasis on certain points. The workshop gave insight in the different user groups and their high level view on Amitran. The survey, filled in completely by 58 respondents, revealed more detailed opinions on the desired requirements for a methodology such as Amitran, e.g. on the relevance of a CO2 assessment methodology for the stakeholders, relevant ITS systems and models, and the desired output. During the interviews a more differentiated view on several topics was possible, which, however, only reflected the opinion of individual organisations or persons. The conclusions drawn here are the bottom line of these opinions.

With respect to requirements on geographical scale, transport modes, modelling, and use of Amitran, it became clear that Amitran has to address a range of stakeholders with individual requirements. The methodology should therefore address these differing needs. No clear preference was observed with regard to systems and geographical scales. Amitran should cover all ranges of ITS and all spatial dimensions of emissions from local to national and European level, as well as all transport modes (road, rail, shipping, passenger and freight), though less stakeholders indicated to be involved in shipping.

The user needs assessment generally supports the high relevance a CO_2 emission assessment methodology of ICT in transport has. Reliability, standardisation, and recognition of the CO_2 assessment were pointed out to be the most relevant requirements. There are high expectations for such a methodology. Very important appears to be the definition of a standardised methodology which is accepted by all relevant stakeholders. It should be transparent and accurate. The reliability and standardisation of assessment methodologies is seen as even more important than the reduction of CO_2 emissions itself, i.e. Amitran could provide the basis for extrinsic motivations to reduce CO_2 emissions (e.g. financial incentives for proven reductions). At present, it is a major concern that the decisions on ITS development and deployment cannot be easily justified. A forum for experiences with such a methodology (Amitran Forum) is welcomed, but not of particular importance to most stakeholders.

The primary users of Amitran are foreseen to be high level authorities and decision makers, who have to compare different measures aiming at CO_2 emission reductions. The most important function of Amitran is therefore to support public authorities, developers and investors to take better informed decisions based on reliable impact estimates. This also stresses the importance of agreeing on the methodology that enables the comparison of assessments from different systems and areas. While the assessment is initiated mainly by

decision makers, the results of Amitran have to be accepted and regarded as relevant also by ITS End Users. The decision makers requiring the application of Amitran will commonly contract the assessment itself to research and consulting organisations.

The systems with the highest expected impact are traffic management and control systems, demand and access management, driver behaviour change and eco-driving. Also the opportunities arising from cooperative systems and the Internet of Things were mentioned to determine the ITS landscape of the future. Intermodality and multimodality will gain increasing importance.

It is also apparent that by focussing on CO_2 emissions only, Amitran addresses only one aspect of system assessment relevant to the stakeholders. The survey respondents indicated that traffic quality (Level of Service) and safety will remain a top priority, though emissions, both locally relevant and globally relevant, will get increasing attention in the future. For companies in the freight sector, efficiency gains are of primary importance, which usually come along with CO_2 emission reductions. By widening the scope of Amitran and taking traffic quality aspects into account, the requirements of the users would be better addressed. Since CO_2 emission calculations require also the estimation of changes in the transport process, usually many of these other aspects will be produced as a side result of Amitran. We need to consider to what extend Amitran will deliver these other aspects as output or side result of Amitran to the user.

70% of the stakeholders use models for CO_2 assessment in their organisations and 59% have ever combined models for CO_2 assessment. However, 33% indicate that they see gaps in CO_2 emission assessment of ITS which cannot be covered by the existing models. Gaps in modelling are partly due to limitations of the models (e.g. insufficient consideration of important aspects for CO_2 emissions like vehicle condition), partly due to unsuitable interfaces between different types of models (e.g. traffic and emission models), partly due to scarcity of data to calibrate and validate the models, and partly due to the lack of transparency of calibration process for users of the model output.
Though it is not in the scope of Amitran to improve existing transport models, the limitations of existing models have to be clearly stated, but also possible future improvements considered. Also it makes sense to implement in Amitran resources to open new opportunities to the use of models by the development of interfaces. This appears to be a pertinent goal to achieve easier integration of different models, which clearly contributes to a higher use of more complex and ambitious models. The interfaces to be developed in Amitran have to take models into account which might close current gaps.

Concerning data, relevant data related issues have been detected, which concern the difficulties in getting reliable and accurate input data. Since data is often very dependent on

the country/region data collection, it is difficult to obtain reliable data and to assess the reliability and accuracy of inputs. This need fits well into the design of Amitran, especially concerning the development of the scaling–up database. The scaling-up methodology can help in providing data or estimates for countries and areas where so far data is not easy to obtain.

Finally, low costs of the methodology is indicated as the least important aspect by the stakeholders. It could be concluded that an extensive and high quality methodology is required rather than a quick-and-dirty approach. However, another interpretation of the fact that costs were rated low, is that many of the stakeholders participating in the survey will not be the ones paying for Amitran assessments and therefore expect others to pay for it.

All in all, the user requirements on the framework and methodology of Amitran are in line with the project goals. From the stakeholders' input, the following points can be extracted which have to be addressed during the Amitran development:

- **Standardised and accepted CO_2 assessment methodology**
  By emphasis on dissemination activities, involvement of major players in the Stakeholder Advisory Council, fostering of the Amitran Forum and both raising awareness for the Amitran activities and prompting feedback, this requirement will be addressed mainly in WP 7 and during the validation process to prove the merits of Amitran and raise the acceptance (WP 6).
- **Broad scope concerning geographical scale and transport modes**
  Consideration in system assessment (WP 3) and framework development (WP 4)
- **Particular attention to cooperative systems and intermodality**
  Consideration in system assessment (WP 3) and framework development (WP 4)
- **Transparent and flexible interfaces to support best use of available and future models used for the assessment**
  Interfaces are developed in WP 5.
- **Consideration of the achievable accuracy of models and possible gaps in the assessment due to insufficient assessment tools.**
  During the framework development (WP 4) and the development of the ITS typology (WP 3) all possible mechanisms relevant for the cause and effect chain from ITS to CO_2 emissions will be identified. From the framework the models to be considered and the interfaces between them will be derived. During this stage modelling challenges have to be recognised and addressed (WP 5).
- **Addressing different stakeholder needs in a dedicated manner.**
  The handbook and checklist should be designed in a way that different users will easily find the information relevant to them (WP 7). The framework has to be adaptable to

different requirements, for instance concerning scope (WP 4). It is foreseen that major users will be high level decision makers, while the methodology itself will be applied by specialists. The output has to be presented in a way easy to understand by all stakeholders, also ITS end users.

- **Seizing opportunities from secondary output (e.g. traffic quality)**
  Intermediate steps in the system assessment of Amitran might be used to judge not only CO2 emissions, but also traffic quality or other aspects. By highlighting this output Amitran will be more attractive, particularly to stakeholders from the logistics sector. The assessment framework (WP 4) and the interfaces (WP 5) should take this into account. In the use cases (WP 6), these opportunities should be exemplified.
- **Providing information for areas where no sufficient data is available (scaling-up)**
  If possible, the scaling-up methodology should provide support for Amitran users in countries or specific fields where no sufficient data for the calibration or validation of models is available. Benchmarks or ways to transfer data from other countries should be indicated (WP 4).

8.3 Use cases for the validation

Four use cases have been defined in order to cover the range of possible applications of Amitran and the major stakeholder groups and categories. The use cases serve the purposive development of Amitran (WP 4+5) and the validation of the methodology (WP 6). The use cases cover the broad range of potential users and stakeholders of Amitran, applications on local as well as national scale, and all transport modes. Figure 23 shows how the development and implementation cycle related to ICT for transport is covered with selected use cases, since other categories of stakeholders can be considered equivalent to any of them. The use cases relate to:

- national authorities (large scale)
- local authorities (small scale)
- logistics (freight)
- research and consulting (innovative systems)

The use cases will be described more in detail at later stages of the project. WP 3 will provide systems which suit the use cases and ensure coverage of a broad range of ITS categories. Details for the use cases will be defined in D6.1 Validation Plan as a part of the WP6 tasks. .

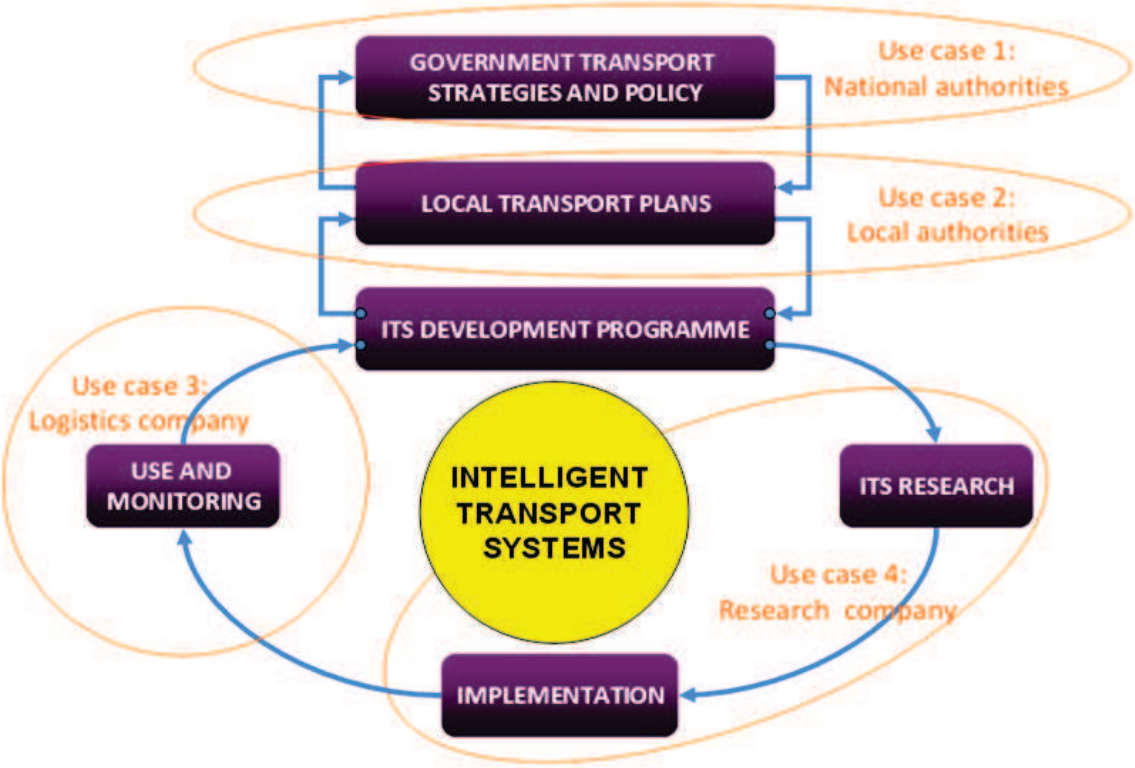


Figure 23: ITS life cycle diagram covered by Amitran use cases

Annex A: Questionnaire tool

There are different tools for conducting online-surveys available on the web. The requirements from the Amitran surveys included the need for a proper layout including project specific graphics (e.g. the project logo), easy time-efficient implementation of the questionnaire and the possibility for quick analysis of results with graphical analysis plus the possibility to create own evaluations from the data entered by the participants. Of course, the cost of using such a tool should be in balance with the project.
After checking a few tools, the selected one was www.lamapoll.de which fulfilled the requirements mentioned above, was flexible to use, provided a very good support,(even during the no-cost trial period!) and also provided a flexible cost plan with monthly subscriptions. Although basically a German tool, it provides multi-language support for the questionnaire itself and also for the user interface for questionnaire development and evaluation. The tool had already been used by other research institutions (e.g. University of Munich and University of Hamburg). This confirmed its applicability for research purposes.
Each partner can invite the contact persons he wants to fill in the questionnaire without showing the contact data to the other partners. This makes sure that partners do not have to publish their own contacts and that the respondents stay anonymous for others.

Annex B: Detailed online survey results

Stakeholder's role

1. Which stakeholder group does your organisation belong to?

Public authority or legislative body	21
ITS Manufacturer or developer	9
Infrastructure Opreator	2
ITS Service/Data Provider	3
Vehicle Manufacturer	4
Research and Consulting Organisations	29
GNSS Provider	1
ITS Network Organisation	2
Other	10

2. What is your personal role in the organisation?

A selection of the answers:

Mayor Office, Air quality, Sustainability, Board, Management, Business Development, corporate, Demand and Infrastructure, Environment and Energy, European Commission DG MOVE, geotechnics, Innovation manager, Innovation Unit, ITS Deployment, Lisbon municipality, Logistics, Mobility, mobility policies, Modeling and ITS technologies, road construction, Product management, project management, Research and development, Roads Directorate, RTD, Senate Department of Urban Development, Strategy & development, System Engineering, Technology and Innovation, Traffic Management, Transport and Mobility, Transport modeling, Transport planning, transport studies, Transport systems and logistics, Transport Unit, Urban development, Vehicle analysis and transport solutions.

3. Which Intelligent Transport System is your organisation involved in (in any way)?

Navigation and Travel Information	47
Traffic Management & Control	55
Demand & Access Management	33
Cooperative Systems, Driver Behaviour Change & Eco-driving	49
Public Transport Services	38
Logistics & Fleet Management & Intermodal Services	41
Safety & Emergency Systems	35
Other	5

4. Which type of ITS work are you involved in?

Technological development of ITS	37
Applications of Measures involving ITS	35
Usage of ITS	42
Funding of ITS Measures	15
Reserach on Impacts	46
Management of ITS Infrastructure	23
Provision of ITS services	25
Advice on ITS (consultancy)	32
Other	7

5. Which types of traffic and transport modes is your organisation involved in?

Commercial	39
Private	44
Goods	49
Passenger	60
Individual Automotive	46
Bicycles	30
Pedestrians	25
Public Transport	53
Rail Transport	28
Inland Shipping	15
Short Sea Shipping	14
Other	7

6. Is your organisation involved in estimating the effects of ITS measures on CO2 emissions? Yes: 48%, No: 31%

Importance of CO2 impacts

7. Please classify the importance of the following aspects of ITS impacts for your organisation as you see them *[Scale from 0% to 100%]*

	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter etc.)	Globally relevant emissions (greenhouse gases like CO2)	Social impacts	Traffic quality	Marketing value for your organisation / company
Mean	71	53	69	71	72	64	77	51
Std.Dev	25	29	27	17	22	22	19	35
Number	45	42	49	47	42	42	49	38

8. Which impacts will become more and which less important for your organisation in 10 years? Please choose from the list and write why you expect this to change in the future.

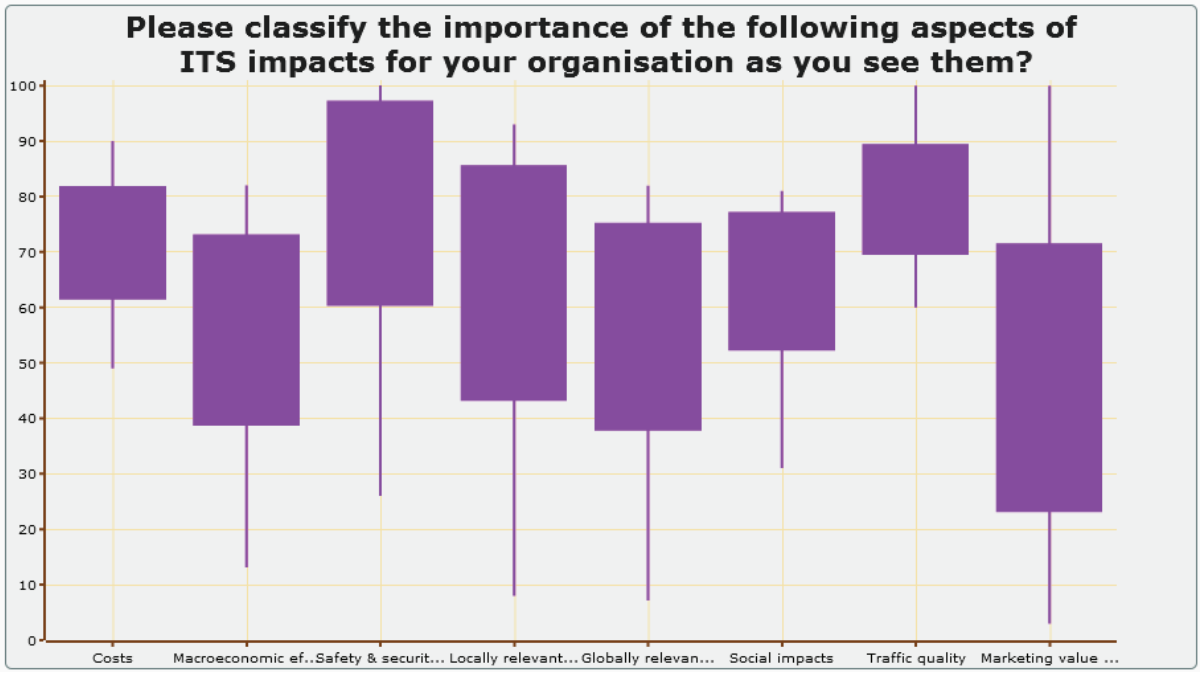
The following tables show the results for the three strongest (=most answers) stakeholder groups.

Public Authorities	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter	Globally relevant emissions (greenhouse gases like CO_2)	Social impacts	Traffic quality	Marketing value for your organisation / company
Mean	78	56	73	65	61	65	80	34
Std.Dev	9	21	19	18	25	16	11	26
Number	11	13	15	16	13	14	16	12

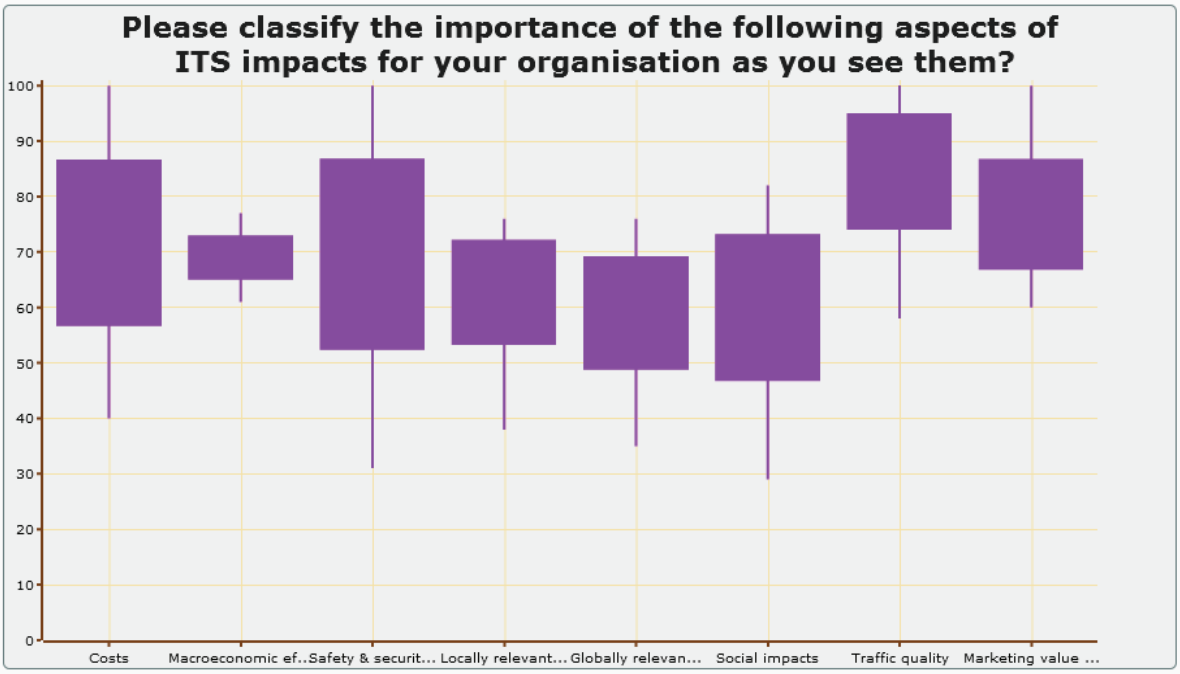
ITS Manufacturers	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter	Globally relevant emissions (greenhouse gases like CO_2)	Social impacts	Traffic quality	Marketing value for your organisation / company
Mean	72	69	70	63	59	60	85	77
Std.Dev	30	11	25	17	21	28	19	15
Number	3	2	5	4	3	3	4	5

Research and Consulting	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter	Globally relevant emissions (greenhouse gases like CO_2)	Social impacts	Traffic quality	Marketing value for your organisation / company
Mean	65	50	63	77	77	67	75	57
Std.Dev	28	31	27	12	18	26	22	41
Number	19	15	17	16	17	16	18	10

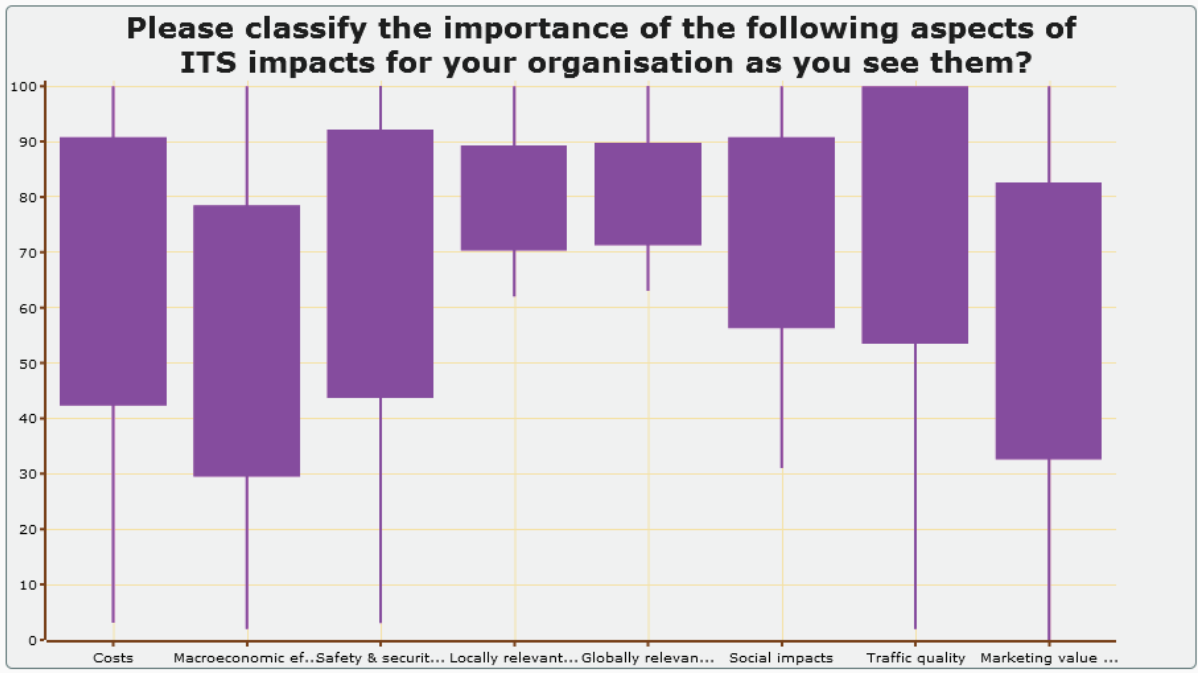
Public Authorities:



ITS Manufacturers:



Research & Consulting:



9. Would it help your organisation if you could assess the CO2 reduction potential of specific ITS in a standardised and generally accepted way?

No	6
Yes	49
no answer	4

If yes, on which scale would it help?

Global	12
European	16
National	8
Local/regional	14
No answer	9

10. Which stakeholders does your organisation find important to present the CO2 reduction assessment to?

Local politicians	11
National politicians	16
Investors	2
ITS end users	5
ITS Manufacturers or Developers including Software and/or Hardware (including infrastructure system manufacturing for example manufacturer of road signs)	0
Infrastructure Operators (including road, rail, port)	4
ITS Service and/or Data Providers	0
Competitors	0
Partners	0
Vehicle manufacturers (including automotive, railway wagons, vessels, public transport vehicles)	3
Research and Consulting Organisations	3
Global Navigation Satellite System Providers	0
Certification Bodies and/or Testing Laboratories	0
Standardisation Bodies	0
ITS Network Organisations	1
Environmental Organisations	0
Insurance Companies	1
General Public	7
Other, please state » Input Field	13

Importance of Intelligent Transport Systems

11. Which impacts will become more and which less important for your organisation in the coming decade?

	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter	Globally relevant emissions (greenhouse gases like CO_2)	Social impacts	Traffic quality	Marketing value of your organisation
Less important	2	2	1	2	1	2	4	8
Same	28	47	35	28	25	35	25	40
More important	32	13	29	33	39	26	34	13
No answer	3	3		2		2	2	4
Sum	*65*	*65*	*65*	*65*	*65*	*65*	*65*	*65*

The analyses for the three different stakeholder groups, as in the previous question, are given in the following tables; the numbers indicate absolute number of answers.

Public Authorities	**Costs**	**Macroeconomic effects**	**Safety & security**	**Locally relevant emissions (noise, particulate matter etc.)**	**Globally relevant emissions (greenhouse gases like CO_2)**	**Social impacts**	**Traffic quality**	**Marketing value for your organisation / company**
Less important	0	1	0	1	1	0	0	4
Same	4	10	7	7	8	8	7	8
More important	12	5	10	9	8	7	9	3
No answer	1	1				2	1	2
Sum	*17*	*17*	*17*	*17*	*17*	*17*	*17*	*17*

ITS Manufacturers	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter etc.)	Globally relevant emissions (greenhouse gases like CO_2)	Social impacts	Traffic quality	Marketing value for your organisation / company
Less important	0						1	
Same	6	6	4	2	1	6	4	3
More important	1	1	3	5	6	1	2	4
No answer	0							
Sum	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*

Research and Consulting	Costs	Macroeconomic effects	Safety & security	Locally relevant emissions (noise, particulate matter etc.)	Globally relevant emissions (greenhouse gases like CO_2)	Social impacts	Traffic quality	Marketing value for your organisation / company
Less important	1	1	1	0	0	2	2	2
Same	11	14	15	10	7	10	8	15
More important	7	5	5	10	14	9	10	2
No answer	3	2	1	2	1	1	2	3
Sum	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*

Models

12. What ITS impacts of relevance to your organisation are not covered by the existing models you use?

- Low number of answers, since there are only nine respondents.
- The more relevant answers, that in general address to not covered models more than to non covered impacts, is summarised as follows:
    - Will of the users

- Noise.
- we are doing no ITS specific models (simulation)
- Business models for ITS
- The calculations are processed for other organisations
- Multimodal transport impacts and energy efficiency impacts considering alternative propulsion systems (electric) and the production of the needed primary energy.
- Most models existing on the market needs improvements to evaluate ITS
- Secondary effects in the rest of the network we tend to study one stretch or one intersection

13. The impact assessment of ITS from user behaviour to CO2 emissions requires the combination of different models. Has your organisation already combined different models? Yes: 60%, No: 27%

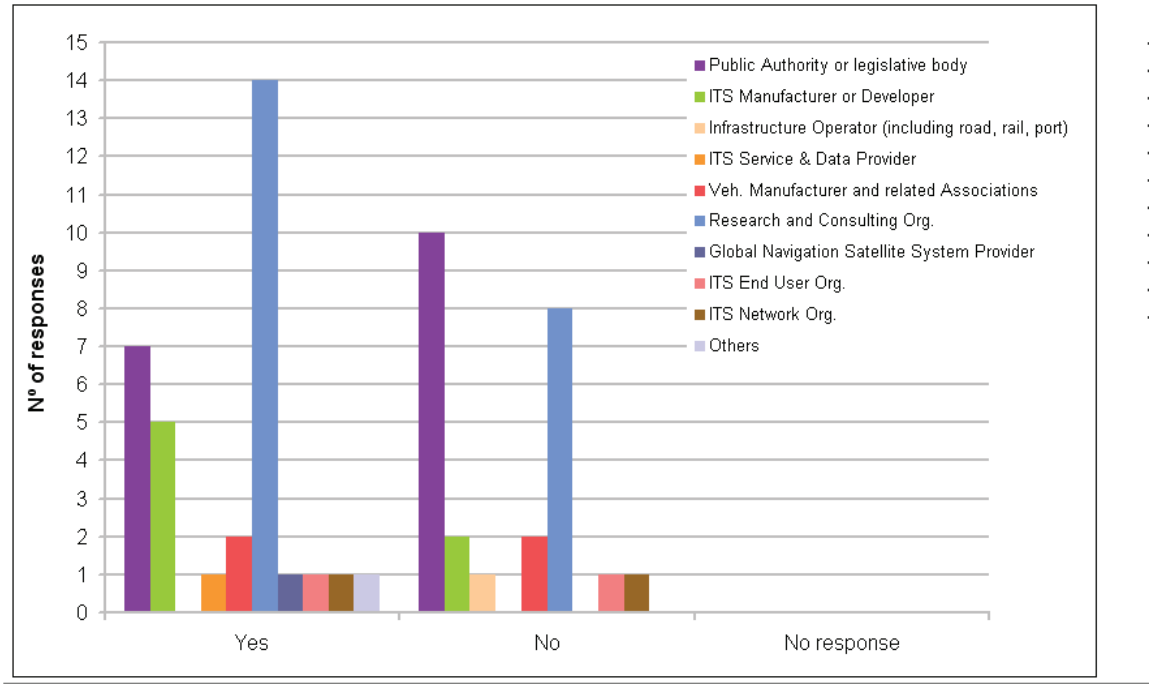


Figure 24: Do organisations combine models for CO_2 assessment?

Stakeholder group	Total answers	Yes	No	%Yes	%No
Public Authorities	17	7	10	41 %	60%
ITS Manuf. and developers	7	5	2	71%	29%
ITS Services and data providers	1	1	0	100%	0%
Vehicle manufacturers	4	2	2	50%	50%

Stakeholder group	Total answers	Yes	No	%Yes	%No
Research and consulting org.	22	14	8	64%	36%
ITS End Users Organisations	2	1	1	50%	50%
GNS System Provider	1	1	0	100%	0%
Infrastructure Operator	1	0	1	0%	100%
ITS Network Organisations	2	1	1	50%	50%
Others	1	1	0	100%	0%

Table 1: Number and percentage of answers related to combination of models for CO_2 assessment by stakeholder category

If yes, did you have problems concerning the interfaces between the models?

- The following answers were found:
  - Data granularity of e.g. demand elasticity models (and their influence factors) and flow models
  - The problem is the concordance between \top down\" and \"bottom up\" models."
  - The inputs of emission models are more than what the traffic models provides as outputs.
  - Integration between micro and macro are not yet totally ready.
  - So far we use very simple models

If no, has your organisation considered combining different models? Did the difficulty in bringing different models together has kept you from trying or succeeding? If you tried, what were the reasons for not succeeding?

- All answers are different:
  - Use of models is not common.
  - High complexity, not compatible models, large uncertainty
  - Very hard to find relevant models
  - Yes we have considered it.. Yes, and also costs.
  - Not a priority topic at the moment

14. Where do you see gaps in CO2 emission assessment of ITS which cannot be covered by existing models?

Stakeholder group	Total answers	Relevant	Not relevant	No response	% Relevant	% Not relevant
Public Authorities	17	4	10	3	25%	59%
ITS Manuf. and developers	7	2	4	1	29%	57%
ITS Services and data providers	1	0	1	0	0%	100%
Vehicle manufacturers	4	2	0	2	50%	0%
Research and consulting Org.	22	9	10	3	41%	46%
ITS End Users Org.	2	1	1	0	50%	50%
Global Navigation Satellite System Provider	1	0	1	0	0%	50%
Infrastructure Operator	1	0	1	0	0%	50%
ITS Network Organisations	1	1	0	1	50%	0%
Others	1	0	0	1	0%	0%

Table 2: Number and percentage of answers related to relevancy of CO_2 models by stakeholder category

Gaps found to this question with a satisfying level of detail with the following answers:

- Key gap is a standardised model/ technique for assessing the CO_2 reduction, in deartil, for solutions that modify traffic or driving behaviour.
- The existing models are not able to appreciably evaluate effects of ITS on emissions (moreover in test phase).
- Lack of specific methods of evaluating specific ITS services in general. E.g. how to estimated impact of specific cooperative services. we need harmonised methods.
- Does not always have relevant in-use rendering - Does not take the ageing of the vehicule into account.
- Model parameters need further assessment
- Suitable drive cycles and harmonised scenarios
- There is no agreement on European scale which model will be the basis for Kyoto measures description...
- We cannot answer this question, it is too vague, it is very difficult to estimate emissions from a whole fleet and even more difficult to estimate changes in emissions due to a measure

- Long term effects and uptake rate
- Not based on actual trips made by vehicles.
- Accessibility and availability of data sources
- To cover scaling up effects of ITS, properly
- Modelling of user uptake and behavioural change
- Often data are needed that are very hard to get
- I would like to see in a near future a combination of models based on traffic simulation, traffic flow optimisation and emission based on real time data as a base for political and investments decisions.
- More accurate models for passenger transport - especially in distinguishing between urban, semi-urban and rural environments.
- Difficulties in getting reliable and accurate input data + lack of info about the accuracy of model calibration made by others + differences in country data collection + lack of evaluation of different emission sources
- Public transport - cycling - usage of personal cars

Methodology relevance

15. Please rate the relevance of the following requirements on the AMITRAN outputs for your organisation? *[Scale from 0% to 100%]*

	ITS Manufacturer	Public authority	Research and Consulting	Other	average	standard deviation
Reliability, standardisation, and recognition	86	77	82	86	81	14
Accuracy of the output	81	66	84	93	80	20
Comparability of results	78	77	78	89	81	16
Completeness of effects	63	72	70	86	72	21
Consideration of indirect effects	64	70	67	67	67	23
Comprehensive modal scope	57	66	65	70	66	19
Online checklist and handbook	62	65	70	58	64	29
Low cost of the methodology	52	62	60	65	60	28

16. Please rate the relevance of the following purposes of a CO2 assessment methodology such as AMITRAN from your organisation's perspective? *[Scale from 0% to 100%]*

	ITS Manufacturer	Public authority	Research and Consulting	Other	average	standard deviation
Support to public authorities, developers and investors to take better informed decisions based on reliable impact estimates	86	83	82	79	82	16
Increase in the reliability, standardisation and recognition of CO2 assessment	76	72	79	81	78	15
Proof of CO2 emission effects of ITS developed or deployed by your organisation	81	69	59	84	65	30
Decrease of the CO2 emissions on the European level	68	75	80	70	75	21
Support to users to take better informed decisions on thransport mode and choice of route	67	67	72	78	71	22
Development of a generic scaling up methodology and database to translate local effects to EU level	67	63	69	75	70	22
Increased cooperation in the field of CO2 assessment through the AMITRAN forum	23	41	48	57	46	29

17. Who do you think will be the primary users (i.e. applying the methodology) and the primary stakeholders (i.e. interested in the output or contractors) of the AMITRAN methodology?

	ITS Manufacturer	Public authority	Research and Consulting	Other	Total
National governments/authorities	6	12	19	8	45
Local governments/authorities	4	11	11	7	33
Policy makers	4	7	13	8	32
Environmental Organisations	3	7	10	7	27
Research and Consulting Organisations	2	4	14	5	25
Infrastructure Operators	3	4	10	4	21
ITS Manufacturers or Developers	4	2	6	6	18
ITS Service and/or Data Providers	2	1	11	3	17
Vehicle manufacturers	3	1	6	4	14
ITS Network Organisations	0	2	5	4	11
ITS End Users	1	2	2	5	10
Investors	1	0	6	2	9
Certification Bodies and/or Testing Laboratories	2	3	2	0	7
Competitors	0	0	3	1	4
Partners	0	1	3	0	4
Standardisation Bodies	1	1	1	1	4
Insurance Companies	0	3	1	0	4
Global Navigation Satellite System Providers	0	1	0	0	1
Other, please state	0	0	0	1	1

Annex C: Interview partners

No	Stakeholder group	Stakeholder level/type	Interview partner	Inter-viewed by	Date of interview
1	Public Authorities & legislative bodies	National	Dutch Ministry of Transport (RWS), Road Authorities Netherlands	TNO	13/04/2012
2	ITS Network organisations	Regional & Local	ITS Niedersachsen, Braunschweig	DLR	12/04/2012
3	ITS Manufacturers & Developers	Traffic Management	Trinite automation	Ecorys	18/04/2012
4	ITS Service & Data providers	Business and IT Consulting	Logica	Ecorys	27/04/2012
5	ITS Users	Private cars	ANWB, Representation of private car owners in NL	Ecorys	30/01/2012
6	ITS Users	Logistics	Meyer & Meyer, shipper	DLR	19/04/2012
7	Research and consulting organisations & projects	Public Transport	Hamburg Consult	PTV	17/04/2012
8	Public Authorities & legislative bodies	National	Ministry of iIfrastructure and Space	TNO	25/04/2012
9	Vehicle manufacturer	transport studies	IVECO	PTV	17/04/2012
10	ITS Users	Private sector, local	San Sebastian Technology Park	Tecnalia	02/05/2012
11	Public Authorities & legislative bodies	Regional & Local	Municipality of San Sebastian (Mobility)	Tecnalia	14/03/2012
12	Vehicles manufacturers including their associations including parts	National	SERNAUTO (Spanish automotive suppliers association)	Tecnalia	12/03/2012
13	ITS Users	Inland shipping	Bureau Telematica Binnenvaart	Ecorys	23/04/2012

Annex D: List of projects

Acronym	Title/Description	Start date	End date
2DECIDE	ITS Toolkit	01/10/2009	30/11/2011
Carbotraf	A Decision Support System for Reducing CO_2 and Black Carbon Emissions by Adaptive Traffic Management	01/9/2011	31/8/2014
CIVITAS POINTER			
Co-Cities	Cooperative cities extend and validate mobility services		
COFRET	Carbon footprint of freight transport	01/6/2011	01/11/2013
COSMO	Cooperative mobility services for energy efficiency	01/11/2009	01/6/2012
Decomobil	Support action to contribute to the preparation of future community research programme in user centred Design for ECO-multimodal MOBILity	01/10/2011	
Drive C2X	With 32 partners, 10 support partners and 18.9 million Euro budget, DRIVE C2X will lay the foundation for rolling out cooperative systems in Europe. Hence, lead to a safer, more economical and more ecological driving.	01/1/2011	31/12/2013
ecogem	Cooperative Advanced Driver Assistance System for Green Cars	01/9/2010	31/3/2013
eCoMove	Cooperative mobility systems and services for energy efficiency	01/4/2010	31/3/2013
eCompass	eCO-friendly urban Multi-modal route PlAnning Services for Mobile uSers	01/11/2011	01/11/2014
Econav	Ecological Aware Navigation: Usable Persuasive Trip Advisor for Reducing CO_2-consumption		
ECOSTAND	Joint EU - Japan - US task force on the development of a standard methodology for determining the impacts of ITS on energy efficiency and CO_2 emissions	11/1/2010	31/10/2013
e-Freight	e-freight capabilities for co-modal transport	01/1/2010	31/12/2013
Elvire	Electric Vehicle communication to Infrastructure, Road services and Electricity supply	01/1/2010	31/12/2012
eMaps	eSafety Digital Maps Public Private Partnership Support Action	01/9/2011	28/2/2013
Euridice	European inter-disciplinary research on intelligent cargo for efficient, safe and environmental-friendly logistics	01/2/2008	31/1/2011
EuroFOT	Bringuing intelligent vehicles to the road	01/5/2008	31/8/2011
europtima	Changing the paradigm in data and fare collection systems	01/1/2011	01/10/2012
FESTA	Field operational test support action	01/1/2008	01/7/2008
FOT-Net		01/8/2008	01/12/2013
FREILOT	Urban Freight Energy Efficiency Pilot	01/4/2009	30/9/2011
GHG-TransPoRD	Reducing greenhouse-gas emissions of transport beyond 2020	01/10/2009	01/9/2011

iCargo	iCargo - Intelligent Cargo in Efficient and Sustainable Global Logistics Operations	01/11/2011	30/4/2015
ICT Emmissions	Development of a methodology and tool to evaluate the impact of ICT measures on road transport emissions	10/1/2011	30/9/2014
IFM	Interoperable Fare Management Project	01/1/2008	31/12/2009
In-Time	Intelligent and efficient travel management for European cities	01/4/2009	31/3/2012
iTetris	Integrated wireless and traffic platform for real-time road traffic management solutions	01/7/2008	31/1/2011
Logistics4life	Logistics Industry Coalition for Long-term, ICT-based Freight Transport Efficiency	01/1/2010	01/7/2012
Modum	Models for optimising dynamic urban mobility	01/1/2011	31/12/2014
PowerUp	Specification, Implementation, Field Trial, and Standardisation of the Vehicle-2-Grid Interface	01/7/2011	30/6/2013
Pre-Drive C2X	Driving implementation and evaluation of C2X communication technology in Europe	01/7/2008	30/9/2010
Reduction	Reducing Environmental Footprint based on Multi-Modal Fleet management System for Eco-Routing and Driver Behaviour Adaptation	01/9/2011	31/8/2014
roadidea	Roadmap for Radical Innovations in European Transport Services	01/1/2008	31/12/2010
SARTRE	Aims to develop strategies and technologies to allow vehicle platoons to operate on normal public highways with significant environmental, safety and comfort benefits.	01/9/2009	01/8/2012
SATIE	Support Action for a Transport ICT European large scale action	01/9/2011	31/8/2014
smart V2G	Smart Vehicle to Grid Interface	01/6/2011	31/5/2014
SmartCEM		01/1/2012	01/12/2014
Smartfreight	Smart Freight Transport in urban areas	01/1/2008	30/6/2010
sunset	Sustainable Social Networking Services for Transport	01/2/2011	01/2/2014
superhub	SUstainable and PERsuasive Human Users moBility in future cities	01/10/2011	30/9/2014
THEMIS	Thematic network in optimising the management of intermodal transport services	01/4/2000	31/3/2004

References

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For more information about 

Amitran project
Gerdien Klunder
TNO (coordinator)
Van Mourik Broekmanweg 6
2628 XE Delft
The Netherlands

gerdien.klunder@tno.nl
www.amitran.eu

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