

Model Documentation System (MDS) evaluation report 2006



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Evaluation of the Model Documentation System

Introduction

The Model Documentation System (MDS) has been developed by the European Topic Centre on Air Quality (ETC-AQ) with the aim of providing, on-line information and guidance to any user of air pollution dispersion and meteorological models, in selecting the most appropriate model for a specified application. Inclusion of a model in the system is by no means associated with any form of endorsement for using the particular model. The range of the suitable models for a particular application is increased as more models are incorporated into the database. The database indicates the most appropriate models according to the specifications submitted as key words through a structured search by the modellers.

A pilot version of the MDS was installed on the World Wide Web in 1997, while an updated operational version was launched in the spring of 1998. Since then, the database has been updated every year (descriptions are continuously adapted to model developments) and new models have been added. User support and the possibility to make minor adjustments to model descriptions, is provided throughout the year. In March 1999, version 3.0 of the MDS was installed including a form for direct model submission over the web. In 2006 a significant update was made by incorporating additional information fields in the models' long description. The new fields covered model information that was not sufficiently represented in the previous versions, as the users indicated in their responses in the previous MDS evaluation questionnaires. More specifically, a field on "Previous applications" of a model was added, where characteristic previous applications of the models were briefly described along with their main reference. A substantial improvement on covering aspects on model validation and evaluation included the addition of the "Validation and evaluation" field, focusing on "Model intercomparison" and "Input data validation". These new fields were considered to be necessary additions into the MDS tool, also in view of the proposal for the new Air Quality Directive, that proposes a "combination of fixed measurements and modelling techniques" to assess ambient air quality. The requirement that modelling techniques are used in order to assess and improve air quality must also be accompanied by tools and information regarding model validation and intercomparison of results, identification of model limitations and error factors. A continuous stream of information exchange between modellers and model users should be established and MDS is already functioning in this context by facilitating model application through its comprehensive and detailed description of a significant number of models and with the addition of these new fields will further contribute to the model validation effort. The users who have submitted their models prior to this database update were asked to incorporate relevant information on these new fields into their models. This action is in line with users' needs and requests as these result from the previous MDS Evaluation report as well as from questionnaires that were distributed to the MDS user community.

In May 2006, a general editing was also made by the MDS Administrator, to all models' long descriptions, in order to ensure that submitted e-mail addresses, URL links and contact persons are valid according to the address book of the MDS Administrator.

At present, a total of 112 models are included in the MDS. The hit and visit statistics for 2006 show that there are, on average, 72 individual visits per working day between January and August, revealing a significant increase in database daily average visits (20) since the last evaluation took place (see MDS Statistics report 2006 for details).

In order to discover the system's remaining weaknesses and to upgrade and further improve the MDS in the next years, frequent interaction with the users of the system is considered essential. Towards this aim, it was decided to set up an evaluation of the updated version of MDS, which would seek to identify the opinions of various users with respect to the technical aspects of the system, the model coverage and presentation and the model quality assessment. For this reason, a questionnaire was prepared and installed on the web, (URL: <http://pandora.meng.auth.gr/mds/questionnaire.php>) enabling the user to submit his/her reply directly after responding to the questions. Users of MDS and the model community were informed of the availability of the questionnaire on 25/09/2006 and were given a month to reply. A total of 22 user answers were collected until 27/10/2006. The analysis of these answers and the findings that emerged from the questionnaire are presented below.

MDS Evaluation results

a) General questions and technical aspects

Firstly, the user is asked to provide feedback on some general questions regarding how they were informed about the existence of the database and the reasons of their visit. From the responses, it follows that the users were informed about the MDS mainly through other colleagues (44%), at a percentage of 22% through a web search or through a conference/workshop, while a 4% of the users were introduced to MDS through an EEA/ETC-ACC (ETC-AQ) report. The main reason for the quest of 53% of the users was their need to get information about various models, while around 23% of the users were motivated by academic interest and 17% had a specific application in mind. The general interest quests were reduced compared to the last MDS evaluation questionnaire, reaching merely 3% of the users.

An assessment of the technical aspects characterizing the MDS database, such as clarity of criteria and options available, user-friendliness, malfunctions etc, was then requested. A first conclusion from the analysis of the responders' answers, as shown in charts 1 to 12, is that, from a technical point of view, the database is favourably assessed by the large majority of users.

The majority, namely around 90%, of the responders find the database sufficiently user friendly. Also the questionnaire revealed that the majority of the users found the navigation tools (buttons/click bars) of the website easy and relatively easy to use (81%). The only malfunction that was reported by a small percentage (14%) of the responders concerned, mostly, difficulties in connecting to the database and was not directly related to the operation of the database itself. Almost half (45%) of the users loaded the database using Internet Explorer and the same percentage using Mozilla (Firefox). However, no conclusions could be drawn from the questionnaire on which web browser performed better in loading the database and which presented the most problems or delays, as no such question was included.

Finally, 86% of the responders have already submitted a model to the MDS, most of them by filling the model information sheet made available for this purpose.

b) Model coverage and presentation

Secondly, the opinion of the users on the actual content of the MDS was sought. The intention this time was twofold: To evaluate, on the one hand, the completeness of the model coverage and the adequacy of their presentation, and on the other hand, to assess whether and to what extent, the database has served its purpose, which is to provide information and guidance to any user of air pollution dispersion models in selecting the most appropriate model for a specified application.

This time, the user's answers cover a broader range of opinions, as each one of them has different needs, expectations and expertise. Overall, they have a high appreciation of the content of the database and specifically on the model coverage and the adequacy of the presentation (charts 13-18). Almost half of them (55%) characterise the model coverage according to the short description as sufficient, and a significant percent (27%) of the users would assess the coverage as complete, while an 18% views it as average. The results were very similar in the case of model coverage according to the long description, with the same percentage (18%) of users who considered the coverage as complete, but an increase (63%) of the users who characterised the coverage as sufficient. This is expected, as the users' requirements regarding comprehensive coverage increase in the case of a long description field. While the largest part of users think that the database distinguishes and covers all possible model categories, some users (11%) do not share this opinion. A suggestion that was made on this issue proposed the addition of a new categorisation of models according to the mathematical solution used in each one of them. Some users have noticed the absence of some well known US models as well as microscale and CFD models. The absence of several public domain models in the area of accidental releases of chemicals has also emerged. It is often the case that for models which already have a dedicated website and are sufficiently described through other on-line sources, the contact persons are not so inclined to re-deliver the information to MDS. However, there should be more effort towards completeness. As far as the model presentation is concerned, around 80% of the responders think that it is adequate. However, in specific issues, several users have pointed out weaknesses and suggested ways for possible improvements.

In particular, regarding the coverage of the various aspects that characterise a model, an important part of the responders regards it as not sufficient enough. More specifically, only a 9%-13% of the responders are fully satisfied with the coverage of issues related to input needed for a model, validation and evaluation, its technical features and its applications. This percentage is slightly higher (15%) when it is related to model contact information.

Depending on the scientific background and the modelling skills of the user, his needs, as far as the information given to him is concerned, vary. Expert users would wish to have more details on scientific issues like parameterizations, model limitations etc, while non expert users would be more interested to know, for instance, what are the types of application a model can be applied to, what are the input data they will need etc. A simpler vocabulary (or interpretation of the terminology used) would also be preferable to them: For example, it is not quite obvious for a non expert user that a model that handles “line sources” is essentially designated to describe the effects from traffic air pollution. Abbreviations should also be avoided or explained as some users are not familiar with them. All users, however, underline the need for a characterisation of the models as regards their quality or, in other words, the reliability of their results. This issue is covered in more detail in the next paragraph. Information on former applications of the models is also regarded as very useful by the responders.

Another remark is that the database is insufficiently updated with respect to references given, practical applications as well as contact person coordinates.

Regarding the assessment of the final benefit and utility of the MDS, the result of the evaluation was quite positive as charts 19-29 allow to conclude. More specifically, almost all users found the search criteria/questions that are used for performing structured searches in order to select the most suitable model for the required application, to be clear (41%), very clear (27%) and average (23%), while the “help” facility was favourably appreciated by 95% of the users.

Half of the users declare having performed a structured search of the database, and the large majority of these search attempts were successful (91%). Half of them had access to the model(s) that resulted from their query and, in most of the cases they applied these models (64%) and obtained final results (59%).

c) Model quality assessment

In the last part of the questionnaire, a set of questions was addressed to the users and aimed at exploring their satisfaction with respect to the level of information on model validation and evaluation currently provided, as well as their need or desire to have more quantitative information on model result uncertainty. As has already been pointed out above, independently of their scientific background or modelling skills, the users would wish to be more soundly and objectively informed as regards quality assessment and quality control of the models included in the MDS. As the model presentation has been made by the modellers or model owners themselves, it tends to be subjective. Some of them are very honest and report the model’s limitations while others tend to exaggerate their model’s capabilities. Also there is often a mixture of

frequently used and well-regarded models and never-used and poorly regarded models and the non expert user cannot easily distinguish between the two (though through the references list, further information is available to the interested user). It should be pointed out that the models submitted to MDS undergo a review by the Laboratory of Heat Transfer and Environmental Engineering of the Aristotle University of Thessaloniki and the Netherlands Environmental Assessment Agency (MNP) as concerns the completeness and the clarity of the model descriptions. However, these findings inevitably lead to the recognition of the necessity for an objective evaluation of the models and clearly the issue of setting a well defined methodology for model quality assessment to be followed and reported by the modellers or model owners arises. These conclusions are a result of both the users responses to specific questions, as shown in charts 30-33, as well as by individual comments and suggestions made by the responders.

More specifically, as far as the users' appreciation of the information given in model validation and evaluation is concerned, approximately 62% would qualify it as sufficient, showing the improvement of MDS in that aspect compared to the last version where only 40% considered relevant information as sufficient. 33% thought the information covering model validation and evaluation was average, while the rest think that it is incomplete (chart 30). An important outcome of the analysis of the responses is that the majority of the users (73%) would, in addition to the recently added validation and evaluation fields, like detailed quantitative information on model uncertainty to be included in the MDS (chart 32).

d) User profile

A set of questions was asked with the aim of collecting information on aspects related to the user himself, such as professional and educational profile, modelling skills, the reasons of his search and how he became acquainted with the MDS. A graphical representation of the statistical evaluation of the answers appears in the charts 34-39. From these charts, it can be seen that 82% of the users are members of a research institute, while the rest 18% represent consulting firms. None of the users belongs to local authorities or administrations. Over half of the responders (55%) are team members, while 27% and 18% are group leaders and heads of a department respectively.

Regarding their scientific background, on the largest part (55%) they are physicists or chemists. A significant proportion of the users, 23%, represent other scientific disciplines, thus confirming the general scientific interest on MDS. The rest are mathematicians and computer scientists (9%), or engineers (14%). In their large majority, the users have very high educational levels as most of them (around 80%) are postgraduates and only 14% of them are graduates. Most of them (59%) have good modelling skills while a 14% and 27% are of an excellent and average level respectively. Most of the responders have submitted one of their own models to the database (68%). Finally, the highest percentages of the responders were from Greece (23%), Belgium (14%) and Italy (14%).

e) Suggestions for possible improvements

In addition to answering the individual questions of the questionnaire, many responders commented further and made useful suggestions for improvements on several aspects related to the MDS. The most applicable among them are summarised below:

- In terms of navigation and access to the database, a direct, easy-to-find access to the actual model list is desirable.
- It was suggested that additional information fields would enhance the ability of the database to provide recommendations for specific models according to the user intended application, including a fitness for purpose scale comparing some typical application types.
- It was also suggested that the MDS information could be linked to the model inventory of COST 728.
- Last but not least, a comment/suggestion made by a lot of responders in many different ways, was the users need to get an objective information on model reliability and quality assessment. E.g. it was suggested to add a field describing uncertainty estimations for specific cases.

Conclusions

After almost ten years of operation of the Model Documentation System and six years since the last MDS evaluation questionnaire, an evaluation of its functionality and utility has been once more performed through a survey of its users. The aim was to identify the system's remaining weaknesses and the success of the latest updated version on eliminating some of these, as well as to proceed to its upgrade and further improvements.

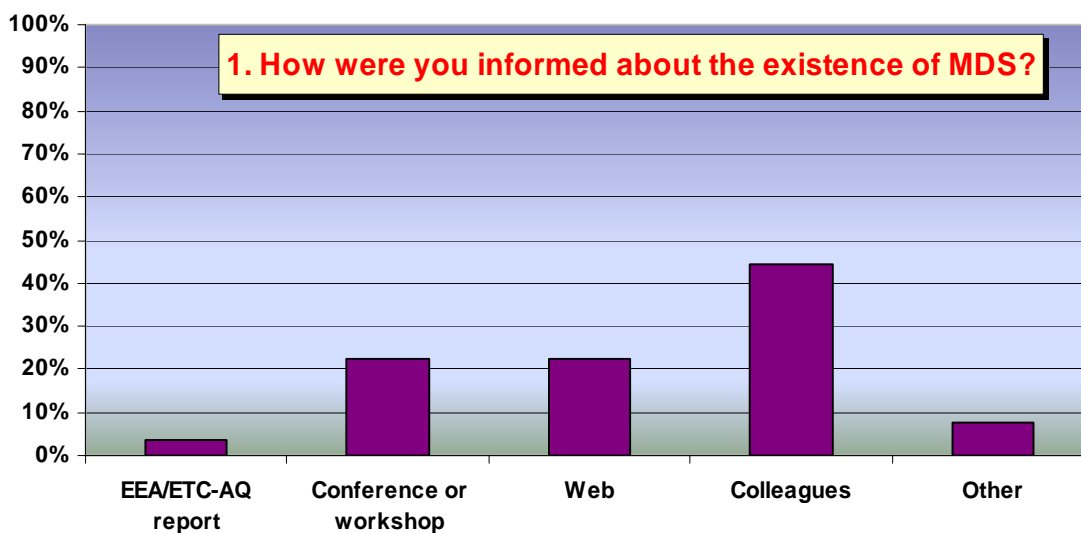
The results of this evaluation are quite encouraging, since they have shown that the MDS is very well accepted by the community of users. Overall, they have a high appreciation of both the structure and content of the database. Many users have used the MDS for selecting an appropriate model for their needs, and their application(s) has led, in most cases, to useful results. Furthermore, an increased fraction of the responders considered the coverage of the model validation and evaluation information satisfactory, compared to the previous questionnaire. There is, however, still ground for further improvements towards several directions such as completeness of coverage, objective and quantitative model evaluation, or navigation, access and database use.

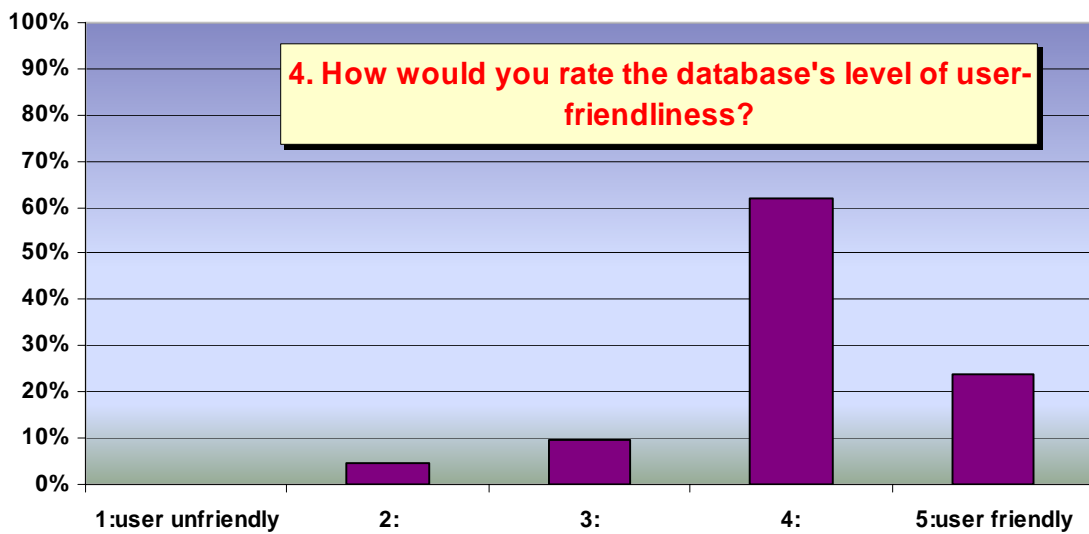
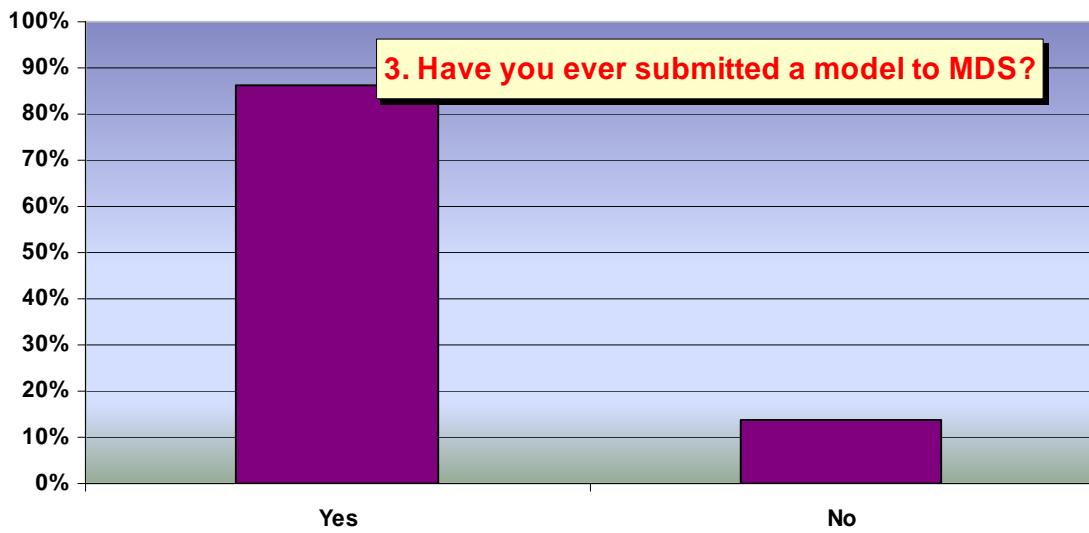
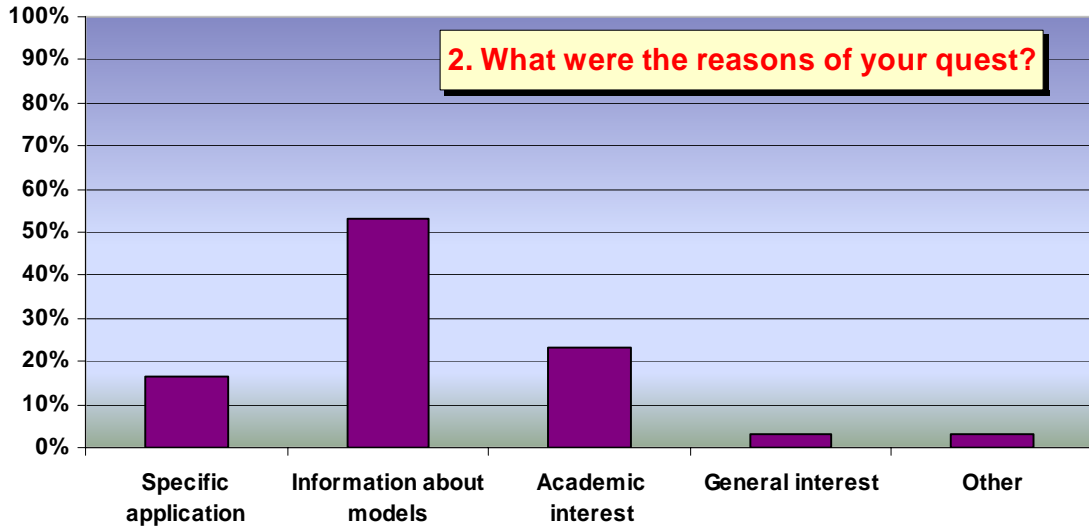
An important finding is that, although most of the MDS users who responded belong to the academic community, the private sector was also represented, in contrast to the previous questionnaire, implying an improved dissemination effort. However, the local authorities and administration sectors were again not represented. This requests increased dissemination of information related to the database, as possibly these users

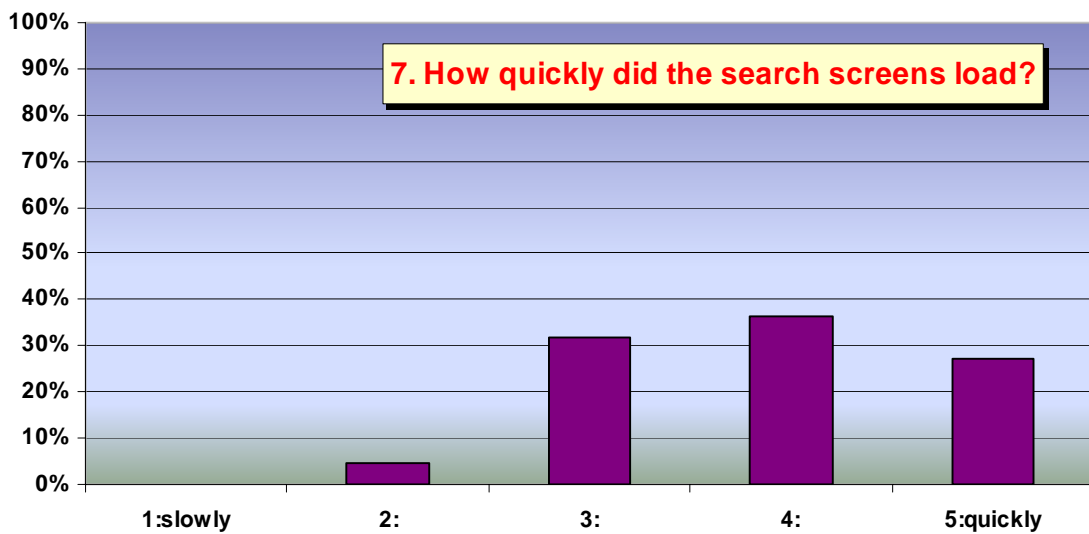
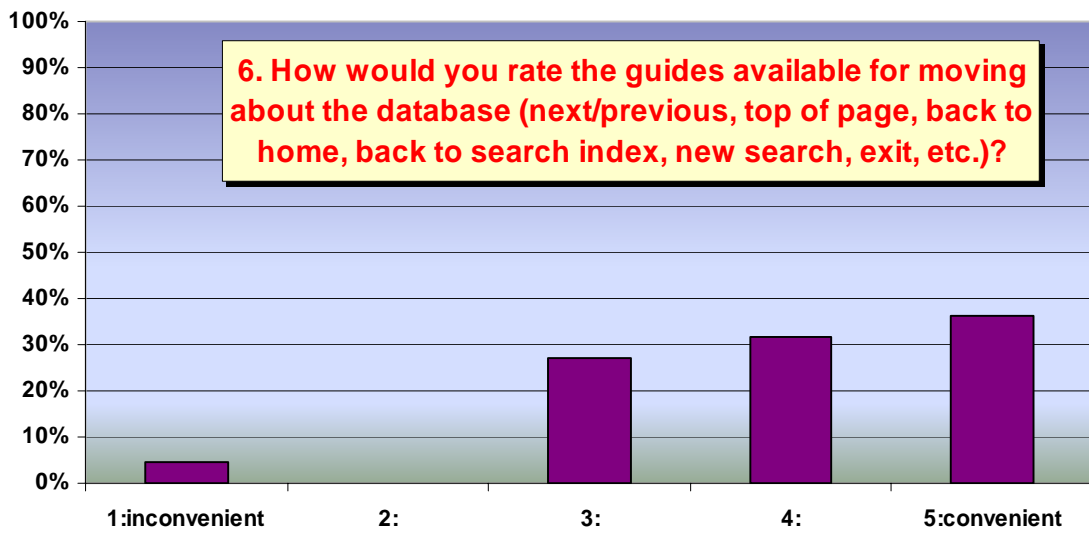
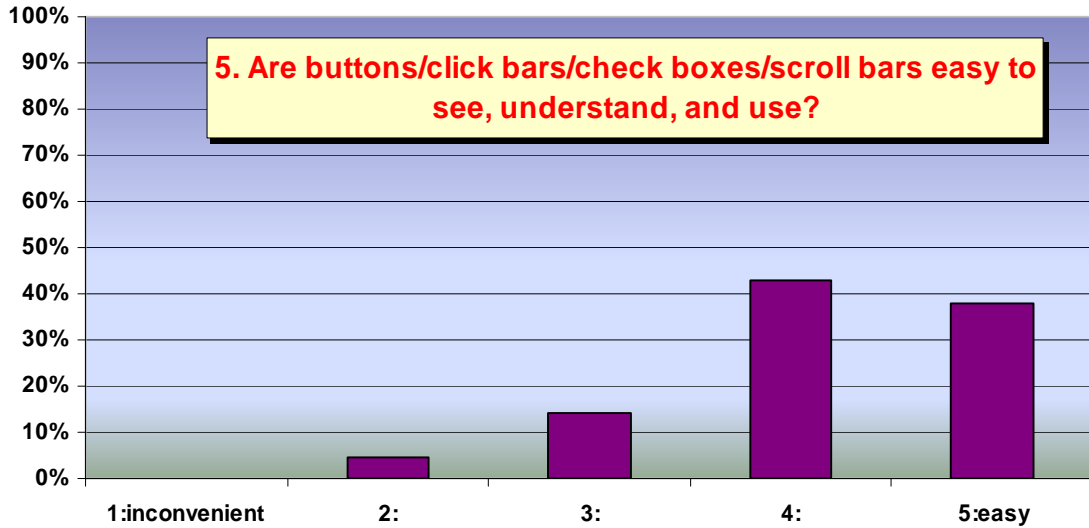
did not realise the possibilities that are offered to them through the use of the MDS and the contribution and benefits of the database to Air Quality Management.

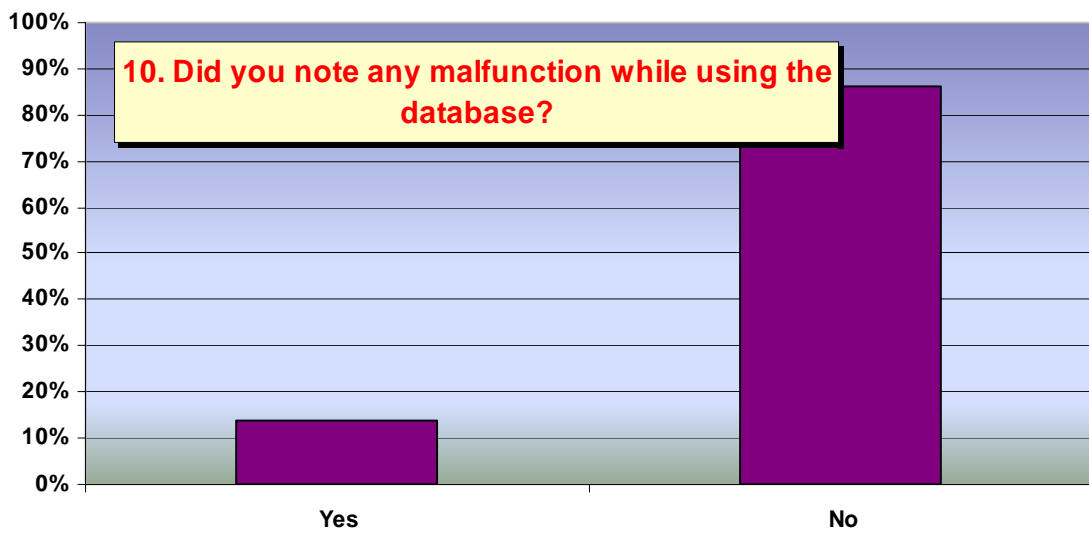
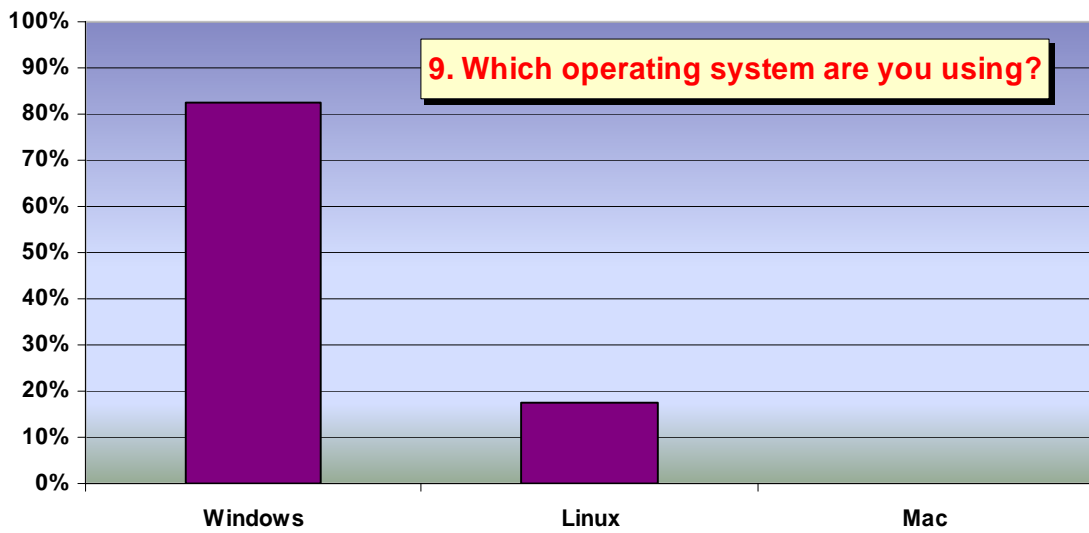
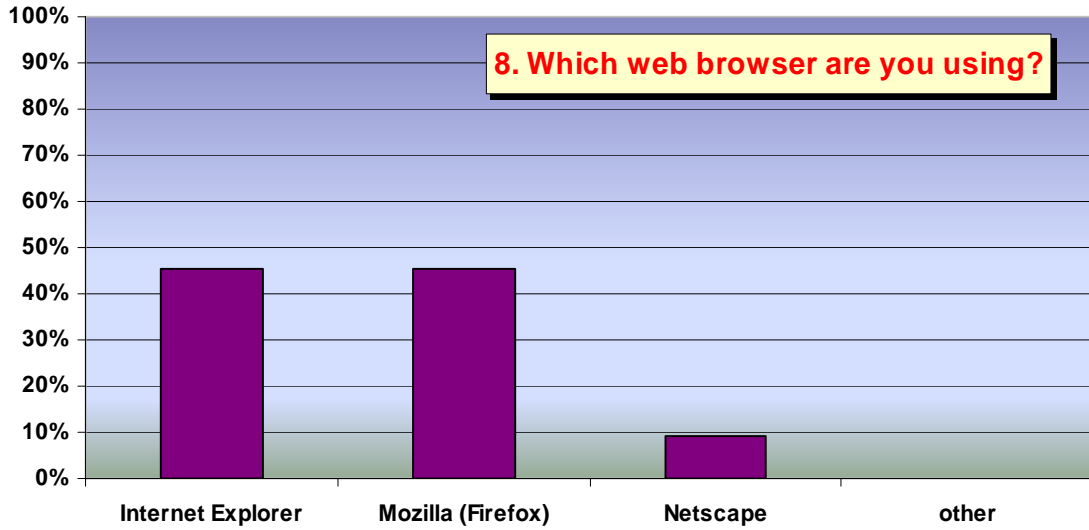
Finally, one of the most important outcomes of the present evaluation, explicitly underlined by many users, which imposes the directions for the MDS future expansion, is the necessity for a quality assessment and quality control of the models, following a well defined and harmonized methodology, extending to all models and model categories.

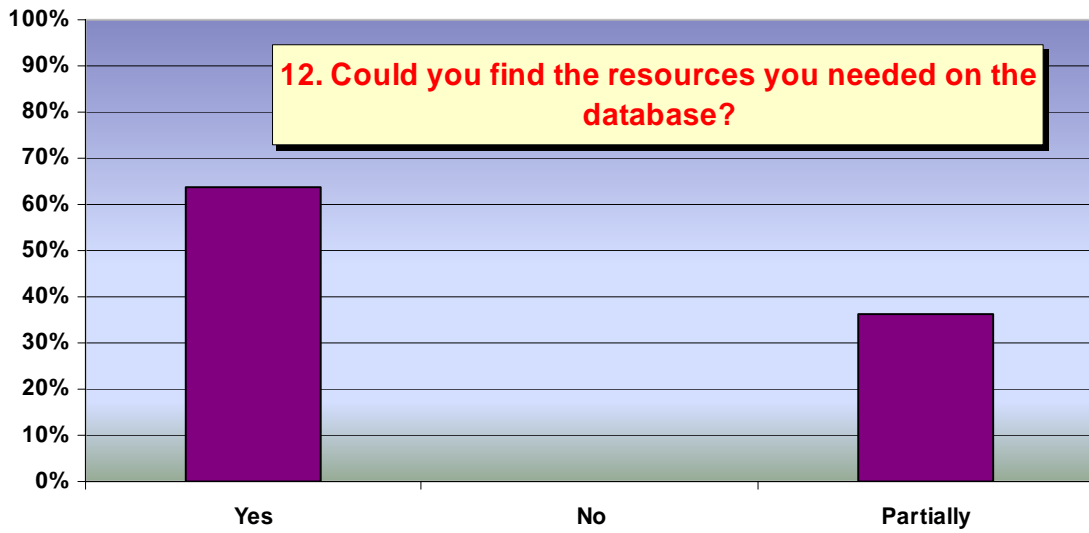
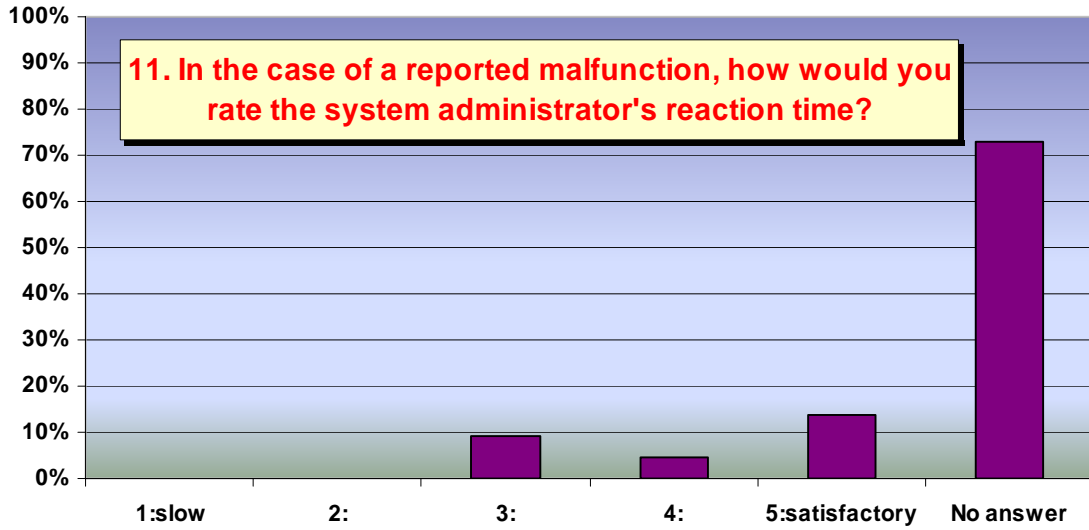
General questions and technical aspects



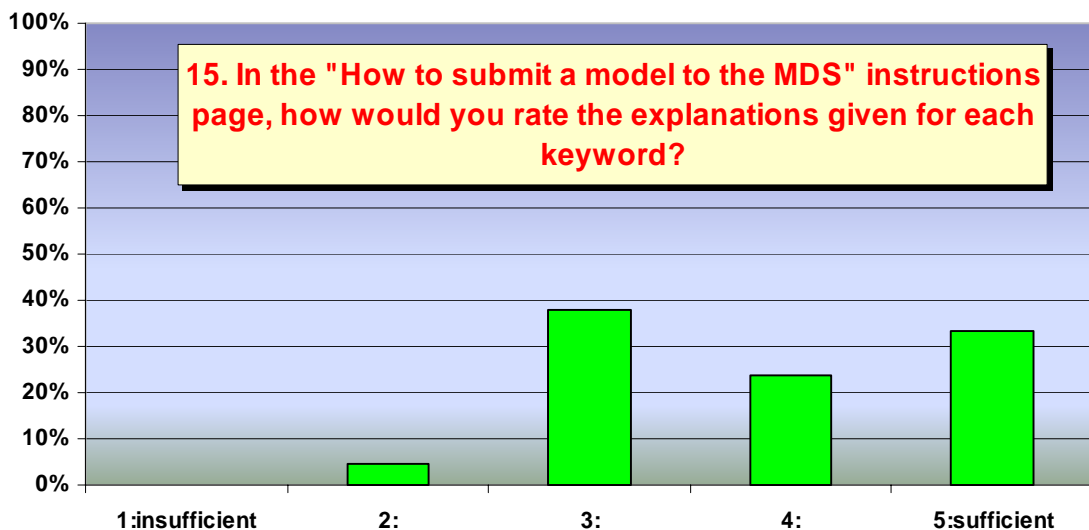
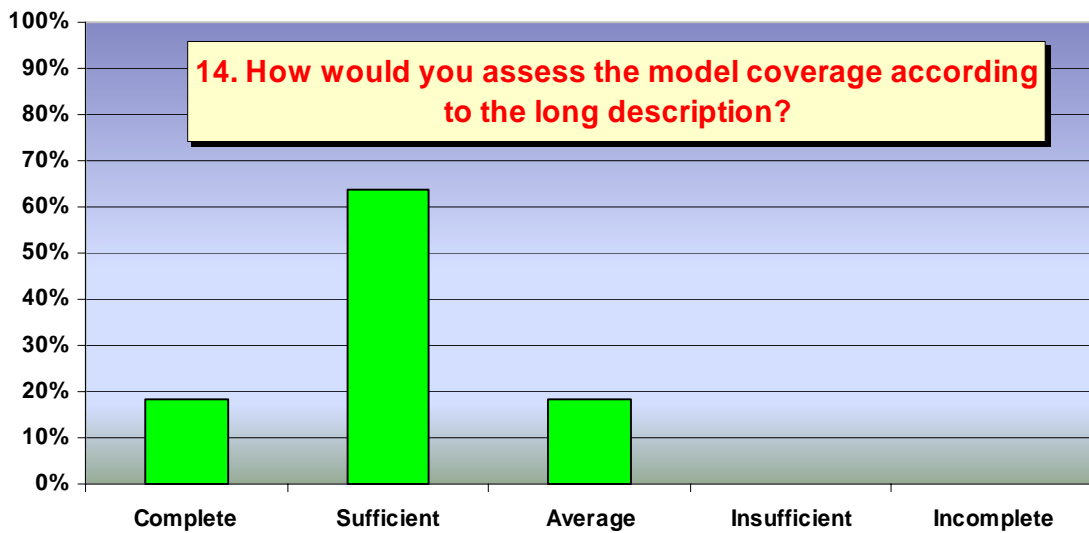
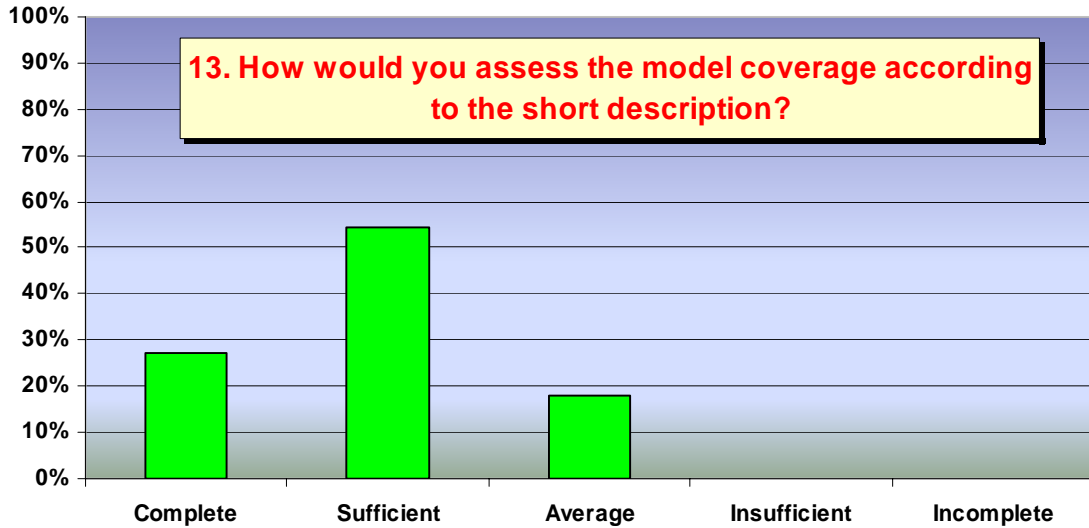


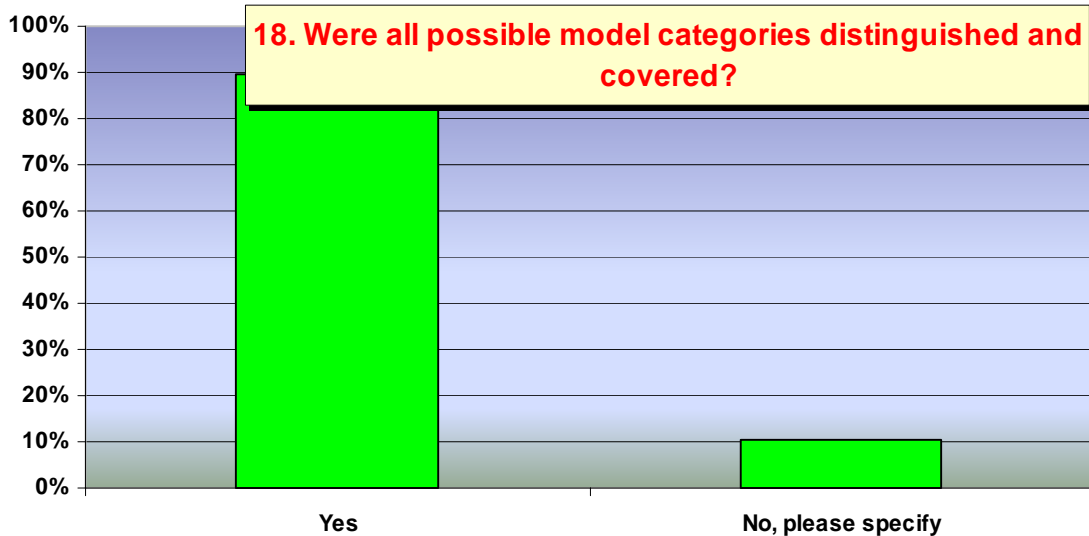
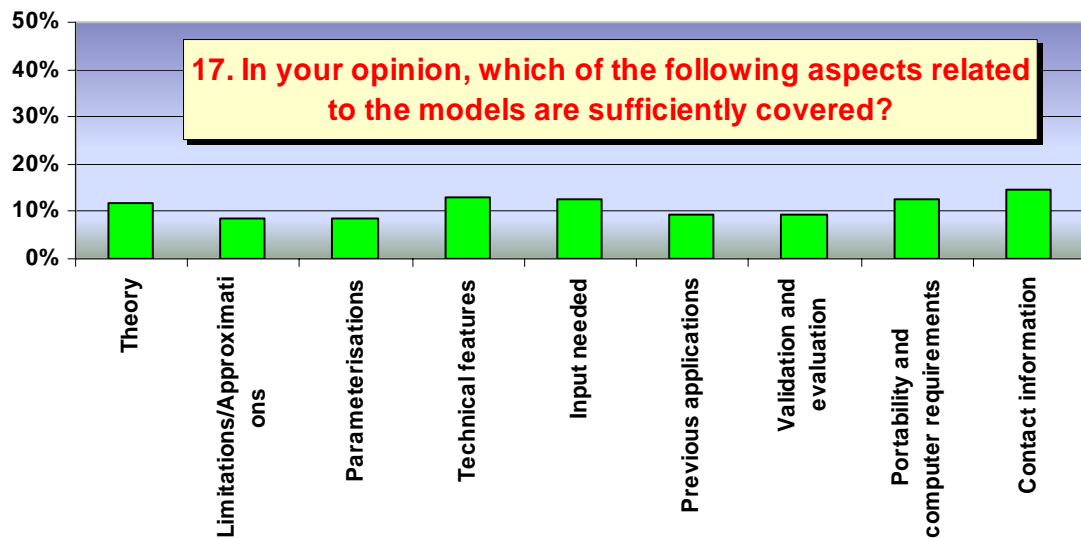
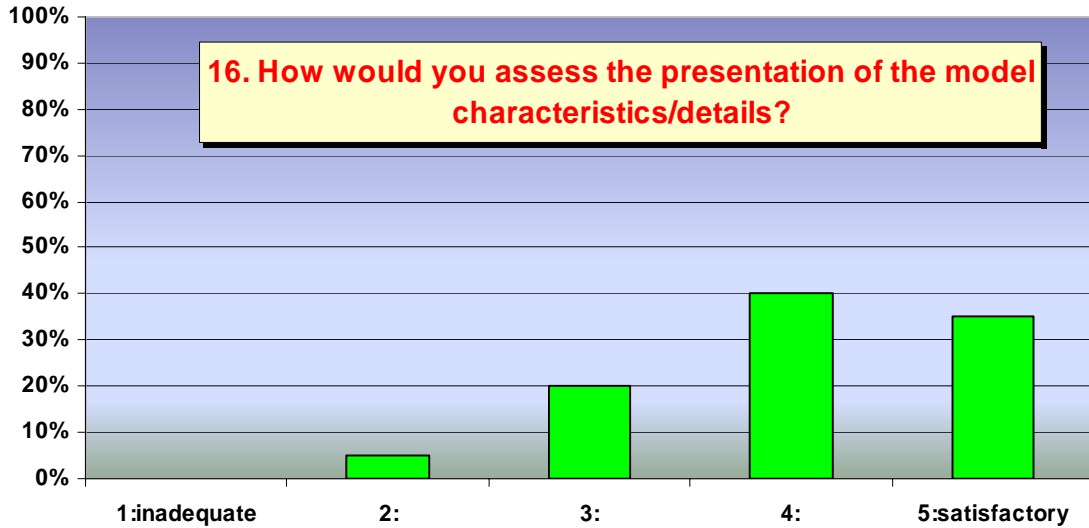


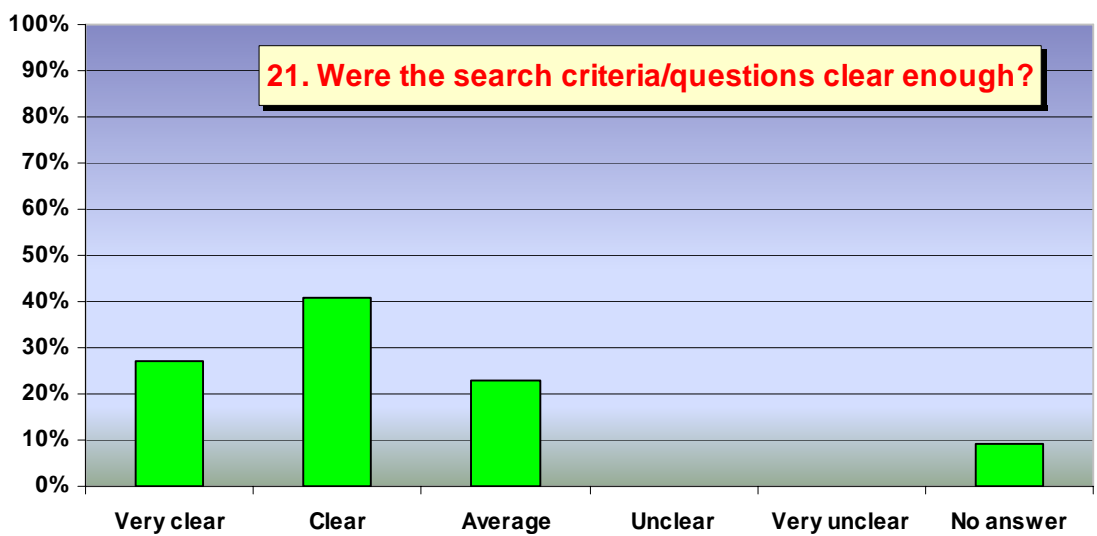
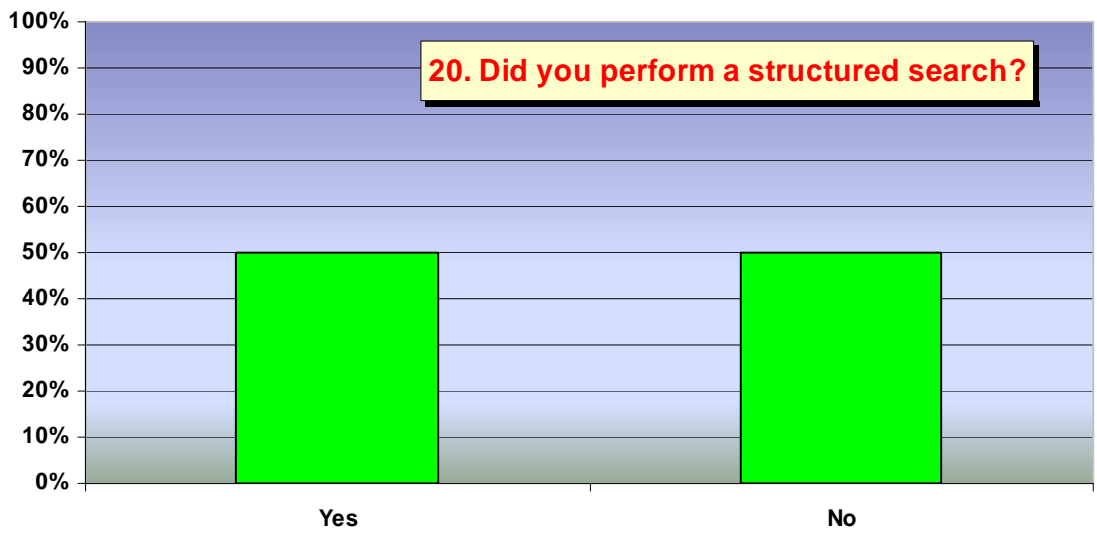


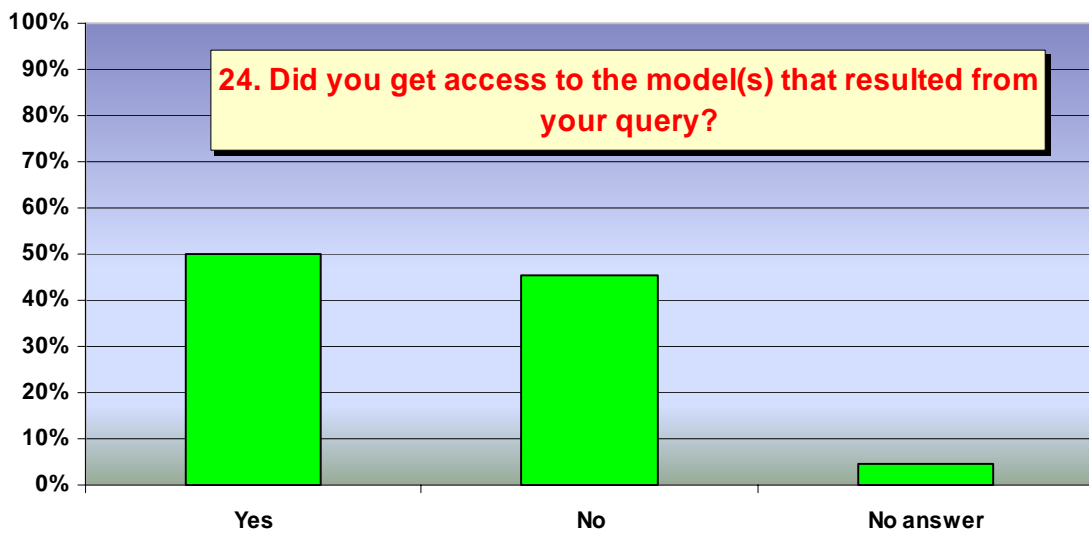
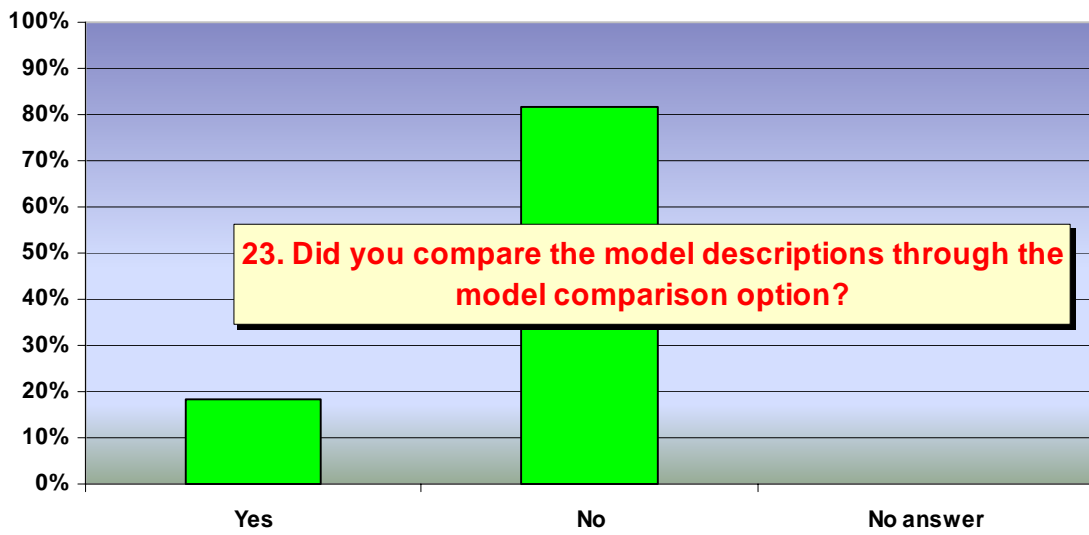
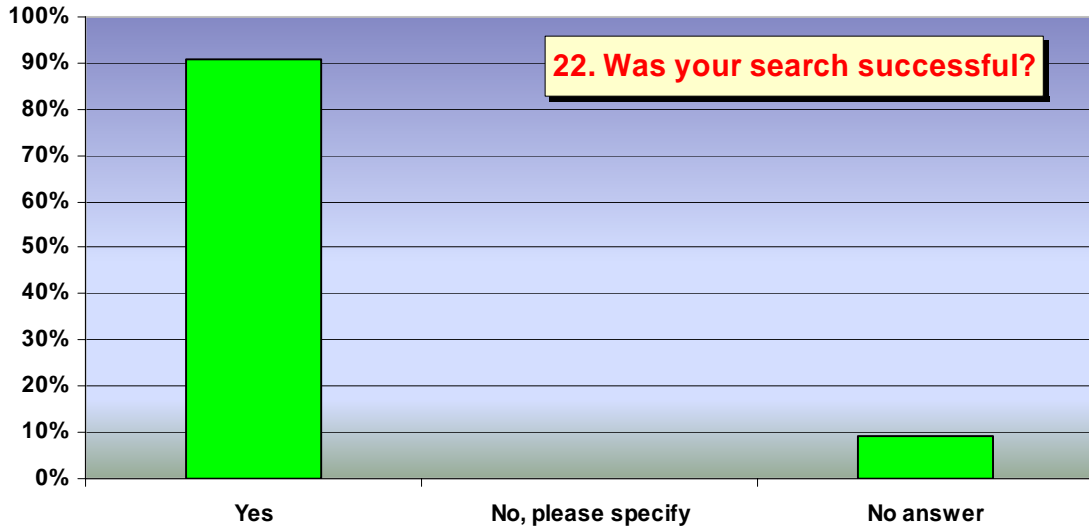


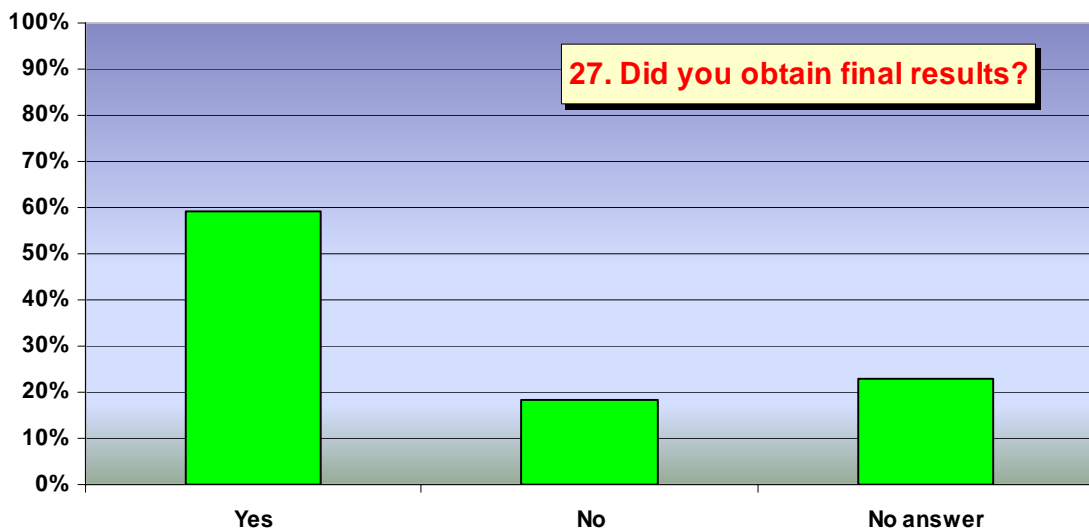
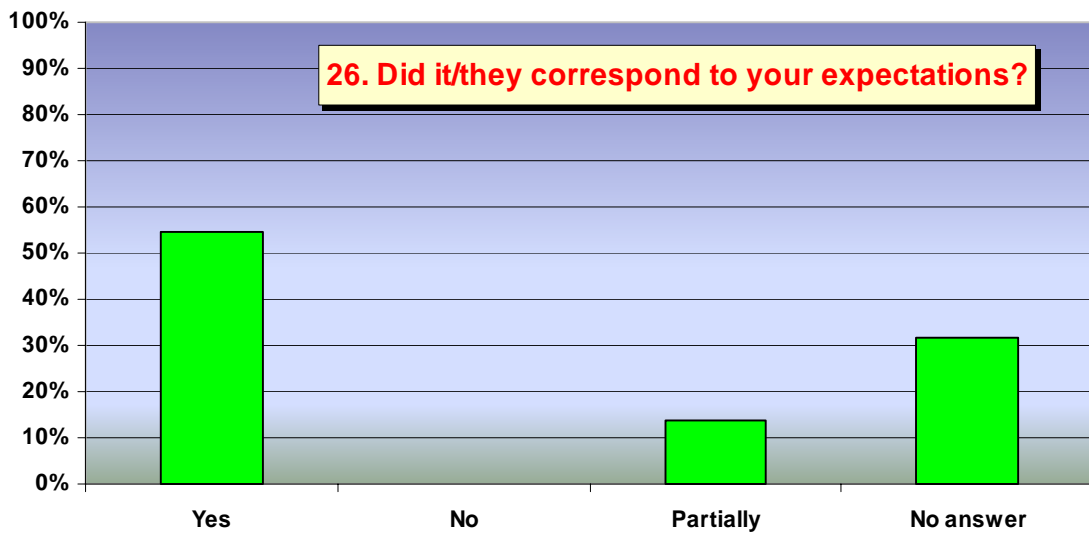
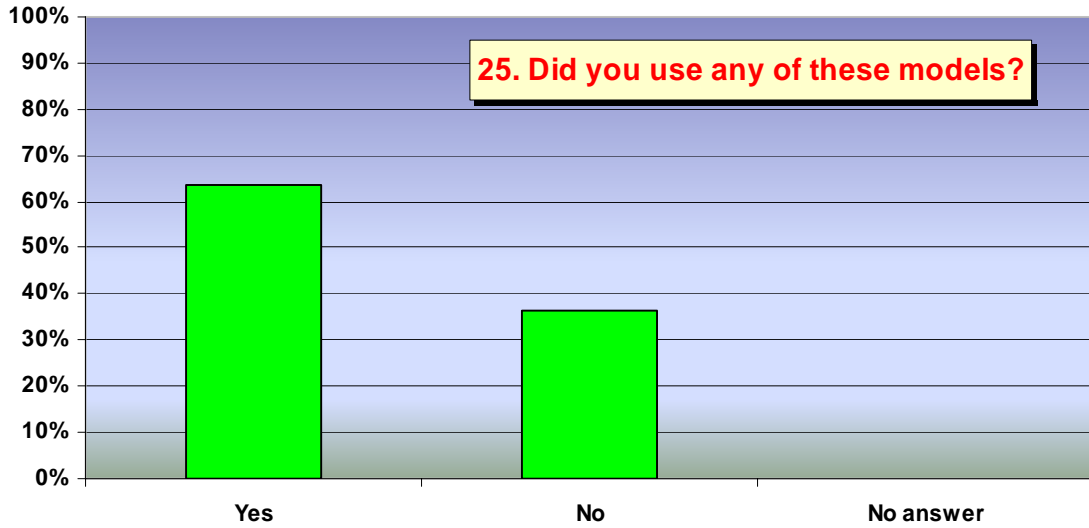
Model coverage and presentation

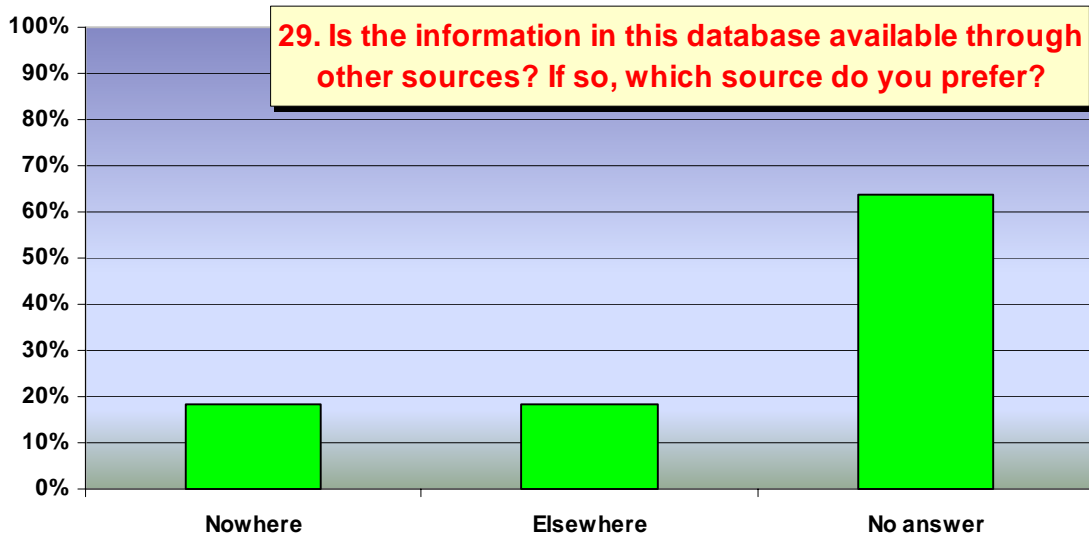
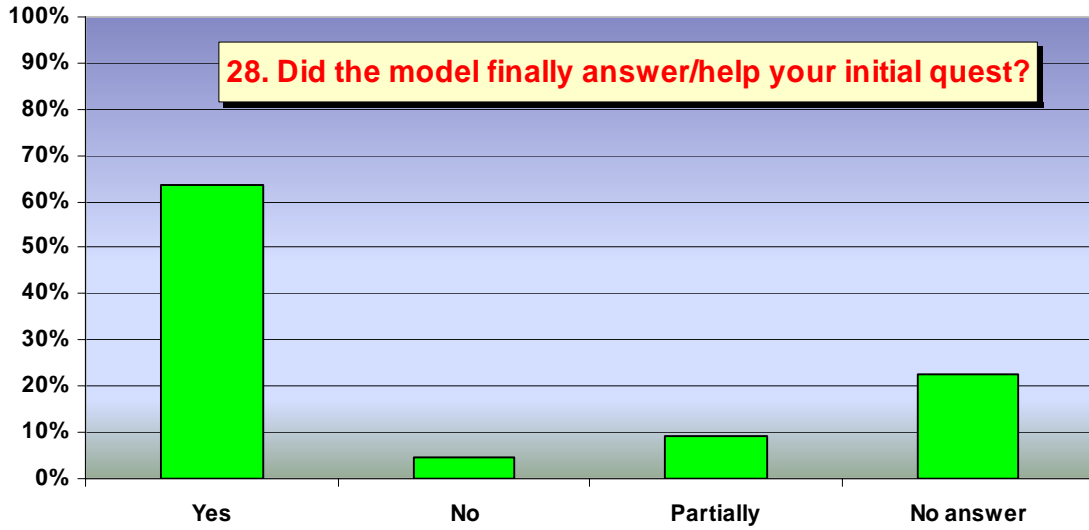




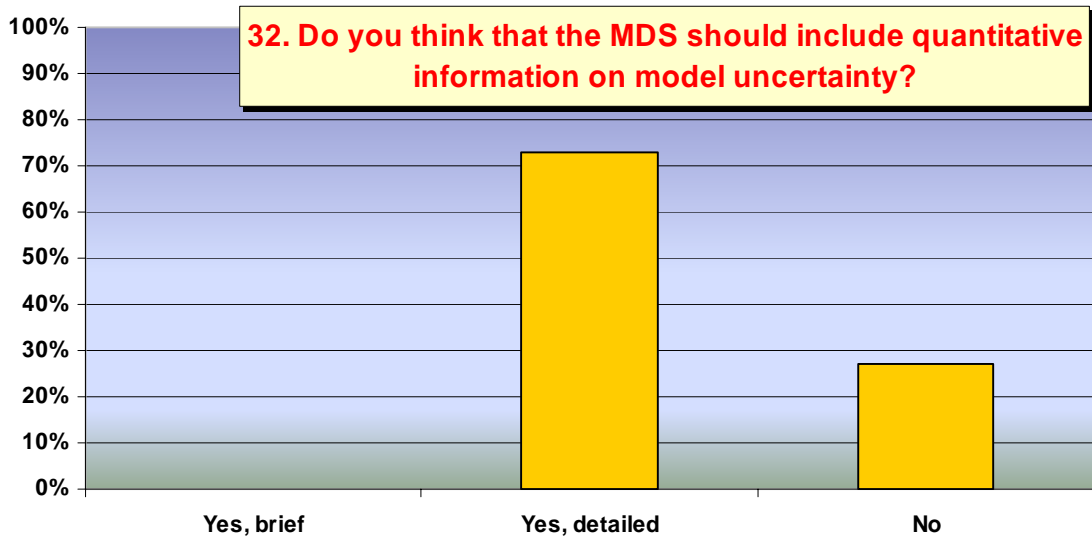
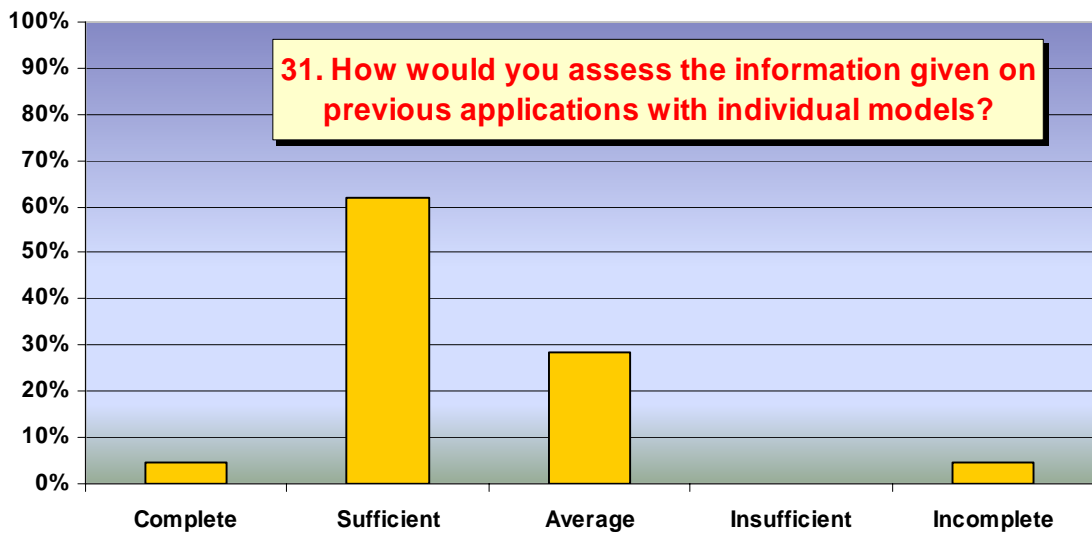
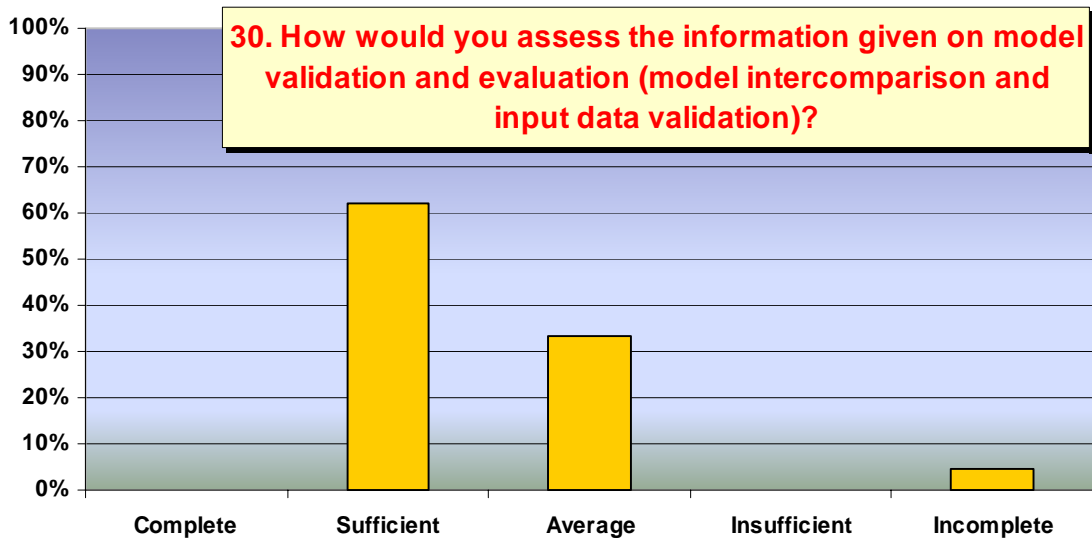


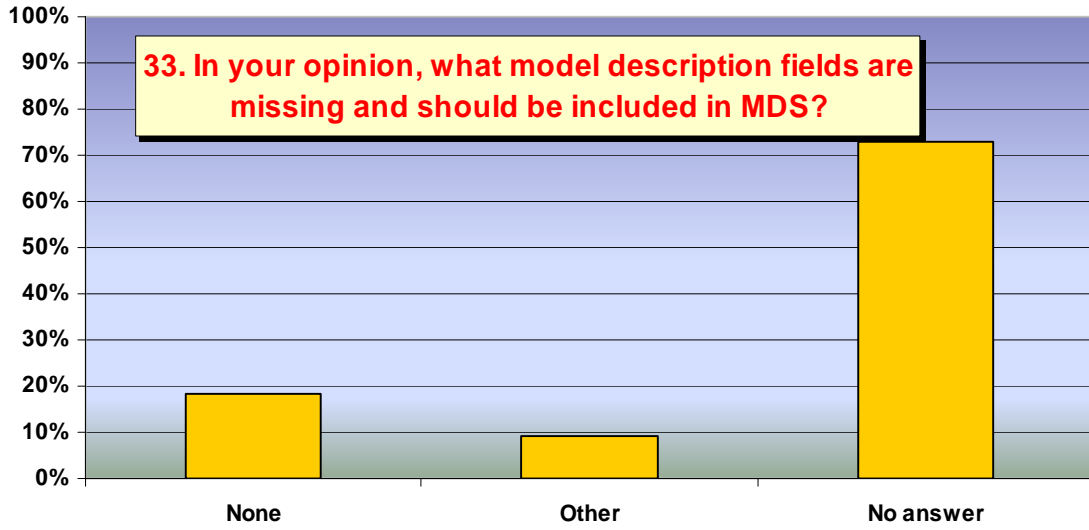






Model quality assessment





User profile

