Ethical Delphi
Manual

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Contents

1.   Overview

1.1   What is an ethical Delphi method?

An ethical Delphi is an iterative participatory process between experts for exchanging views and arguments on ethical issues. The method is structured around the notion of a virtual committee where the exchange of ideas is conducted remotely through a series of opinion exchanges (in the form of 'Rounds'). Anonymity of the participants is central to the process. This feature aims to eliminate external power relations and personal influences that may interfere in the discussion of ethical dimensions within a committee environment. The Delphi method, first developed by the RAND Corporation in 1950s, was designed to combine the knowledge and abilities of a diverse group of experts to the task of quantifying variables that are either intangible or shrouded in uncertainty. The technique has been used for a variety of applications such as technology assessment, Environmental Impact Assessment (EIA), public health. This wide use has led to the development of the original technique and a family of Delphi-related processes. The ethical Delphi is a developed method that can be used to characterise the ethical issues raised by the use of novel biotechnologies.

1.2   By whom and when can the ethical Delphi be used?

This method can be used by a number of groups to explore ethical issues raised by the use of a defined technology. The tool is particularly relevant for use by (i) government advisory or regulatory committees and (ii) non-governmental organisations. When considering applying the ethical Delphi, the method is valuable when all or the majority of the following conditions are present:
-      expert input is required for policies under review or development;
-      issues are uncertain, controversial and complex;
-      many diverse research communities and stakeholders have concerns;
-      outcomes from the process should have an impact on several issues, including future policy-making;
-      there is need for cross-sectorial scientific debate.

1.3   What are the expected outcomes of exercises using the ethical Delphi?

The ethical Delphi methodology is applied to:
- identify the diversity of expert value judgements on the use of technology;
- identify divergence and convergence in expert opinion;
- encourage ethical reflection;
- provide a rational basis for ethical decision-making;
- clarify the basis of disagreements and highlight related values.

1.4   What use of the ethical Delphi cannot do

The ethical Delphi aims to map expert opinion on the ethical dimensions of the use of a novel technology. The tool highlights issues, as well as divergence and convergence of views and values. However, the method will not provide decision-makers with judgements or overall opinions. The selection of participants is a key stage of the process. It is therefore important that participants: (i) feel directly involved in the problem of concern; (ii) have pertinent information to share; (iii) are motivated to include the Delphi task in their schedule of competing tasks; (iv) feel that the aggregation of judgements of a respondent group will include information which they too value and to which they would not otherwise have access.

2.   Background theory

The Delphi method was developed at the RAND Corporation in the 1950s and was designed to combine the knowledge and abilities of a diverse group of experts to the task of quantifying variables that are either intangible or shrouded in uncertainty. This methodology was first utilised by the US in defence research. The technique has since been used to generate forecasts in a variety of applications such as technology, education, planning, environmental impact assessment, social policy, public health, etc. This wide use has led to a large amount of variation from the original technique and a family of Delphi-related processes.

The objective of most Delphi applications is the reliable and creative generation of ideas, exploration of future scenarios, improved data collection and informed decision-making. Results of a proper application of the Delphi method can greatly assist policy makers to improve creativity and their decision-making when information is incomplete, or the validity of the information is disputed (Adler and Ziglio, 1996).

The Delphi method lends itself best to studies that want to gather opinion, initiate debate, and identify value judgments as opposed to those that seek an in-depth technical analysis of an issue. The technique allows experts to deal systematically with a complex problem or task. The Delphi method is based on a structured process for collecting and distilling knowledge from a group of geographically dispersed experts by means of a series of questionnaires interspersed with controlled opinion feedback. The Delphi method represents a useful communication device among a group of experts and thus facilitates the formation of a group judgement.

The application to ethical issues has been tested by researchers from the Centre for Applied Bioethics at the University of Nottingham and The National Committee for Research Ethics in Science and Technology in Norway. This section sets out the theoretical background of the ethical Delphi method. Further information on the Delphi method can be found in Section 3.6.

2.1   What are the essential features of the ethical Delphi?

The ethical Delphi is a structured process for collecting and distilling knowledge from a group of geographically dispersed experts by means of a series of questionnaires interspersed with controlled opinion feedback. The ethical Delphi

represents a useful communication device among a group of experts and thus facilitates the formation of a group judgement.

The essence of the technique is fairly straightforward. A series of questionnaires are sent either by post or e-mail to a pre-selected group of experts. Increasingly questionnaires are being made available as web-based surveys. The questionnaires are designed to elicit and develop individual responses to the problems posed and to enable the experts to refine their views as the group's work progresses in accordance with the assigned task. The advantage of the ethical Delphi is that it can bring together individuals from different perspectives, abilities and skills sets to contribute to the solution of a complex problem.

The ethical Delphi usually undergoes four distinct phases. The first phase is characterized by the exploration of the subject under discussion where each participant contributes additional information he/she feels is pertinent to the issue(s). The second phase involves the process of reaching an understanding of how the group views the issue(s) (i.e., where the members agree or disagree and what they mean by relative terms such as probability, acceptability, feasibility etc). If there is significant disagreement, then that disagreement is explored in the third phase to bring out the underlying reasons for the differences and possibly to evaluate them. The last phase, a final evaluation, occurs when all previously gathered information has been initially analysed and the evaluations have been fed back for consideration (Linstone and Turoff, 2002). The stages of the ethical Delphi are:
-    defining the remit, ethical context and the scope of the study;
-    expert recruitment;
-    development of questionnaires;
-    execution of ethical Delphi - first round of comments from the expert participants;
-    execution of ethical Delphi - a series of rounds where participants comment and rate (e.g. score) other participants' responses and comments;
-    analysis of responses;
-    dissemination and evaluation (including feedback from participants).

Four key features are regarded as necessary for defining the Delphi method: anonymity; iteration; controlled feedback and statistical aggregation of group responses (Martino, 1983):

2.1.1   Anonymity

Each member of the group submits their own independent answers to the relevant questions. Anonymity counters the biasing effects of group pressure and dominant individuals, and assures that the answer of every individual in the group is taken into account in the final group judgement.

2.1.2   Iteration of responses

Iteration with feedback allows a certain amount of interchange among the members of the group but in a controlled manner. With iteration of questionnaires over a number of rounds individuals are given the opportunity to change opinions and judgements.

2.1.3   Controlled feedback

Controlled feedback with each iteration is important to allow participants to review their previous forecasts and assumptions based on group responses. The results of a given round of responses are summarised and reported to the group, who are then asked to reassess their replies in light of the feedback.

2.1.4   Statistical aggregation

At the end of the procedure the result is typically given as a group mean, median, or other measure of central tendency. The spread of forecasts can be used as a measure of the consensus reached and assures that the opinion of every member of the group is represented in the final response.

The process is an anonymous and confidential procedure that facilitates the exchange of information and ideas by enabling each participant to have equal input. The method prevents bias caused by other experts' positive status or dominant personalities, as the participants do not directly interact with one another. The respondents can speculate individually and this can lead to the exploration of ideas and the identification of consensus and divergence in expert opinions. The iteration of the process makes it possible for all participants to gain access to the other participants' estimations in terms of views and arguments, and of course to respond to these through a quantitative process.

Methods of data analysis vary according to the purpose of the Delphi study, structure of the rounds, types of questions and numbers of participants. Typically content analysis techniques are used to identify the major themes generated by the initial unstructured questionnaire. These are then translated into a structured

questionnaire that forms the basis of the following rounds. Second and subsequent round data being quantitative in nature are analysed using ranking or rating techniques. Third and subsequent rounds should indicate to the participant the central tendency and dispersions of scores from the previous round.

There is a danger that greater reliance will be placed on the results than might be warranted. Therefore, it is important to note that the existence of a consensus does not mean that the correct answer, opinion or judgement has been found. Instead, the method and results should be used as a means for structuring group discussion and as a means of raising issues for debate. It helps to identify areas that one group of participants or 'experts' considers important in relation to that topic. It may be most useful in gathering opinions from large numbers of people and as a 'heuristic device', rather than as a means of predicting the future (Hasson et al, 2000).

Results of a comprehensive application of the ethical Delphi may greatly assist policy makers to improve creativity and their decision-making when information is incomplete, or the validity of the information is disputed (Adler and Ziglio, 1996). The ethical Delphi lends itself best to studies that want to gather opinion, assess value judgments and initiate debate as opposed to those that seek a factual analysis of an issue. The technique allows experts to deal systematically with a complex problem or task.

2.2 How is ethical theory represented in the ethical Delphi?

The ethical Delphi does not explicitly include ethical theories or principles in the approaches. The ethical dimensions of the issue are drawn out through the initial context of the questionnaire and the statements or questions included in the initial questionnaire. Values are therefore identified by participants, developed and analysed in the subsequent rounds of the ethical Delphi.

The ethical Delphi can be used to identify and map the ethical arguments and value judgements that are used by the expert participants when discussing specific issues. Participants are also asked to score the level of importance of these issues. The perceived significance of specific issues can be used to indicate (as a semi-quantitative scale) ethical judgement.

These quantitative outcomes indicate quantitative judgements. However it should be noted that it is not possible to directly deduce from the data analysis the ethical acceptability, or otherwise, of any proposed technology.

3.　Users of the ethical Delphi: User groups and objectives

When considering whether to apply the ethical Delphi, a user should consider a number of contextual and logistical issues. Further details on general methods and user information are set out in the following sections. Details on the application of an ethical Delphi to specific case studies can be reviewed in the section on case studies (see Section 3.5).

3.1　Different ways the ethical Delphi can be used

The ethical Delphi has a structured methodology. A number of factors influence the way in which the method is applied by different organisations:
- the aim and topic of the project;
- its connection to policy-making bodies;
- the type and number of experts involve;
- main actors, institutions, companies that are driving forces in the field;
- the cultural, political and institutional considerations that influence all of the above.

The ethical Delphi allows for:
- feedback of individual contributions;
- assessment of group judgments;
- opportunity for experts to revise views and reassess previous contributions;
- provision of some degree of anonymity for individual responses.

The ethical Delphi can produce valuable information and support decision-making in policy making. An ethical Delphi has limitations as previously highlighted, for example experts' possible lack of knowledge, etc. The restrictions of the process only make it possible for experts to state their opinion in relation to other expert opinions. Therefore data collected through the Delphi method should be considered as part of a wider deliberative process of appraisal.
　　Users of the ethical Delphi should clearly set out the aims and objectives of the process, define the target audience, and identify the political, institutional and cultural context when considering the applicability of this method.

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4.   Applying the ethical Delphi: methods and logistics

It is important to clearly define both the scope of the study and overall objectives as this not only impacts on the selection of participants, but also influences the nature of briefing papers that are sent to participants. In order to highlight a step-by-step approach that can be used in the application of the ethical Delphi methodology, the relevant stages are set out below.

Planning:
Project Management Staff
Advisory Committee
Scope, Topic, Funding

Recruitment and Selection of Expert Panel

Preparatory arrangements 1
Project Introduction
Formulation of questionnaire
Decision on type of Ethical Delphi

Preparatory arrangements 2

Test of questionnaire
Re-formulation of Key Questions if necessary

Running of Ethical Delphi

Round 1: Distribution of questionnaire
     Collection of topics and views
Round 2: Distribution of 2nd round questionnaire
     Collection of comments from Round 1
     Calculation and analysis of comments and ratings
Round 3: Distribution of 3rd round questionnaire
     Collection of replies to comments
     Calculation and analysis of comments and ratings
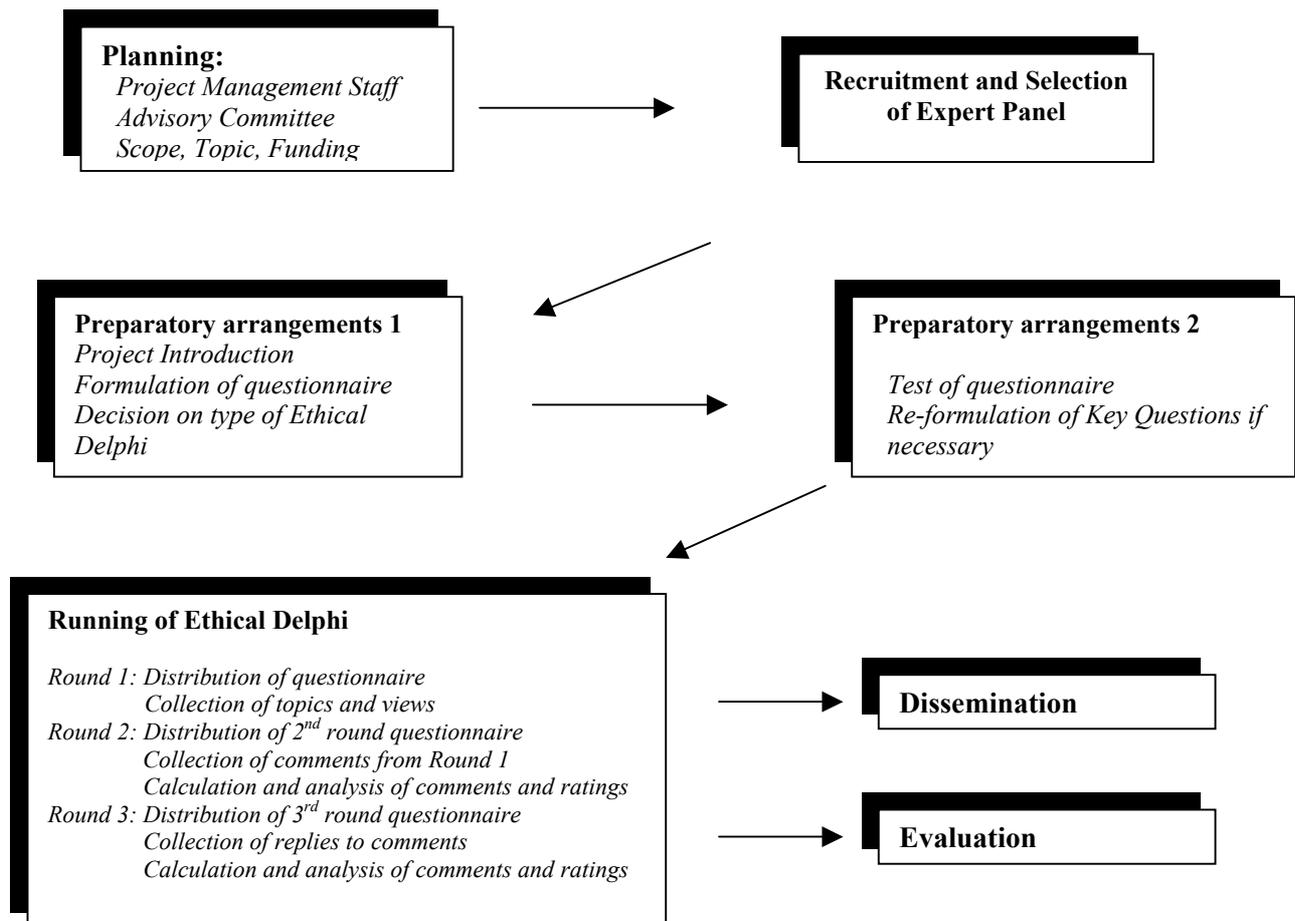
Dissemination

Evaluation

Figure 1   Key steps in an ethical Delphi

4.1   Application of the ethical Delphi as an 'expert approach'

Conducting an ethical Delphi can be represented by the following steps:
-      Selection of topic/study;
-      Identification of the participants:

- Recruitment and selection of expert panel;
- Preparation of introductory material;
- Preparation of the questionnaires and weighing/analysis methods, promotion.
- The running of the ethical Delphi:
  - Final report printing and dissemination;
  - Evaluation.

4.2   Planning the process

As previously mentioned, planning considerations include the aim and topic of the project, its connection to policy-making bodies, the geographic draw, funding sources, and the cultural, political and institutional considerations that influence all of the above.

4.2.1   Setting out the objectives of the process

The users of the method will set out the remit for the process. Consideration must be given to an array of factors including the resources available and the researchers' competency and skills.

It is important to note that facilitators of the process must retain copies of all responses so that external groups or interested parties can review the original responses and therefore fully evaluate conclusions of the process. There are a number of factors that can affect the success of an ethical Delphi:
- societal context:
  - extent of public debate;
  - coinciding with de facto decision-making;
  - political interest in the topic;
- institutional context:
  - link to the political sphere;
  - credibility and reputation of the (funding and coordinating) institution;
- properties of the process:
  - inclusion of experts from different and representative fields;
  - perception of the process (e.g. as meaningful, fair and informed) by the experts;
  - output of the process has a practical impact;
  - involvement of political actors in the process.

4.3 Defining the remit

In many cases researchers decide upon the remit of the study (the scope of the initial questionnaire) before approaching the expert group. The ethical Delphi is only appropriate to investigate certain research problems, so careful consideration must be given to the nature of the problem before selecting this approach. Understanding the nature of the problem and the logistical considerations that may arise, needs to be established before deciding to use the ethical Delphi method (Hasson *et al.*, 2000).

4.4 Expert identification and recruitment

One crucial point in running an ethical Delphi is to include a broad and representative selection of experts. The expert panel should be selected fairly well in advance (e.g. two months before the actual running of the exercise). This is due to the fact that many international experts will have periods of time when they are not available to participate. When approaching the participants, it is important to highlight the broadness, impartiality and novelty of being involved with this type of study. The planning and selection of experts should be done in close cooperation with the commissioning group. This aspect raises the complex issue of 'who counts as an expert'. The remit for inviting a participant to take part in this process as 'an expert' should be considered and made explicit as part of the preparation phase. The definition of 'expert' varies according to the context and field of interest in which the ethical Delphi is going to be applied. Being 'expert' entails acquisition of experience, special skills in, or knowledge of a particular subject and not necessarily the possession of academic qualifications, such as a PhD.

Individuals should be prominent in the current discussion of any chosen technology and willing and able to make a valid contribution. The goal should be to obtain members from a wide variety of backgrounds who are interested in the specific topic, have important knowledge or experience to share. An ability to think strategically is also valuable. Key considerations include:
- the group should be selected to reflect a wide range of institutional interests and perspectives;
- the group should represent a diversity of viewpoints as this will help to generate interest and involvement;
- the group should represent a wide knowledge base as this will should lead to a diversity of initial ideas;
- the group should represent a range of worldviews and ethical positions.

4.4.1 Motivation to participate

When considering the recruitment of participants, it is unrealistic to expect effective participation unless respondents:
- feel personally involved in the problem of concern or issue being reviewed;
- have pertinent information to share;
- are motivated to include the Delphi task in their schedule of competing tasks;
- feel that the aggregation of judgments of a respondent group will include information which they too value and to which they would not otherwise have access.

Ethical Delphi panellists are motivated to participate actively only if they feel they will obtain valuable information as a result of the process. This value received needs to be at least equal in their minds to the effort expended to contribute information. This is one reason why 'blanket' invitations to participate in a Delphi exercise that do not specify who will involved and what the feedback will be, often result in very low participant rates. When selecting the expert panel the following issues should be considered:
- participants should feel a 'tension' for change or action i.e. they should be dissatisfied with the current situation around which the ethical Delphi focuses;
- participants should feel the ethical Delphi process could help them deal with their problem, and they must believe the situation can change for the better through this group process;
- participants need to believe the ethical Delphi process is not just an 'exercise', but that the group is in a position to contribute to current policy and practice discussions (if this is a true representation) and that now is a good time to be actively involved.

Members should believe they are capable of following though with the ethical Delphi process, they must understand how it works and they need to have a precise schedule of the activities the group will follow and to understand the strategy that will be used. The experts should be made aware that the involvement in an ethical Delphi might consume, for example, between 3 hours and one working day in total.

Numbers of participants will vary according to the scope of the problem and resources available, but group sizes have been noted ranging from 10 to 1000s (Reid, 1998). The number and representativeness of participants will affect the potential for ideas as well as the amount of data to be analysed.

Obviously the larger the group size, the greater the generation of data, which in turn influences the amount of data analysis to be undertaken. This will lead to issues of data handling and potential analysis difficulties, particularly if researchers are focusing on a qualitative approach.

4.4.2 Instructions to experts

Preparing the expert group for the ethical Delphi process is an important step, which if not carried out appropriately, could adversely affect response rates in ongoing rounds. When respondents have agreed to participate they need to be informed of exactly what they will be asked to do, how much time they will be expected to contribute and what use will be made of the information they provide. Written information accompanying the first round ethical Delphi is effective. If the group has an understanding of the study's aims and the process, this helps to build a research relationship, which is important as the ongoing response from the second and third rounds is based on the premise of self-selection.

Clear instructions can help increase the reliability of responses. The effectiveness of information exchanges and providing key words and clear instructions for carrying out tasks required can increase the reliability of the assessment of information exchanges. When using the ethical Delphi it should always be remembered that characteristics of the design of the process (i.e. methods of collecting experts' opinions, scales used, feedback provided etc) can have important effects on both the nature of the communication process amongst group members and the final outcomes, therefore instructions, scales and any other device used to collect expert judgements should be properly pre-tested. The same should be done for the different ways available to the research group of providing feedback to the experts on responses to previous ethical Delphi questionnaires.

4.4.3 Anonymity

Anonymity removes some of the common biases normally occurring in the face-to-face committee processes. Codes are often used to label each person's contributions (e.g. P1, P2 etc) to allow better understanding of individual trains of thought. Absolute anonymity can cause participants to feel isolated and may make it difficult for them to judge how best to formulate their ideas so others will understand them. Providing a biographical sketch of each member, which includes general background information, a summary of reasons why each member was chosen and a description of their expertise, can lessen negative

impacts of absolute anonymity. This will give participants a better understanding of the group. It should be noted that neither option is a methodological requirement.

Reasons for anonymity include: if an idea turns out to be unsuitable no one loses face for having been the one to introduce it; persons of high status are often reluctant to produce questionable ideas; committing ones name to a concept makes it harder to reject or change one's mind about it. However, anonymity may lead to lack of accountability of views expressed and encourage hasty decisions (Adler, 1996).

4.5 Stages of the ethical Delphi process

Having selected both the topic and the experts, the next stage is to design and develop the questionnaire.

4.5.1 Questionnaire statements

The ethical Delphi process is essentially a series of questionnaires and may begin with either:
- open-ended questions/statements where the participants themselves define and identify potential issues to be included in subsequent questionnaires;
- participants are given a set of semi-structured or structured questions/statements (closed) designed by the research team, however this approach may bias the responses or limit the available options.

Each subsequent questionnaire is built upon responses to the preceding questionnaire and the process stops when it is considered consensus has been reached among participants. All four of the following can be combined in one exercise:
- open - i.e. the participants themselves frame the issues that are to be considered within one specific field;
- closed - i.e. the organiser frames the issues that are to be considered within one specific field;
- qualitative - i.e. the comments and replies on the given issues are assessed and viewed only through the arguments and the reasoning;
- quantitative - i.e. the participants only rate the issues according to a preset scale of importance and/or agreement.

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It is valuable to reflect on the aim of the process and then to explore the following needs:

- if a broad mapping of the field is needed (initially unstructured by the researchers/facilitators), then choose the open approach;
- if a mapping of certain positions within the field is needed, then choose the closed approach;
- if substantive arguments and counter-arguments on ethical issues is needed, then choose a qualitative approach;
- if weighing and measuring of different positions is needed, then choose the quantitative approach.

Qualitative approach

The qualitative approach to an ethical Delphi analyses the discourse between the participants when the issues and arguments are assessed. This is often used for small groups.

Quantitative approach

The quantitative approach to an ethical Delphi suggests that mapping fields of consent and dissent in the expert community are of interest. Here the experts will be asked to rank/weigh different statements according to their relevance to the current topic.

> The framing of ethical Delphi statements is extremely important for the success of the study and must be done within a well-established set of rules (Loveridge, 2002):
> - There must not be any ambiguity or any conditional statements that make the primary question depend on the fulfilment of a series of conditions;
> - Statements where this occurs should be split into two or more separate statements;
> - Any scientific or technological terms must be correct and verifiable;
> - The number of words in each statement should not be less than 10 or greater than 30.

Box 1   Ethical Delphi statements

The statements that comprise the elements of an ethical Delphi exercise inevitably reflect the cultural attitudes, subjective bias, and knowledge of those who formulate them. Statements may be too concise, leading to excessive variations in interpretation, or too lengthy, requiring the assimilation of too many

elements. Consequently, there is usually a constraint on the number of words leading to the widest agreement in interpretation. Low and high numbers of words yield low consensus with medium-statement lengths producing the highest consensus. If many words are used, less information results as to the occurrence of a familiar event. On the other hand, a longer-word description raises the consensus level for unfamiliar events (Linstone and Turoff, 2002).

An example of a Round 1 **OPEN STATEMENT** might be:

'Please indicate significant advantages or disadvantages of the production and use of GM salmon (e.g.   benefits/risks   to animal health and welfare; food safety/consumer acceptance; environment effects; economic interests, etc).'

Issue:
Comments:

Example 1 Open statement

Where an *Open Statement* is used, the participants would list, in this particular example for instance, issues related to the advantages or disadvantages of the production and use of GM Salmon. In the comment box they have the opportunity to expand on why they consider this particular issue to be important. Facilitators will then use these issues to formulate specific statements for the Round 2 questionnaire.

An example of a *Closed Statement* (either Round 1 or subsequent rounds) might be as below (the answering categories are explained in Section 4.5):

Degree of agreement		Degree of knowledge	
Strongly agree Agree Slightly agree Disagree Strongly disagree I have no opinion		Very familiar Quite familiar Not very familiar Unfamiliar	
Comments:			
……………			

Example 2   Closed statement

Referring to examples 1 and 2 above, the first task therefore in developing the questionnaire is to either include:
-       a list of statements that are to be commented on -> open + qualitative;
-       a list of statements that are to be ranked and/or commented on -> closed + quantitative and/or qualitative.

4.5.2   Individual and group self-ratings

Rating scales are used to provide a way of collecting information on the extent to which experts feel confident about the various tasks assigned in the exercise (e.g. self reported confidence of being accurate, self assessed knowledge etc), they indirectly offer a measurement of experts' perceived reliability and accuracy in performing the assigned tasks in Delphi questionnaires. Various rating scales may be used depending on the topic being considered. A neutral answer is not usually included. The option 'no judgement' can be included for any question. A neutral position offers very little information in policy debates and it is usually desirable to force the respondent to think the issue out to a point where they can take a non-neutral stance (Linstone and Turoff, 2002).

Statements may be rated in terms of likelihood of occurrence; importance (priority or relevance); feasibility (practicality), desirability (effectiveness or benefits); confidence (in validity of argument of premise) etc. The participants may also be asked to rate 'self-assessed knowledge'. This allows them to estimate their own degree of expertise on the judgement they are supplying and has been found to improve the quality of the estimates made (Adler&Ziglio, 1996).

Example definitions of the chosen answering categories should be given as demonstrated below, and it should be noted that it is not necessary for every question to have all the answering categories:

Degree of agreement (example)	
Strongly agree	Self explanatory
Agree	
Slightly agree	
Disagree	
Strongly disagree	
I have no opinion	

Degree of self-assessed knowledge (example)	
Very familiar	You actively work in this area or with these issues
Quite familiar	You are not working in this area, but you are well informed about arguments dealing with the issues
Not very familiar	You have read only a few articles in the news media (newspapers, magazines, television, the Internet) about these issues
Unfamiliar	You have very little or no knowledge about the issues

Degree of agreement		Degree of knowledge	
Strongly agree Agree Slightly agree Disagree Strongly disagree I have no opinion		Very familiar Quite familiar Not very familiar Unfamiliar	
Comments:			
……………………..			

An alternative way of presenting the answering categories is for the issues/topics to be scored on an ordinal scale as demonstrated below:

Degree of agreement	
Strongly agree	1
Agree	2
Slightly agree	3
Disagree	4
Strongly disagree	5
I have no opinion	6

Degree of self-assessed knowledge		
Very familiar	You actively work in this area or with these issues	1
Quite familiar	You are not working in this area, but you are well informed about arguments dealing with the issues	2
Not very familiar	You have read only a few articles in the news media (newspapers, magazines, television, the Internet) about these issues	3
Unfamiliar	You have very little or no knowledge about the issues	4 4

In which case an example statement might appear in the questionnaire as below:

Degree of agreement					
1	2	3	4	5	6

Degree of self assessed knowledge			
1	2	3	4

Comments:

4.5.3 Round 1 questionnaire

The Round 1 questionnaire should be pre-tested by a monitor group to ensure the questions will be understood in the manner intended. Within a classical Delphi, Round 1 begins with an open-ended set of questions that pose the problem in broad terms and invites answers that generate ideas and allow participants complete freedom in their responses. This helps to identify issues that will be addressed in subsequent rounds. Open-ended questions are recognised to increase the richness of the data collected.

Participants are encouraged to justify their choice of issues with comments, all of which are reported in each round. Participants are encouraged to donate as many opinions as possible so as to maximize the chance of covering the most important opinions and issues. These individual issues are then consolidated into

a single set by the research group who produce a structured questionnaire from which the views, opinions and judgments of the ethical Delphi group members may be elicited in a quantitative manner in subsequent rounds. To ensure all issues have been considered and the analysis is not limited by the design capability of the research group, the respondents should be given the opportunity to indicate where they feel the questionnaire has not sufficiently addressed the issues.

Some studies report that infrequently occurring items in the Round 1 open-ended questionnaire can be omitted to keep the resulting list manageable, however, this goes against the underlying tenets of the ethical Delphi technique. Participants themselves should judge items in terms of quality, not the researchers. The iterative building process, central to the ethical Delphi, is challenging enough to advance, without unclear intervention by the research group.

A Round 1 pack containing the questionnaire, comprehensive guidelines for completing it (see Box 2), and a short briefing paper on the ethical Delphi methodology should be circulated to participants. On return of the questionnaires, qualitative analysis of the results is undertaken and this provides the basis on which to construct the second and subsequent questionnaires. The qualitative data from Round 1 can be analysed using content analysis, which is a tool used by researchers to quantify and analyse the presence of certain words or concepts within texts. In this case the data collected from this initial stage are analysed by grouping similar items together. Where several different terms are used for what appears to be the same issue, the researcher groups them together in an attempt to provide one universal description. These descriptions and grouping systems need to be verified to ensure that the data are fairly represented.

Section 1 - General information:
- Introduction to the Delphi method;
- The role of the Delphi survey;
- The overall method and process;
- Reasons for anonymity;
- Practical instructions for completing the questionnaire.

Section 2 - Instructions for answering the questionnaire;
- Explanation of the structure ;
- Definition of the answering categories;
- How to respond to the issues/ topics;
- Date for return.

Box 2   Guidelines for completing the questionnaire

4.5.4 Responses from Round 1, interpretation and Round 2 questionnaire

Where the first round of an ethical Delphi begins with CLOSED STATEMENTS the process is as for Round 2. The responses to the Round 1 questionnaire are collated into a single set of statements by the research group and sorted and ordered to eliminate overlap or repetition. This list forms the basis for subsequent questionnaires and is used to give a more detailed judgement of the issues identified and sets out the collective initial views of the group.

The qualitative data (i.e. all comments) submitted in each round must be reported in subsequent rounds. This allows for feedback on other participants' views and positions. The wording used by participants, with only minor typographical editing, should be used in listing items for Round 2. Round 2 and subsequent rounds involve specific closed questions, with the questionnaire seeking quantification of earlier findings, usually through ranking or rating techniques. The Round 2 questionnaire requires respondents to rank or score all options identified in Round 1, not only the issues they have raised themselves, and experts can argue in favour of, or against, each item. Various rating scales may be used depending on the topic being considered (see Section 4.5).

The Round 2 participant pack including summary results from the Round 1 questionnaire and instructions for completing the questionnaire are circulated to participants asking for a further response and allowing them to revise their initial position if they wish to do so. The first two (closed) statements in the Round 2 questionnaire might be structured as below:

Statement

Degree of agreement					
1	2	3	4	5	6

Degree of self assessed knowledge			
1	2	3	4

Comments from Round 1:
P1 ………… P2 …………..

New comments:

Or alternatively:

Statement

Degree of agreement		Degree of knowledge	
Strongly agree Agree Slightly agree Disagree Strongly disagree I have no opinion		Very familiar Quite familiar Not very familiar Unfamiliar	
Comments from Round 1:			
P1 ………….			
New comments:			

4.5.5   Responses from Round 2, interpretation and Round 3 questionnaire

Four positive outcomes from the Round 2 questionnaire should be:
- areas of agreement: identifiable in the light of comments and scoring/ranking;
- areas of disagreement: topics/issues in Round 2 indicate the initial position of the participants. Comments to issues can further clarify those positions. Based on this information, analysis of the Round 2 questionnaire can indicate to some degree why differences occur;
- areas needing clarification: identified items in the Round 2 questionnaire where respondents are unclear as to the meaning;
- understanding: the Round 2 questionnaire is the beginning of the dialogue between the participants and the aim is to help participants to understand each other's position and to move towards accurate judgment concerning the relative importance of the issues topics (Adler, 1996).

Following analysis of the Round 2 questionnaires, the Round 3 pack is issued. The Round 3 questionnaire contains the original issues/topics from the Round 2 questionnaire and any additional issues introduced in order to gain further information/feedback. Statistical results are included in Round 3, i.e. either the percentage rating or the group's mean and median scores, and standard deviation for each issue. In this manner feedback comprises opinions/judgments of all group members and not just the most vocal. The statistical information is presented to indicate issues that have gained collective opinion and to enable comparison of the group's views. Participants are asked to re-consider and respond again indicating agreement or disagreement with the given issues. The aim of each round (or iteration) is to identify consensus and divergence of opinions amongst the group.

A means of showing the dispersion of scores is important and participants should also be given an indication of where their scores were placed in relation to the overall picture. The opportunity to revise previous scores in light of this is an important element in the move towards consensus. A second or subsequent round example showing how a) percentages rates may be represented in the questionnaire:

Statement

Degree of agreement		Degree of knowledge	
	60%		
			70%
	25%		
			19%
Strongly agree	8%	Very familiar	
Agree		Quite familiar	8%
Slightly agree		Not very familiar	
Disagree	2%	Unfamiliar	
Strongly disagree			3%
I have no opinion			
	0%		
	5%		

Comments from Round 1:
P5 …….
Comments from Round 2:
P7 ………….
New comments:

A second or subsequent round example showing how b) mean and median scores, and standard deviation may be represented in the questionnaire:

Statement

Mean: 1.78	SD: 0.92	Median: 1.5	Mean: 1.78	SD: 0.63	Median: 2
Degree of agreement			**Degree of self assessed knowledge**		
1			1		
2			2		
3			3		
4			4		
5					
6					
Comments from Round 1:					
P7………………….					
Comments from Round 2:					
P10 ……….					
New comments:					

After several rounds of questionnaire iterations, group judgement is taken as the statistical average (mean) of the group member's estimate of the final round. The mean is selected, as the purpose of the ethical Delphi approach is to include all opinions and also strongly felt extreme positions would be registered using the mean (Ilbery *et al.*, 2004).

It was observed in early forecasting Delphis that a point of diminishing return is reached after a few rounds. Most commonly, three rounds proved sufficient to attain stability in the responses; further rounds tended to show very little change and excessive repetition was unacceptable to participants (Linstone and Turoff, 2002). The researcher must be aware of when to stop collecting data and what the definition of 'consensus' is in relation to the study's findings.

4.5.6   Meaning of consensus

Many researchers do not attempt to set a level for consensus prior to the ethical Delphi process, instead they make a decision after the data have been analysed. This means that the concept of consensus is arbitrary and unless a value or range of values is stipulated, the notion of a high level of consensus could almost be unilaterally decided upon by the researcher. An additional strand of subjectivity is then introduced when the investigator puts a personal interpretation on the level of consensus, often limiting the description of its value to the word 'high' (Williams and Webb, 1994).

There appear to be no firm rules for establishing when consensus is reached, although the final round will usually show convergence of opinion, the dispersion of participants' views lessening with each round. Although

convergence of opinion is usually comparatively slight, degree of dissent and divergence amongst participants' views should be highlighted (Powell, 2003).

There is a danger that greater reliance will be placed on the results than might be warranted. Therefore, it is important to note that the existence of a consensus does not mean that the correct answer, opinion or judgement has been found. Instead, the method and results should be used as a means for structuring group discussion and as a means of raising issues for debate. It merely helps to identify areas that one group of participants or 'experts' considers important in relation to that topic. Findings from an ethical Delphi survey help to streamline work, which can be used as an adjunct to meetings, thus allowing the involvement of more individuals and enhancing the reliability and validity of the results. It may therefore be most useful in gathering opinions from large numbers of people and as a 'heuristic device' rather than as a means of predicting the future (Hasson et al., 2000).

4.5.7 Analysis of the data

The principal contribution to the improvement of the quality of results is the analysis that the research team perform on the results of each round. This analysis has a number of specific objectives:
- to improve the understanding of the participants through analysis of subjective judgements and produce a clear presentation of the range of views and considerations;
- to detect hidden disagreements and judgemental biases that require further clarification;
- to detect cases of ambiguity in the interpretation of different participants;
- to detect patterns of information;
- to detect critical items that need to be focused upon (Adler, 1996).

Methods of data analysis vary according to the purpose of the Delphi study, structure of the rounds, types of questions and numbers of participants. Typically content analysis techniques are used to identify the major themes generated by an initial unstructured Round 1 questionnaire. These are then translated into a structured questionnaire that forms the basis of the following rounds. Second and subsequent round data being quantitative in nature are analysed using ranking or rating techniques and should indicate to the participant the central tendency and dispersions of scores from the previous round by calculating and displaying either the mean, median and standard deviation or the percentage rates (see examples section 4.5).

On conclusion of Round 3, which is usually the final round, the analysis of the data for reporting purposes should include:
-       mean - a measure for the average rating of the group;
-       median - a measure for the distribution of the ratings;
-       mode - a measure for the most common rating of the group;
-       standard deviation - a measure of the degree of dispersion of the data from the mean value.

4.6   Evaluating the outcomes and the process

After the analysis has been conducted and main findings highlighted and presented to the participants, an evaluation form should be distributed to all participants. The purpose of this evaluation is to discover whether or not they felt that the method was productive; how 'satisfied' they felt about the technique; if there was any bias with regard to their perceived selection of experts; if it was too time consuming; whether they felt that their views were treated fairly; how 'enjoyable' they found it etc. The result of the evaluation should be included in the final report. The evaluation is both a helpful tool for the organisers in interpreting the results and for conducting further exercises.

4.7   Reporting

It is important to consider how to present the final results in either graphical and/or statistical representations with an explanation of how the reader should interpret the results, and how to digest the findings in relation to the emphasis being placed upon them.

As is standard practice, the report must be distributed to experts in the relevant institutions, as well as to funding partners and universities relevant to the project. In order to ensure that participants are confident in the way the data has been analysed and to also ensure the quality of the analysis and reporting, participants should have access to all questionnaires if they wish to view these.

Participants should also be sent a copy of the draft report so that they can identify how their input or comments have been used. This allows participants to ensure that their comments and responses in each round have not been taken out of context. This is a process of verification. It can also be valuable to obtain expert verification of the draft report in the form of peer-review.

After the final report has been sent to the commissioning authority it should also be sent to all participants and all interested and subject-related groups so that the method and the outcomes are disseminated as widely as possible.

4.8   Timeline

The timeline for conducting a Delphi is dependent on the objective of the exercise and the desired outcomes. However, it is possible to highlight a timeline for the method.

Consideration
Depending on the size of the Delphi being planned with relation to the number of participants, it is advisable not to spend less than four months from conceiving the idea to implementing the process. It is important to remember that the legitimacy of the findings of an ethical Delphi is dependent upon the preparatory work.

Three months prior
The research team should start to consider selection of experts and the formulation of the questions, a useful starting point is to collect background material on the topic from scientific journals and from the national press and to identify experts on the basis of this exercise.

Two months prior
Contact prominent experts from different backgrounds in the technology and invite them to participate in the ethical Delphi. The research team should apply the selection criteria as indicated in an earlier section. It is advisable to negotiate and select dates that are convenient for all candidates.

One month prior
Trial the questionnaire and amend it according to feedback. Prepare a briefing document for the participants on the ethical Delphi methodology and the process applied; this will also be useful for inclusion in the final report.

Running the ethical Delphi
Give the participants enough time to complete the first questionnaire, for example at least five days. If an 'open' ethical Delphi is used, the first round is used to collect different views on the technology in question. The second round is used to record the experts' comments and score the issues/topics identified.

The third round is used to collect reactions to these comments and scores. Allow sufficient time to process the rounds, for example at least five days for rounds two and three. The survey can be conducted via email, an online web-based survey etc. An evaluation form can be circulated for participants to record their views on the ethical Delphi process.

One month after
Send out the results and findings to the participants with brief comments on the professional identity of the participants.

Two months after
Disseminate the results

4.9   Sample budget

The resource requirements for applying an ethical Delphi very much depend on the objective of the exercise, the number of participants, the reporting requirements and the outcomes of the event. The success of the Delphi technique relies upon the administrative skills of the researcher, which should not be underestimated. Devising a coding system to track respondents and their responses from the first to the final round, sending reminders out, analysing change of opinion etc, are just a few of the tasks to be undertaken. As a simple example of the potential resources usage (sample budget), the following can be used a guideline.

Sample budget for a specific project brief
Conducting an ethical Delphi exercise. Three rounds with 15 participants. The report will be submitted to a relevant commissioning body (i.e. Government department, funding organisation, etcetera):
-    personnel:
      -    project manager (planning the exercise, setting out the questionnaires with the project assistant, writing the feedback report);
      -    project assistant (manage the participant communications, feedback forms and collating the responses).
-    communications:
      -     distribution of material to participants;
      -     printing of questionnaires;
      -     printing of draft and final reports;
      -     press release.

- other resources:
  - web-based or e-mail-based questionnaire and report forms.

4.10 Strengths and limitations of the method

From work conducted by the project group on the case studies and from the current literature it is possible to identify a number of methodological strengths and weaknesses.

Strengths
- Particularly useful for studies that call for subjective judgment rather than precise statistical analysis.
- Process allows participants time to think through their ideas and forces them to write down them down before they present them to the group, promotes careful and in depth thinking.
- Process provides a record of a group's thoughts which can be reviewed as needed.
- Provides consensus of expert opinion without bias which can occur in comparable techniques e.g. group discussion, committee meetings, etc, where stronger individuals can dominate and others be intimidated or inhibited from expressing views.
- Anonymity allows them to express opinions and take positions they might not otherwise be able to express, peer pressure or pressure to conform to the group is not a factor.
- Method facilitates exchange of information and ideas, views can be retracted, altered or added with benefit of considered thought.
- Efficient and cost effective way to combine the knowledge and abilities of a large group of experts drawn from a wide area, more people can participate in this method than could practically be included in meaningful face-to-face discussions.
- Novel, interesting and motivating for participants and has ability to obtain large quantities of information.
- Should have high content, face and concurrent validity because of use of group of 'experts'.
- Allows participants enough time to digest group's comments carefully and thoroughly before responding.
- Feedback between rounds can widen knowledge and stimulate new ideas and in itself be highly motivating, interesting and educational for the participants.

- Participants bring a wide range of direct knowledge and experience to the decision-making processes.
- Expert participants are more likely to generate reasoned, independent and well-considered opinions in the absence of exposure to persuasively stated opinions of others.
- Has been shown to be effective way to conduct research when responses being sought are value judgments rather than factual information.
- Systematic procedures if properly conducted should result in objective findings.
- Focuses attention directly on the issue under investigation.
- Provides a framework within which individuals with diverse backgrounds or in remote locations can work together on the same problem.
- Minimises tendency to follow the leader and other psychological and professional barriers to communication.
- Provides equal opportunities for all experts involved in the process.
- Produces precise documented records of the distillation process through which informed judgment has been achieved.

Limitations
- Anonymity, may lead to lack of accountability of views expressed and encourage hasty decisions.
- Delphi may best be viewed as a useful communication tool to generate debate, rather than reach a conclusion, output is at best an opinion and should be interpreted as such.
- As panel is purposively rather than randomly selected it's not representative of target population.
- Accuracy of the forecast is limited by the quality of opinions provided by the experts although the same may be said for any other type of qualitative survey.
- Lacks stimulation of face-to-face communication leading to feeling of detachment from problem-solving effort and creating communication and interpretation difficulties among respondents.
- Can often be difficult to get people to take part and keep them on board throughout the iterative process, high degree of motivation is needed.
- Quality of responses highly sensitive to nature of monitoring team, potential for biasing of results and suppression of extreme responses in attempt to force respondents to some form of consensus.
- Use of group of experts relies on subjective judgments of people (although informed by objective information) and is no substitute for objective assessment of topic.

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- Very different results might ensue depending on group of experts participating.
- The results are only valid if group of experts reflects full range of opinion within relevant subject area.
- The questionnaire is completed at a distance increasing the sensitivity of results to ambiguity and misinterpretation.
- Should not be used when any of the following critical conditions are not present: adequate time; participant skill in written communication; and high participant motivation.
- Common pitfalls are use of unclear evaluation scales and poor techniques in interpreting results.
- Consensus approach may lead to watered down versions of the best opinion and key principle of anonymity may lead to lack of accountability of views expressed and encourage hasty decisions.
- Experts' possibly lack knowledge of what is publicly desirable in a given situation. However, the restrictions in the process only make it possible for experts to state their opinion in relation to other experts while these experts assess each other's points of view. It can only make sense for instance as part of a wider deliberative process of appraisal.

5.   Case studies

The ethical Delphi has been tested for agri-food biotechnologies. This section illustrates its use by summarising how it has been employed in the ethical analysis of GM salmon. The experience of the application may provide useful background information for those wishing to use the ethical Delphi to address new issues. Other experiences with this method can be reviewed in the reference section (6.2).

5.1   The case of GM salmon

The project team applied the ethical Delphi method to the case of the development and use of GM salmon. Two discrete studies were organised and conducted in the UK and Norway.

The ethical Delphi was conducted by e-mail. A comprehensive literature review and internet search was carried out to identify experts in the GM salmon field in the UK and Norway. Experts involved in the ethical Delphi included marine biologists; economists; members of the salmon industry; animal welfare specialists; members of government advisory bodies. Further details of the results of these two Delphis are available on the project website (www.ethicaltools.info). Further information can also be obtained from the project reports and the related publications.

5.2   Additional Information

The following references highlight published papers reporting on the use of the Delphi method in the agri-food sector:

Angus, A.J, I.D Hodge, S. Mcnally & M.A. Sutton, "The setting of standards for agricultural nitrogen emissions: A case study of the Delphi technique", *Journal of Environmental Management* (2003) 69, 323-37.

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Wheeler, J.I. & J.I. Corbett JI, "Criteria for breeding forages of improved feeding value - Results of a Delphi survey", *Grass and Forage Science* (1989) 44, 77-83.

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6.   Further information and resources

This section should provide potential users with additional information on the method and on potential training events and further contacts.

6.1   Training

In September 2005, members of the Centre for Applied Bioethics, University of Nottingham, UK and NENT, Norway conducted a two-day training event with the Lithuanian Bioethics Committee and members of Lithuanian Ministry of the Environment. A separate report of this event can be downloaded from the project website. If you are interested in training events or organising a workshop on the ethical Delphi please contact:

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6.2   References

Further reading and references (general papers and information on methodology):

Adler, M. & E. Ziglio (eds.), *Gazing into the oracle: The Delphi method and its application to social policy and public health*. Jessica Kingsley Publishers, London 1996.
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6.3 Further contacts

If you are interested in discussing the use of the ethical Delphi please contact:

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