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A virtual and anonymous, deliberative and analytic participation process for planning and evaluation: The Concept Mapping Policy Delphi

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Abstract

Integrating knowledge and values across a range of stakeholders and experts is a common goal of, and challenge in, forecasting and planning processes across numerous decision-making domains. In this paper we present a virtual and anonymous, deliberative and analytical participatory group process which we applied in a planning study. The process was a combination of concept mapping and a policy Delphi. The Concept Mapping Policy Delphi offers an iterative process that is meant to foster critical, dissensus-based thinking by a group about an evaluation problem. In particular, it offers a platform on which to structure the group brainstorming of ideas, integrates knowledge and values, and creates a shared conceptual framework for addressing evaluation problems. We discuss the merits and limitations of this process and compare it with other public engagement mechanisms for decision-making. We argue that the use of a Concept Mapping Policy Delphi is relevant in forecasting and decision-making processes that aim to integrate information which is from various disparate points of view in order to clarify arguments and values, democratize and mediate public participation, and/or provide strategic advice about scenarios or planning options, while mitigating the problematic aspects of face-to-face group processes.
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1. Introduction

Integrating knowledge and values across a range of stakeholders and experts is increasingly becoming a common goal of, and challenge in, forecasting, planning and evaluation processes across numerous decision-making domains. The drive for integration using analytical participative mechanisms in decision processes has arisen from concerns with democratic and procedural justice, maintaining trust in governing bodies, and enhancing social learning in the adjudication of alternatives to increasingly complex problems. Indeed, there is a growing awareness of the complexity

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(Roe, 1998), or 'wickedness' (Rittel & Webber, 1973), and/or 'post normal' (Funtowicz & Ravetz, 1993) nature of many of the problems facing decision-makers today. Rittel and Webber (1973) argue that these types of problems are exceptionally difficult to resolve because they are particularly vulnerable to framing conditions; affect numerous stakeholders; are plagued by large uncertainties; involve often incompatible criteria for judging the 'goodness' of decisions; involve the experiential valuation of decisions; and offer no enumerable or exhaustible describable set of possible solutions.

As De Marchi (2003) suggests, given the 'risky' nature of complex problems, value judgments arise at every stage of the decision-making process. Jasanoff (1990), Nowotny (2003) and Rayner (2003) argue that the implication is that the decision-making process should be informed by those who will be affected by the decision, rather than solely by decision-makers. For example, in the context of public policy-making, Davenport and Leitch (2005) suggest that the complexity of public policy problems has given rise to the need for a modern 'agora' for science-society debate.

Dozens of public engagement mechanisms have been developed over the last few decades. These can be distinguished according to the flow of information they facilitate. Rowe and Frewer (2005) described two categories of one-way information flow mechanisms: (1) public communication; and (2) public consultation. In the first category, information is conveyed from the decision-makers or their representatives to the public. In the second, information is gathered from the public by decision-makers or their representatives. Rowe and Frewer (2005) described one category of two-way information flow mechanisms: public participation. In this category, information is shared between decision-makers (or their representatives) and the public, and some means of knowledge and values integration (consensus or compromise) is used to facilitate learning and policy-development. Here, following Renn (2006), consensus means the product of deliberation that represents a win-win solution, or a course of action that serves all participants' interests and values better than any other solution. By way of compromise, we refer to van den Hove's (2006) characterization of a negotiated outcome of deliberation in which the agreed solution, or course of action, represents the maximal level of constraints on particular claims that each participant is willing to accept.

In their useful typology of public engagement mechanisms, Rowe and Frewer (2005) propose six key distinguishing variables: (1) participant selection method (who sits at the table?); (2) facilitation of information elicitation (is a facilitator present?); (3) response mode (open-ended or closed questions?); (4) information output (is the information required by participants easily accessible?); (5) medium of information transfer (face-to-face or not?); and (6) facilitation of aggregation (structured or unstructured aggregation of participant information?). It is important to note that in the public participation category of public engagement mechanisms described by Rowe and Frewer (2005), only face-to-face approaches are included (e.g., citizen panel/jury, consensus conference, action planning workshop, task force, deliberative opinion poll, planning cell and town meeting). However, face-to-face approaches are often plagued by power dynamics that can affect the quality of the experience for participants, as well as the quality of the information gathered and integrated through the process. For example, as Rowe (1998) suggested, some individuals may dominate the conversation while less confident participants are silent (or muted), the group may become polarized around contentious perspectives, or the group may reach a conclusion prematurely. What are needed are techniques that mitigate these problematic characteristics of face-to-face group interactions, by using, for example, virtual and anonymous group deliberation frameworks such as the Delphi method.

In this paper we present a virtual and anonymous, deliberative and analytical participatory group process that we have developed in a futuristic planning study, designed to: (1) integrate the knowledge, values and experience of a group of people representing different areas of expertise; (2) advance social learning; and (3) map consensus and dissent; while (4) mitigating the risk that divergent views will be silenced by dominant voices during deliberation. The resulting process is a combination of concept mapping, developed by Kane and Trochim (2007), and a policy Delphi, as characterized by Turoff (2002). The purpose of this paper is not to engage in a thorough analysis of the substantive recommendations of the expert group.

Instead, we focus on the method that was developed in order to undertake the futuristic planning study, with a view to identifying its potential utility to researchers and practitioners working in participative forecasting and planning in order to inform decision-making processes.

2. The policy Delphi

Linstone and Turoff (1975) characterize the Delphi as: "*a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem*" (p. 3). One of the most prominent characteristics of the Delphi is its iterative process: experts are initially asked questions, usually in the form of a questionnaire; the contributions are then summarized and redistributed to all participants, who are invited to revise their views, upon which the process is iterated until a pre-determined criterion is met. Linstone and Turoff (1975) mention two other noteworthy characteristics of the Delphi: (1) participants remain anonymous to each other; and (2) depending on the aim of the Delphi, participants may be asked, at each iteration, to rank their responses with respect to various measures of importance, priority, feasibility, success, etc., which can be assessed statistically and included in the feedback mechanism. Furthermore, the classical Delphi aims to produce a stable consensus within a group of experts about a forecasting estimate, evaluations of policy options, and so forth.

There are a number of advantages associated with using a Delphi to structure group interactions. In general, the Delphi technique overcomes many communication barriers that can arise during face-to-face group interactions, and can effectively counter group pressure to conform to a dominant opinion. More specifically, according to Hung, Altschuld, and Lee (2008a), the strengths of the Delphi include: bringing geographically dispersed panels of experts together and overcoming spatial limitations; the anonymity and confidentiality of responses; the potential for a thoughtful consideration of questions; avoiding direct confrontation between experts; facilitating honest opinions, free from group pressure; focused discussion; gathering the collective wisdom of the participants; and being potentially educational for the participants.

In situations where a consensus is not necessary and eliciting dissensus is more appropriate to the planning and evaluating process, the policy Delphi is a more appropriate technique. A number of policy Delphi methods have been developed for eliciting experts' divergent views, such as Steinert's (2009) dissensus-based "roundless" online Delphi, and Tapio's (2002) Disaggregative Policy Delphi. The policy Delphi rests on the premise that decision-makers are interested in gaining insights into the different options and the supporting evidence for different courses of action. As Turoff (2002) pointed out: "*The policy Delphi is therefore a tool for the analysis of policy issues and not a mechanism for making a decision. Generating a consensus is not the prime objective, and the structure of the communication process as well as the choice of the respondent group may be such as to make consensus on a particular resolution very unlikely*" (p. 80).

The steps generally involved in a policy Delphi are: (1) formulating the issues; (2) exposing the options; (3) determining initial positions on the issues; (4) exploring and obtaining the reasons for disagreements; (5) evaluating the underlying reasons; and (6) reevaluating the options (Turoff, 2002). In keeping with Turoff and Hiltz's (1996) discussion of the policy Delphi processes, Table 1 presents the kinds of information that can be elicited through a policy Delphi, including the desirability and feasibility of different courses of action, the importance and validity of different arguments, and a set of policy alternatives with their pros and cons. As with the consensus-based Delphi, the policy Delphi usually entails several iterations.

The policy Delphi is similar to a committee process. However, it limits the influence of domineering personalities or outspoken individuals who can take over in face-to-face group interactions. It also circumvents some of the issues that can arise in the committee process, such as when certain individuals are unwilling to take a position until all of the facts have been laid out and it is known which way the majority is headed, or the unwillingness of some respondents to abandon a position once they have stated it publicly (Turoff, 2002, p. 82). The policy Delphi is particularly

Table 1
The policy Delphi structure (based on Turoff & Hiltz, 1996).

Information elicited	Voting scales	Results
Problem resolution	Desirability Feasibility	Alternative courses of action
Argument	Importance Validity	Pro and cons to a given resolution Reasoning

well suited to decision-making processes that require inputs from multiple, different, and often conflicting points of view, since it allows participants to respond in their own time, to share their opinions without the risk of losing face, and to contradict others who may occupy a more powerful social position.

The most significant limitations of the Delphi, and the policy Delphi in particular, are methodological in nature (Landeta, 2006; Rowe, Wright, & Bolger, 1991). Critics have highlighted the use of ambiguous questionnaires (Sackman, 1975; Tapio, 2002; Ziglio, 1996), oversimplified structured inquiries which constrain the elicitation of new ideas (Hill & Fowles, 1975; Linstone, 1975; Tapio, 2002), and the time-consuming nature of the exercise (Hung, Altschuld, & Lee, 2008b; Linstone, 1975; Martino, 1970; Mullen, 2003).

To address these three limitations, a number of modifications can be made to the Delphi process. To begin with, in response to the large amount of time required to conduct multiple rounds of questionnaires, some researchers have developed a "roundless" Delphi using an internet-based computer software program (Gordon, 2007; Gordon & Pease, 2006; Steinert, 2009). This approach can be seen to both simplify the Delphi process and increase its efficiency by providing participants with real-time feedback and access to other participants' responses. Although the more verbose, quicker answerers may come to dominate a roundless Delphi through their answers, moderator-controlled constraints such as deleting duplicate opinions and providing a forum in order to allow communication between the experts and the moderator can mitigate such a risk (Steinert, 2009).

With regard to improving the structure of the questionnaire and the analytical process, the use of concept mapping offers a standardized framework involving multivariate statistics to create graphical representations of the results of group deliberations. The combination of a "roundless" policy Delphi process with concept mapping provides a number of advantages for public participatory policy planning and evaluation that either method on its own lacks. The following section describes concept mapping in more detail and explains how it complements the policy Delphi.

3. Concept mapping

Concept mapping is "*a structured methodology for organizing the ideas of a group or organization, to bring together diverse groups of stakeholders and help them rapidly form a common framework that can be used for planning and evaluation, or both*" (Kane & Trochim, 2007, p. i). Concept mapping may improve evaluation and planning by offering a systematic process for articulating and depicting the inter-relationships between key concepts (Caracelli, 1989; Caracelli & Riggin, 1994). It has been used in a wide range of planning and evaluation projects (Quinlan, Kane, & Trochim, 2008; Stokols et al., 2003; Trochim, Marcus, Masse, Moser, & Weld, 2008), and is also considered to be an effective catalyst for organizational learning in the development of jointly authored conceptual frameworks to be used in evaluation and planning (Sutherland & Katz, 2005).

Concept mapping is a multistep process that uses multivariate statistics to analyze the ideas generated through the process of brainstorming. The process of concept mapping also facilitates the interpretation of statistical analyses through the use of graphs. Although various approaches to concept mapping have been developed and discussed in the literature, we describe Trochim's (1989) approach because it has been widely applied. According to Kane and Trochim (2007, p. 9), the concept mapping process involves six main steps: (1) preparing the focus statement and prompt (this sentence will provide the focus of the

mapping exercise); (2) brainstorming (this process will generate statements that will subsequently be mapped); (3) grouping and rating the statements; (4) performing statistical analyses and constructing maps (multidimensional scaling, hierarchical cluster analysis, bridging analysis, production of maps, pattern matching, bivariate plots); (5) interpreting maps (the participants are asked to interpret the maps); and (6) using the results for further analysis, research and planning.

Although the concept mapping approach resembles a policy Delphi in terms of eliciting and evaluating multiple options (Table 2), it differs in various important ways and offers a standardized, statistical analytical framework to the policy Delphi. Concept mapping has the advantage of providing a facilitated open-ended brainstorming exercise in which participants generate a list of (divergent) options for decision-making. The brainstorming process allows new ideas to emerge as the participants respond to other participants' statements. Moreover, concept mapping provides a structured analytical process that facilitates the interpretation of the results and the elicitation of divergent opinions. The use of various ranking scales, cluster analysis, and the production of analytical graphs helps to summarize the results of the group deliberation exercise, providing depictions of the groups' conceptual framework for the problem in question, which in turn can help participants to reflect and comment upon the elements of the shared conceptual framework which fall short of representing their particular views.

A different way of understanding the way in which concept mapping and the policy Delphi differ and complement each other, is that concept mapping generates many "boundary objects" that facilitate the building of coherent meaning from the disparate views of a group of experts who occupy different institutional cultures and who hold different stakeholder expectations. Although the Delphi's anonymity and iterations, and its mitigation of group pressures, are characteristics that are useful for facilitating dialogue between experts from divergent institutional backgrounds, it does not produce objects that can integrate and translate an individual's particular perspectives and values. Concept mapping provides boundary objects, such as cluster rating graphs, that are flexible enough to adapt to individual interests, while also maintaining a common identity across different knowledge-bases and value systems (Leigh Star & Griesemer, 1989). Therefore, concept mapping generates, integrates and translates individual views and values within concept maps, which also serve as "objects of discussion" that can facilitate reflection upon the group's shared conceptual framework and elicit divergent responses.

4. Application of the Concept Mapping Policy Delphi[1]

Our objective in this study was to map the characteristics of an ideal, hypothetical future university-government-industry formal research network in the Canadian forest sector. This futuristic planning study was meant to: (1) integrate the knowledge, values and experience of a group of existing research network members representing different areas of expertise; (2) advance (individual and organizational) social learning about how to design university-government-industry research networks; and (3) map consensus and dissent about the most important, feasible, and problematic features of a cross-sector research network; while (4) mitigating the risk that divergent views will be silenced by dominant voices during deliberation. This structured group process was specifically designed to elicit divergent views on what the characteristics of an ideal cross-sector research network should be. The planning exercise also served to analyze the difference between an 'ideal' hypothetical future network and the actual network, thereby offering insights as to some of the organization's 'lessons learnt'.

The participants were asked to take on the role of members of a hypothetical advisory committee charged with designing a new forest research network. To introduce the exercise, the following text was provided to the participants:

[1] The results of and substantive recommendations that were proposed from the application of the Concept Mapping Policy Delphi are the subject of another manuscript: Klenk and Hickey (2009).

Table 2
Comparison of the steps involved in the policy Delphi and concept mapping.

Steps	Policy Delphi	Concept mapping
1	Formulation of the issues	Preparing the focus statement
2	Exposing the options	Brainstorming statements
3	Determining initial positions on the issues	Sorting and rating of statements
4	Exploring and obtaining the reasons for disagreements	Statistical analyses and the construction of maps
5	Evaluating the underlying reasons	Interpreting maps
6	Reevaluating the options	Eliciting reasoning: agreement and dissent

In our utopian future, there is a broad commitment by stakeholders to maintain a national research network. Given your extensive experience in, and knowledge of, the actual research network, you have been asked to sit on an Advisory Committee of experts mandated to conceptualize an improved second generation national forest research network for Canada. In this hypothetical situation, you are expected to envision what would be an ideal network and to delineate what would be the future research network's guiding principles. Specifically, the role of the Committee is to provide guidance on the following organizational issues for the ideal forest research network:

- The scope of the research
- The objectives
- The desired outcomes
- The funding model
- The management structure
- The role and responsibilities of management and staff
- The communication strategy
- The desired partners
- Proposal evaluation procedures
- Research priority setting
- Membership requirements.

This list of organizational issues was not exhaustive and participants were not restricted to it; they were also invited to suggest other organizational issues that should be considered.

4.1. Participants

The selection of 'experts' for our Concept Mapping Policy Delphi was informed by an advisory committee of long-time members of the research network core (administration, management, and standing committees), who provided a list of individuals who were highly knowledgeable about the structure and evolution of the existing research network and representative of the different sectors involved. Five sectors (academia, industry, government, network administration, and aboriginal people) were targeted, due to their differing levels of influence on the management and direction of the existing network.

Fourteen individuals participated in the exercise: two academics, three aboriginal representatives, two industry representatives, three existing network staff, and four government representatives. The participants were between 40–69 years of age, with most (5) being between 50–59 years of age. Most participants (6) had been involved in the existing research network for more than eight years.

With respect to the patterns of response and attrition, a total of eight participants completed all of the tasks involved in the Concept Mapping Policy Delphi exercise. Nine participants completed the brainstorming step, eleven completed the sorting step, ten completed the first ranking scale, and nine completed the second and third ranking scales (the tasks are described below). Eight participants provided comments and arguments for and against the results obtained through the statistical analyses.

4.2. Procedure

To begin with, each participant was assigned a code name and password for logging on to the internet-based Concept Mapping project website. For each of the following steps, a timeline of two weeks was allocated for completing the task. As is described in Table 3, in the first step of the exercise the participants were asked to list answers to the focus prompt: "*I think that the new and improved forest*

Table 3
Outline of the concept mapping policy Delphi exercise.

Concept Mapping Policy Delphi	Participant questions
Preparing the focus statement	"I think that the new and improved forest research network should have this particular guiding principle for this particular organizational issue…".
Brainstorming statements	A total of 63 statements were obtained.
Sorting and rating of statements	"Sort each statement into a category you create. Group the statements by how similar in meaning or theme they are to one another. Give each category a name that describes its theme or contents". "Rate each guideline or principle of the new and improved research network on a five point scale in terms of its feasibility". "Rate each guideline or principle of the new and improved research network on a five point scale in terms of its importance". "Rate each guideline or principle of the new and improved research network on a five point scale in terms of the extent to which it differs from the actual research network".
Statistical analyses and the construction of maps	Point map, point cluster map, cluster rating map, and "Go-Zone" plots.
Interpreting maps and eliciting reasoning for dissent	"Are the results surprising to you and why?" "Do the results truly reflect your own opinion?" "If not, why?"

research network should have this particular guiding principle for this particular organizational issue…". The process of brainstorming was open-ended, as the participants were not limited to a set number of statements or topics. As statements were added to the list, the participants were then able to change their original contributions and add more statements to the list in order to respond to others' contributions. The brainstorming task therefore allowed the participants to compile a list of contradictory statements. This process embodied the iterative nature of the Delphi, in that individual opinions could be (trans)formed through an anonymous group interaction. However, some evidence of the mitigation of group pressure, which usually leads to the conformity of views with those of the 'dominant(s) speaker(s)', can be gleaned from the fact that the list of statements exhibited a large number of starkly contradictory and disparate propositions and values. After the brainstorming task was over, the facilitator filtered the statements to remove duplicates. However, few statements were removed, in order to ensure that the breadth and scope of the participants' statements were truly reflected in the exercise. A total of 63 statements resulted.

Next, the participants were asked to sort the statements into categories, based on how similar in meaning or theme they were to one another, and to give each category a name that described its theme or contents. This step provided an opportunity for the participants to organize the list of disparate and contradictory propositions into groupings that made sense to them. This was therefore the initial step in the creation of the conceptual framework. While the sorting task was conducted by the individual participants, the cluster analysis used the sorting data to produce clusters of propositions in a subsequent step.

In the third step, the participants were asked to rate each guideline or principle of the new and improved research network in terms of its feasibility, importance and difference to the actual (existing) research network. Given that the purpose of the Concept Mapping Policy Delphi was to create both a conceptual and an evaluative tool for the design of a future network organization, this step provided some data on how the participants rated each proposition in the list created through the brainstorming session. These ratings were later aggregated within clusters of propositions in order to provide an overview of the most important, feasible, and 'different' aspects of the organizational design. The feasibility and importance rating scales ranged from 1 to 5, where '1' meant 'This guideline or principle is not [feasible, important]', '3' meant 'This guideline or principle is moderately [feasible, important]', and '5' meant 'This guideline or principle is extremely [feasible, important]'. The rating scale that referred to the difference to the actual

research network ranged from 1 to 5, where '1' meant 'This guideline or principle is extremely similar to the actual network', '2' meant 'This guideline or principle is somewhat similar to the actual network', '3' meant 'I cannot say', '4' meant 'This guideline or principle is somewhat different from the actual network', and '5' meant 'This guideline or principle is extremely different from the actual network'.

The next steps of the Concept Mapping Policy Delphi involved statistical analyses and the creation of maps. Although we do not provide illustrations of all of the graphs produced in the experimental Concept Mapping Policy Delphi, it is nevertheless important to explain how the resulting maps were created, so that the logic of the method is clear. Once the sorting and rating steps were completed, we produced a "point map", which displayed the results of the multidimensional scaling of the grouping data. In this map, each point corresponded to a guideline or principle of the new and improved research network. A "point cluster map" was then produced to overlay the hierarchical cluster analysis results on the multidimensional scaling point map. Eight clusters were subsequently retained because they represented the most useful detail between clusters of guidelines and principles, while merging those that sensibly belonged together (Kane & Trochim, 2007, p. 103).

The next step in the analytical process brought together the grouping and rating data to produce an integrated conceptual and evaluative framework. To do this we produced three "cluster rating maps", displaying the average rating values (feasibility, importance and difference to the actual research network) computed for each cluster of statements as a third dimension on top of the cluster map. Thus was done in order to illustrate the group's aggregated views and foster deliberation about the appropriateness of the conceptual and evaluative framework presented. For example, Fig. 1 shows the cluster rating map, illustrating the average feasibility rating for the propositions within each cluster. This map suggests that some clusters of ideas, such as those referring to 'knowledge exchange' and 'scope of research', were deemed more feasible than others for a future research network. Such a graphical depiction of the group's valuation helped to elicit dissensus within the group, because it allowed the participants to reconsider their original propositions and ratings based on how they related to the aggregated results. In other words, the three cluster rating maps (of the feasibility, importance, and 'difference to the current network' ratings) were used as 'boundary objects' to elicit the participants' opinions on the appropriateness of the overall evaluative framework (the number and contents of the clusters as well as their ratings), and their reasons for any disagreement with the conceptual and evaluative framework.

Finally, we produced three "Go-Zone" graphs, which were essentially bivariate plots, divided into four quadrants using the axes of two rating scales for the project (e.g., feasibility and importance, feasibility and difference to the actual network, importance and difference to the actual network). In the "Go-Zone" graphs, each of the guidelines or principles for a next generation research network fell into one of the quadrants, depending on their ranking. For example, Fig. 2 shows the importance and feasibility "Go-Zone" graph. This graph illustrates the principles and guidelines that fell into the zones of (1) high importance/high feasibility; (2) high importance/low feasibility; (3) low importance/high feasibility; and (4) low importance/low feasibility. These "Go-Zone" graphs were then used as a second set of 'boundary objects', to help participants focus their responses on what could be the most/least appropriate direction for a future research network.

Once the cluster maps and "Go-Zone" graphs had been produced, we summarized the results and sent the summary to each of the participants for their comments. More specifically, each participant was asked the following questions: (1) "Are the results surprising to you, and if so, why?"; (2) "Do the results truly reflect your own opinion?"; and (3) "If not, why not?". This iterative process was meant to draw out the participants' reasons for (not) supporting the results of the group. Seven participants responded with their comments on the results, which were then summarized and re-distributed via email to all participants (remaining anonymous). The participants were then invited to respond to the others' opinions and arguments, with two individuals proposing substantive changes to the cluster analysis. Five participants also provided feedback about the effectiveness of the process in generating a useful conceptual framework for the design of a future research network.

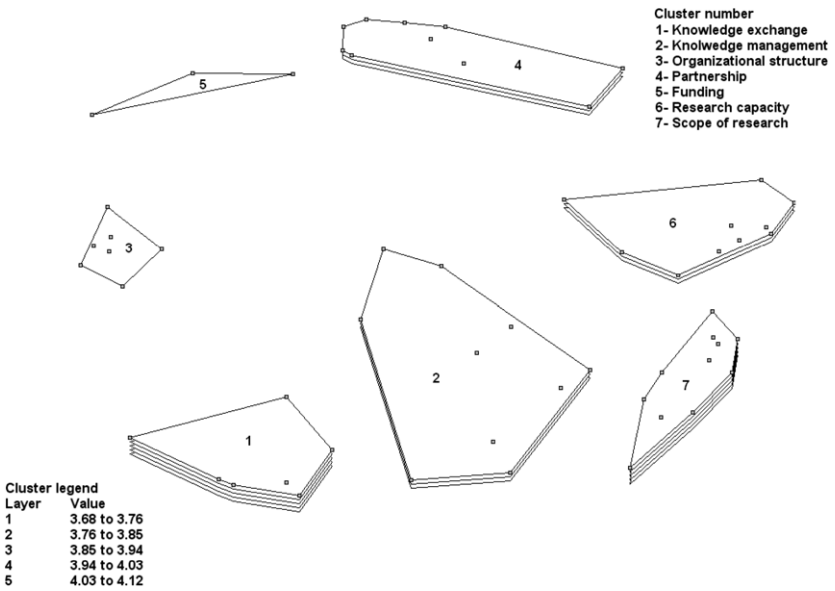

Fig. 1. Cluster rating map generated in the Concept Mapping Policy Delphi exercise. Cluster ratings represent the average rating values (feasibility here) computed for each cluster of statements and displayed as a third dimension on top of the cluster map.

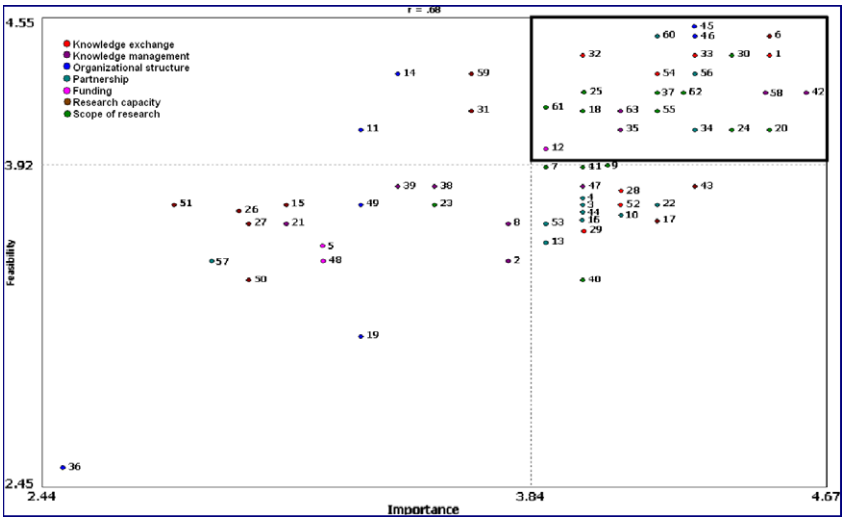

Fig. 2. "Go-Zone" map generated in the Concept Mapping Policy Delphi exercise, divided into 4 quadrants using the axes of two rating scales for the project (feasibility and importance here). Each statement is illustrated here with a dot. Each dot has a color to reflect the cluster the statement belongs to. Each statement which was gathered into a specific cluster with other similar statements falls into one of the quadrants: high importance/high feasibility, high importance/low feasibility, low importance/high feasibility, and low importance/low feasibility. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

It should be noted that the iterative process of the policy Delphi was not applied at every step of the concept mapping process. However, it was particularly important in the brainstorming task, where the participants could see others' statements and receive feedback in real time. It was also important in the circulation of comments on the results of the cluster analyses and "Go-Zone" maps, where

the participants were made aware of each other's arguments for and against the resulting depictions of the group's conceptual framework.

5. Discussion

5.1. Similarities and differences to other modified Delphi applications

In some ways, the Concept Mapping Policy Delphi resembles a normative Delphi (Martino, 1999; Novakowski & Wellar, 2008), in that it is meant to derive normative characteristics of what should be done about a planning or forecasting problem, given current knowledge. The normative Delphi, as outlined by Novakowski and Wellar (2008), is consensus based, prescribes several survey iterations and does not involve a structured method of knowledge integration and value elicitation, nor does it explicitly seek to map out different courses of action or reasons for dissent. Therefore, our Concept Mapping Policy Delphi may be understood as taking the idea of a normative Delphi, but transforming the classical Delphi design using an internet-based platform to seek knowledge and value integration while mapping dissent.

The Concept Mapping Policy Delphi also resembles some of the more widely used participatory multi-criteria analysis methods (Stirling, 2006; Wittmer, Rauschmayer, & Klauer, 2006), though it also differs from them in important ways. For example, participatory multi-criteria decision-aiding methods such as 'deliberative mapping' involve a mix of face-to-face workshops, seminars, and deliberations, structured by a process that seeks to define a problem and establish evaluative criteria and decision options which are subsequently evaluated, aggregated and ranked (Burgess, Stirling, Davies, Eames, & Staley, 2007). The Concept Mapping Policy Delphi resembles multi-criteria analysis to the extent that both methods aim to structure the integration of knowledge and values in the decision-making process. However, our method offers a means of circumventing the geographical challenges and group pressure dynamics that may arise in participative public policy group processes. Although participative multi-criteria analysis may involve a greater degree of public participation in framing the problem and establishing evaluative criteria for the different options, this process requires a greater cognitive commitment on the part of participants to engage in an intense knowledge and value elicitation technique. The Concept Mapping Policy Delphi also aims to facilitate knowledge and value elicitation and integration; however, it does so using a reduced number of steps, while providing visual depictions of the group's conceptual and evaluative framework. These frameworks are then used to elicit individual reasonings for or against the group deliberation results. Furthermore, due to its anonymous nature, the Concept Mapping Policy Delphi may improve group deliberation by reducing socially desirable responses and ensuring equality between participants.

5.2. Strengths and weaknesses of the Concept Mapping Policy Delphi

A number of participants ($n = 5$) provided feedback on the effectiveness of the process in generating a useful conceptual and evaluative framework for the design of a future research network. Some of the perceived strengths of the method were that it offered a means of reflecting on past experience and considering future options more carefully, and helped to identify clearly the issues that the former research network faced, which should be of concern in the design of a future network. The perceived weaknesses of the method were that while the process appeared effective, the results did not distinguish between what were infeasible and desirable principles and guidelines for a future research network. This limitation in our application of the Concept Mapping Policy Delphi highlights the need for researchers to craft the initial question for the brainstorming step and the rating scales carefully, to ensure that the cluster analysis provides a clear conceptual and evaluative framework for decision-making.

Effective forecasting and planning in participatory decision-making contexts often require that the framing of the issues and evaluative norms structuring the process be established by participants (Caron-Flinterman et al., 2006; Ross, 2007). Although our Concept Mapping Policy Delphi involved real-time feedback mechanisms, such as in the brainstorming step and the facilitator mediated feedback on the concept maps, increased participation and iterations could be fostered elsewhere within the process.

Indeed, the participants could be involved to a greater extent in framing the problem by articulating the focus prompt for the brainstorming session and deciding upon the ranking criteria. The process could also involve repeating the sorting and ranking tasks once the first round has been completed and the reasoning for and against the group results has been solicited, summarized and circulated within the group. Increasing the number of iterations may result in more nuanced concept maps and fine-tuned strategic decision-making aids such as the "Go-Zone" maps. There are, however, additional costs associated with the amount of time required for each participatory input/iteration which should be kept in mind if a Concept Mapping Policy Delphi is to be used in a public engagement context.

A major advantage of the Concept Mapping Policy Delphi technique is that it offers a structured, yet flexible and open-ended, process that seeks to stimulate critical group thinking about problematic situations in order to create shared conceptual and evaluative frameworks, and expose differing points of view. As Stirling (2006) suggested, integrating participatory and analytical procedures in decision-making processes may result in either 'closing down' the process or 'opening it up'. 'Closing down' the decision-making process refers to assisting decision-making by cutting through the messy, intractable and conflict-prone diversity of views in order to develop a clear, authoritative, prescriptive recommendation (Stirling, 2006). In contrast, 'opening up' the process involves "*including marginalized perspectives, focusing on neglected issues, considering ignored uncertainties and highlighting new options*" (Stirling, 2006, p. 101). In this context, the Concept Mapping Policy Delphi technique can be used to integrate information from disparate points of view in order to clarify arguments and values, democratize and mediate public participation and research, and provide strategic advice about alternative courses of action in planning, forecasting and policy making.

5.3. Implications and recommendations for forecasting Delphi applications

The Concept Mapping Policy Delphi may be useful in forecasting and scenario-based evaluation contexts when an anonymous and iterative group deliberation process is required to integrate different knowledge bases and values and create a shared conceptual and evaluative framework. As other researchers have pointed out, there are a number of ways in which modified Delphi applications, such as those that integrate cluster analysis, can enhance the effectiveness of forecasting studies, for example in the case of scenario-based strategic planning (Rikkonen, Kaivo-oja, & Aakkula, 2006; Tapio, 2002). Wright and Goodwin (2009, p. 818) suggested that the limitations of scenario-based strategic planning are: "*. . . that it may reinforce existing framings of the future unless the addition of the views of "remarkable people" can counter these viewpoints. The creation of detailed scenarios—containing particular causal chains of events—may also serve to increase the perceived likelihood that a specific scenario will, in fact, occur. Also, the method may cause participants to discount the possibility of high impact events which are not reached via these causal chains*". Tapio's (2002) use of a disaggregative policy Delphi structured by a cluster analysis illustrated the benefits of using multivariate statistics to enhance scenario formation, evaluations, and deliberation. However, while Tapio's (2002) approach documented contrasting arguments about future scenarios, it did not involve a systematic value elicitation task, which leaves the role of evaluation in the hands of decision-makers.

In the Concept Mapping Policy Delphi, the brainstorming tasks could be used by a group of experts, including "remarkable people", to define the scenarios used in a forecasting exercise through a creative, open-ended process which elicits divergent views so as to 'open up' the scenario building exercise. For example, the brainstorming exercise could elicit statements about low probability, high-impact events facing an organization. The sorting task would organize events according to their similarity. Hence, the brainstorming and sorting tasks, followed by a cluster analysis, could help mitigate the risk of framing and motivational biases by enhancing the potential for surprising framings through the aggregation of divergent views and values. The ranking tasks offer a means of estimating the plausibility, likelihood, and impacts of these events on the objectives of the organization. Hence, each event and its clusters could be discussed in terms of its score on these ranking questions in an iterative process.

Furthermore, the cluster analysis could provide several graphs depicting the group's conceptual organization of future scenarios, which in turn could be used as an "object of discussion" to elicit the causal links and drivers of the (clusters of) events. The elicitation of causal links and key drivers after the cluster analysis would mitigate the risk that "*imagining the occurrence of a sequence of events makes the focal sequence appear more likely to occur*" (Wright & Goodwin, 2009, p. 818). Moreover, concept mapping's slew of decision-aiding maps and graphs, such as the "Go-Zone" graph, could structure deliberations about which (cluster of) scenarios require the most urgent consideration, given their plausibility, likelihood, and impact scores. The Concept Mapping Policy Delphi could also be used to help decision-makers to assess the uncertainty by distinguishing (clusters of) events whose likelihood we know from those that we don't know, and should identify those uncertainties which have the greatest potential impact (Wright & Goodwin, 2009).

The use of the Concept Mapping Policy Delphi shows promise in scenario-based forecasting studies, given its several additional analytical measures and "boundary objects" over Tapio's (2002) use of cluster analysis as a tool for systematic scenario formation in his dissagregative policy Delphi. Moreover, if the decision-making, forecasting, or planning context is meant to be participatory with respect to the framing and subsequent evaluation of options or scenarios, then the Concept Mapping Policy Delphi is likely to be a useful method for several reasons. The method can accommodate a large number of individuals in the brainstorming step, which could provide an opportunity to seek a representative (or very large) sample of individuals (if this is of importance to the forecasting and decision-making context) for framing the issue and creating a list of potential options or characteristics of scenarios. A subset of individuals could then be invited to sort and rate the statements. This number ranges from a minimum n = minimal number of expected dominant and divergent views (or stakeholder groups, or areas of expertise, et cetera) to a maximal n = the number of individuals the facilitator is willing and able to communicate with in order to elicit additional reasons for dissent in the last step of the process. The Concept Mapping Policy Delphi therefore offers a flexible method for accessing a large number of views, but it also allows researchers to reduce the number of participants in later stages of the process, in order to collect sorting and rating data from 'remarkable people', or elicit divergent views from a group of 'remarkable people'.

Finally, the skills required of the facilitator are that he or she understand the basic logic of cluster analysis; such an understanding is facilitated by: (1) the numerous guidebooks and applications of concept mapping accessible in the literature, and (2) the fact that the analysis can be automated in software packages, eliminating the need for the facilitator to conduct their own statistical analyses. The production of maps and their interpretation is straightforward but requires an understanding of the logic of the analysis, which is again facilitated by the vast body of literature on concept mapping applications. However, the use of an electronic medium and graphical depictions of a conceptual and evaluative framework may not be suitable for all participants, who will vary with respect to their familiarity with web-based technology and for whom the graphs might require more explanation. If the latter consideration is of concern, then greater efforts would be required of the facilitator for explaining the meaning of the graphs to participants in both the invitation to participate in the process and the iterative discussion of the participants' interpretations of the graphs. That being said, applications of the Concept Mapping Policy Delphi are needed to assess its effectiveness in forecasting studies such as scenario-based planning.

6. Conclusion

The Concept Mapping Policy Delphi was developed in order to: (1) protect the anonymity of participants due to uneven degrees of power and influence, and starkly different perspectives on issues; (2) facilitate an iterative anonymous group discussion; and (3) elicit reasons for dissent from the group's conceptual and evaluative framework. The subsequent experimental application was successful in integrating the knowledge, values and experience of a diverse group of expert participants and mapping the consensus and dissent about the resulting conceptual and evaluative framework, while mitigating the risk that divergent views would be silenced by dominant voices during deliberation. The most important way in which concept mapping improves the policy Delphi is by pro-

ducing "boundary objects" that facilitate the building of a coherent meaning from the disparate views of a group of experts. While such boundary objects may have different meanings ascribed to them by different experts (in the interpretation of the results), their structure is common enough to more than one expert to make them recognizable, which makes them important "objects of translation" across different social and institutional worlds.

The Concept Mapping Policy Delphi is relevant in forecasting, planning and decision-making contexts where information from disparate points of view needs to be integrated in order to clarify arguments and values, democratize and mediate public participation, and/or provide strategic advice about policy options, while mitigating the problematic aspects of face-to-face group processes. Of particular interest is its potential to support decision-making on 'wicked' problems (e.g., healthcare, defense, education, food security, climate change, etc.) at the international, national, state and local levels. However, further applications of the Concept Mapping Policy Delphi are required to assess its effectiveness.

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