Q Methodology to Support the Design and Evaluation of Stakeholder Dialogue

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Abstract: *Most of today's pressing societal problems—such as issues related to energy supply, food, biodiversity and mobility—are characterized by scientific uncertainties and high stakes. Policymakers have to deal with situations in which different people (scientists and stakeholders) have different ideas about what exactly the problem is and how it should be solved. These types of policy problem have been labelled wicked problems. Stakeholder dialogue can be used as a vehicle to inform policymaking on wicked issues. A stakeholder dialogue is geared towards learning about the diversity of perspectives on a problem and its potential solutions. This process of problem structuring needs to be supported by specific tools, methods and procedures. One of the biggest challenges for stakeholder dialogues is to find methods that can be used to design and evaluate dialogues in a way that does justice to the wicked nature of the policy issue at stake. Q methodology is a useful and appropriate method for selecting stakeholders who represent the diversity of perspectives and for evaluating the learning about perspectives that occurs in stakeholder dialogue. This article demonstrates how Q methodology was applied for these purposes in a stakeholder dialogue on sustainable bioenergy in the Netherlands.*

Introduction

This article discusses and demonstrates the value of Q methodology to support policymaking on wicked issues. Wicked issues involve high and divergent societal stakes and (scientific) uncertainties (Rittel & Webber, 1973). This goes for many of today's pressing societal problems. Issues such as climate change and biodiversity loss, for example, are highly complex in that cause–effect relations are difficult to establish. In addition, impacts involve large timescales and a wide geographical scope, making it difficult to act on them. Yet when impacts are irreversible (for instance due to climate change) it makes acting urgent. Actors in the policy arena, however, often disagree on what should be the goal of policy, as well as on what should be the relevant means (that

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is, policy measures) for attaining that goal. The necessity of a sustainable energy supply can, for instance, be framed in terms of independence from geopolitically instable regions, care for nature or efficient energy use. These different problem definitions lead to different ideas about appropriate policy measures.

Policymakers thus have to deal with situations in which different people (scientists and stakeholders) have different ideas about what exactly is the problem and how it should be solved. Policymaking for wicked issues takes the form of policy as learning (Hisschemöller & Hoppe, 2001) about a problem (or the goals of policy) and solutions for the problem (or the range of possible policy options). Deliberation and stakeholder participation in policymaking are widely recognized as ways for dealing effectively with wicked policy issues (see for example, Fischer & Forester, 1993; Funtowicz & Ravetz, 1993; Hisschemöller, Hoppe, Dunn, & Ravetz, 2001; Renn, 2004).

A *stakeholder dialogue* is a vehicle for such a learning process. It is an organized meeting, or series of meetings, of stakeholders with different perspectives, knowledge and backgrounds, who would otherwise not meet (or not meet all together), structured to a greater or lesser extent by means of specific methods, tools or techniques (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010). Stakeholders are actors involved in, affected by, or knowledgeable of the issue at stake, or are those who have relevant expertise or experience (definition based on Van Asselt & Rijkens-Klomp, 2002). The purpose of a dialogue is to exchange knowledge and ideas in order to gain an improved understanding of the diversity of perspectives on the problem and its potential solutions (see also Renn, Blättel-Mink, & Kastenholz, 1997; Dunn, 2004).

Stakeholder dialogue needs to be supported by specific tools, methods and procedures (Cuppen, 2012b). One of the biggest challenges for stakeholder dialogues is to find methods that can be used to design and evaluate stakeholder dialogue in such a way as to do justice to the wicked nature of the policy issue at stake. The aim of this article is to demonstrate how Q methodology can be used as a tool to support the design and evaluation of stakeholder dialogue.

This article is structured as follows. In the next section I discuss why Q methodology is a useful method to support the design and evaluation of stakeholder dialogue. The third section introduces the example of an orchestrated stakeholder dialogue on sustainable energy from biomass in the Netherlands (the 'Biomass Dialogue'). The fourth and the fifth sections respectively describe how Q methodology was used in the Biomass Dialogue to select stakeholders and to evaluate the learning effects of the dialogue. The final section presents some conclusions and discussion points.

Designing and Evaluating Stakeholder Dialogue

The wicked nature of the policy issues under study means that problem boundaries are not well defined. They need to be probed (Dunn, 1997), and it is difficult to know whether the problem boundaries have been sufficiently approximated. Methods that are based on prior assumptions about the problem boundaries or aspects of the problem (for example, who knows or values what, or which categories of perspectives there are or need to be taken into account) are inherently poorly suited. Q methodology, however, is not based on any such predispositions regarding stakeholder perspectives. It allows participants to use their own frames, phrasings and ideas as inputs for the analysis, and the results can sometimes even surprise the analyst. Q's congruency with the wicked nature of policy issues is closely aligned with the role of Q to 'open up' policy appraisal as discussed by Ockwell (2008).

In what follows, I describe how Q methodology can be used as a congruent method to support the design of stakeholder dialogue through the selection of stakeholders on the basis of their perspectives and the evaluation of learning about the diversity of perspectives in stakeholder dialogue.

Stakeholder Selection

There are numerous accounts in the literature showing how Q methodology was used to map stakeholder perspectives on policy issues. Q methodology has, for instance, been used to identify views regarding citizenship, the public interest, environmental policy, the quality of participation processes and policy and planning of renewable energy sources (Barry & Proops, 1999; Davies & Hodge, 2007; Swedeen, 2006; Webler, Tuler, & Krueger, 2001; Wolsink, 2004; Ellis, Barry, & Robinson, 2007; Breukers, 2006). Van Eeten (2001) demonstrates how Q can bring new points of view to the table and thereby open up a deadlocked situation. Q serves to uncover more marginal perspectives in addition to dominant ones. This is a powerful characteristic of Q when it comes to learning in stakeholder dialogue. Marginal viewpoints (or rarely mentioned hypotheses) are more likely to provide new insights than dominant viewpoints (hypotheses mentioned more frequently) (Dunn, 2001). Highly probable or predictable hypotheses do not challenge accepted knowledge claims (see also Brodbeck et al., 2002).

Q methodology furthermore allows for an analysis of stakeholders' positions with regard to the perspectives that exist with respect to the issue, enabling a stakeholder-selection procedure that can capture a variety of perspectives, including more marginal ones. The idea to use Q methodology for stakeholder selection has been put forward earlier, most notably by Davies, Blackstock and Rauschmayer (2005) and Dryzek and Niemeyer (2008). This article presents a 'worked example'.

Stakeholder selection is a relatively underexposed, yet critical, element in the design of stakeholder dialogue and participatory processes in general. Selection procedures are commonly based on actor type (for example, stakeholders may be selected from industry, academia, NGOs, or policymakers). This procedure is based on the implicit assumption that diverse actor types reflect diverse perspectives. Yet this assumption may very well be incorrect, as was shown, for example, in the case of sustainable biomass (Cuppen et al., 2010).

Evaluation of Learning in Stakeholder Dialogue

The second role of Q methodology pertains to the evaluation of stakeholder dialogue. A small number of studies are available that make use of repeated Q measures to evaluate the effect of a specific intervention. Q has, for instance, been applied in a study of the effect of deliberative discussion on environmental preferences (Walton, 2012), the effect of collaborative dialogue on learning (Raadgever, 2009), the effect of an experiential learning approach on perceptions of authority relations (Rodenbaugh, 2002), the effect of deliberation on environmental policy preferences (Niemeyer, 2002, 2004) and on viewpoints on policy for the local food system (Pelletier, Kraak, McCullum, Uusitalo, & Rich, 1999). As long ago as 1977, Steven Brown applied repeated Q methods to investigate the impact of reading political literature on individuals' political responses (Brown, 1977).

This type of application of Q methodology is a valuable contribution to the field of participation and policy interventions. Quite some attention has been paid in that literature to methods to facilitate or support participatory procedures (Andersen, 1999; Rowe & Frewer, 2000, 2005; Einsiedel & Eastlick, 2000; Abelson et al., 2003; Van de Kerkhof & Wieczorek, 2005). However, insights into methods for the evaluation of participation are lacking. Without effective evaluation mechanisms, participation may be inappropriately applied, impact may be reduced, efforts may be duplicated and output may be ignored or dismissed (Burgess & Clark, 2009). The evaluation of participation concerns process and outcomes. In the literature, most attention is paid to evaluation of process and design. This usually concerns assessments of the extent of stakeholder involvement (Burgess & Clark, 2009), acceptance criteria (Rowe & Frewer, 2000) and criteria such as fairness and competence (Webler, 1995). The focus on design and process criteria reflects the assumption that these are preconditions for learning: a positive score on process criteria makes learning very likely. The actual assessment of the desired output, that is, learning is not very often included in evaluations. This may have to do with a lack of criteria for, and experience with, methods to systematically evaluate learning.

At least three criteria are relevant for evaluating learning (Cuppen,

2012a). First, the desired effect of dialogue, namely learning as improved understanding of the diversity of perspectives, must be operationalized. Second, the evaluation should ensure that possible learning effects can be attributed to participation in the dialogue rather than to external factors. This requires the inclusion of a reference or control group, which is salient as dialogues often take place over long time-spans, as a result of which it is difficult to attribute observed changes to participation in the dialogue. Finally, 'congruency' and 'replicability' (based on Dunn, 1997) are needed. Replicability refers to the reliability of methods. A replicable method involves 'specific and readily comprehensible prescriptions for carrying out a sequence of operations' rather than 'general and vague guidelines' as is the case for methods with low replicability (Dunn, 1997). Congruency refers to the validity of methods and was discussed above in terms of fit to the type of problem under investigation.

For reasons of congruency and replicability, Q methodology seems like a suitable candidate to support the evaluation of stakeholder dialogue. The quantitative character of Q methodology means that it has a higher replicability than a qualitative method, as the quantitative elements involve specific prescriptions for carrying out specific procedures. The qualitative character of Q methodology allows for congruency with the level and type of the problem under investigation, for example, by staying close to the phrasing and framing of actual stakeholders.

The Biomass Dialogue

The aim of the Biomass Dialogue was to develop ideas about sustainable biomass chains for the Netherlands, and to identify what is needed in order to realize these chains. A biomass chain covers the lifecycle from biomass to energy: from production of crops or organic waste, via processing and transport, to energy usage. Sustainable energy from biomass can be labelled a wicked problem, as there are many uncertainties and disagreements with regard to the knowledge and values at stake. Values or goals for policy include, for example, security of energy supply, climate change mitigation, sustainability and independence from geopolitically unstable regions. (Scientific) uncertainties relate, for instance, to the CO_2 balance of biomass chains, economic and socioeconomic impacts and land-use changes.

The Biomass Dialogue took place between May 2007 and May 2008 and consisted of a preparation phase and three workshops. It was organized under the umbrella of two different research projects which investigated the implementation of biomass delivery chains and sustainable transport policy. Researchers from these projects formed a project team and were responsible for design and facilitation of the

dialogue. For some parts of the dialogue, external chairs were invited. The first workshop was aimed at analysing the current situation in order to identify the problems that needed to be tackled. In the second workshop a desirable future vision was developed on the basis of specific biomass chains that were proposed by participants. This was taken in the third workshop as a starting point to 'back-cast' (Robinson, 1982; Quist & Vergragt, 2006) the implementation trajectory would be necessary to achieve the future vision.

In addition to the substantive aim of the dialogue to develop ideas about sustainable biomass chains for the Netherlands and identify what is needed in order to realize these chains, there was a methodological aim. This methodological aim concerned the application and evaluation of a methodology for problem structuring in stakeholder dialogue, which had been developed in another research project, labelled the Constructive Conflict Methodology (Cuppen, 2009). This methodology follows the rationale as set out in Cuppen (2012b). The aim of the methodology is to enhance learning in stakeholder dialogue through diversity.

Q methodology was employed in the dialogue with a threefold aim. First, the aim was to select stakeholders for participation in the dialogue on the basis of an empirical analysis of the variety of stakeholder perspectives. Stakeholder selection was supposed to result in the balanced inclusion of the variety of perspectives, including disparate or marginal perspectives. Second, the aim was to structure the dialogue on the basis of the perspectives. Third, the aim was to evaluate learning in the dialogue in terms of changes in Q factors (perspectives). This article reports mainly on the first and third aims.

Stakeholder Selection in the Biomass Dialogue

Methods

About 200 statements were collected as part of the concourse-definition phase. These statements were taken from public debates, reports, newspaper articles and transcripts of a stakeholder dialogue on biomass that was organised earlier by one of the members of the project team. The biomass issue was very topical at the time of the study, which made it relatively easy to find statements that reflected the wide range of ideas and opinions about biomass. Three members of the project team individually categorized the 200 statements, and then identified unique statements within categories. The three categorizations and sets of unique statements were compared and discussed iteratively until sixty-two statements remained. As a check on the Q set, the Q sort was piloted with five people who were all well aware of the biomass debate. This resulted in a definite Q set of sixty statements (see Appendix 1). Furthermore, during the Q-sort interview respondents were asked to

suggest any statements they felt were missing from the Q set. Only a few respondents made suggestions. In all cases, the respondents' proposals were in essence already covered by other statements (for instance, proposals offered a positive statement of an existing negatively worded counterpart).

In order to identify stakeholders to compose the P sample, newspaper articles, news websites and existing networks were used. We contacted people directly as far as possible. In some cases, we contacted organisations to ask which person would be most relevant to interview. Again, due to the topicality of the biomass issue, identifying stakeholders was relatively easy. Snowball sampling was also used. After each interview the respondent was asked to mention someone with a different perspective from theirs on energy from biomass and someone with a similar perspective. This resulted in a group of 75 respondents, which could be expected to include the broadest possible range of perspectives. This number of respondents was deemed necessary to do justice to the richness and variety of viewpoints and interests in relation to bioenergy and because the Q interviews served as preparation for the dialogue, for which we wanted to invite about 40 stakeholders. The latter implied that the P sample had to be sufficiently large ensure this target could be achieved. Respondents originated from different sectors and organizations: knowledge institutes and academia, (energy) companies, industry associations (for example, for oil and fat), small- and medium-sized enterprises (including energy consultants, such as those working on cultivation or treatment of biomass, or on energy, heat, or fuel production), NGOs, and national, regional and local government.

The face-to-face Q interviews took place between August and October 2007 and lasted about 60 to 90 minutes. The Q sort was supplemented by a number of open questions to gather qualitative data for interpretation of the factors. Before the sort, the respondents were asked to explain briefly their ideas on biomass in relation to a sustainable energy supply for the Netherlands. Respondents were then asked to rank-order the statements according to a forced normal distribution with eleven positions from most to least 'according to my point of view'. After the sort the interviewer asked three questions: "Why are these statements at the extremes?", "Are there any statements you think are missing?" and "Would you like to come back to, or add something to your answer to my earlier question about your ideas on biomass?"

PQMethod 2.11 (Schmolck, 2002) was used to analyse the Q sorts. The average correlation between Q sorts was 0.22, indicating the heterogeneity amongst the P sample in terms of their ideas and opinions about biomass. Factor analysis of the correlation matrix was

not straightforward. In order to be able to identify meaningful factors, an iterative approach was followed. Going back and forth from different types of factor extraction and rotation to the qualitative interview data, meaningful factors were eventually identified using the centroid analysis method, and rotated using varimax. Factors were identified that had at least one significant loading. Six factors could clearly be identified and explained with the help of the qualitative interview data. The total variance explained was 46%. Although variance explained is not considered a relevant measure in Q methodology, the relatively low explained variance reinforces the high variation of ideas and viewpoints with regard to biomass, which underlines the complexity and uncertainty with regard to the issue. Of the 75 respondents, 42 loaded significantly on only one factor. Of these 42 respondents, seven respondents loaded significantly on factor 1, 14 on factor 2, three on factor 3, seven on factor 4, seven on factor 5 and four on factor 6. One respondent did not load significantly on any of the factors, and all of the remaining respondents loaded significantly on more than one factor.

Results

The six factors were interpreted based on the factor arrays and the interviews as six distinct perspectives on sustainable biomass (see Table 1). Arrays of differences between factor z-scores were used to further investigate similarities and differences between the six perspectives. These six perspectives reflect sufficiently different perspectives on sustainable biomass. Yet there are also issues of overlap between perspectives. For instance, both perspectives 4 and 5 see biomass as a commodity in a market in which it will eventually compete with fossil fuels, but on the condition that biomass applications have a positive energy balance. Perspective 4 is, however, more positive about the question as to whether this will be feasible and sees the solution in second-generation, certified biomass. Second-generation biomass commonly refers to residuals and waste, or lignocellulose (woody material), and excludes the use of food crops for energy production (which is referred to as first generation). Perspective 5 doubts the feasibility of a positive energy balance, as well as the potential availability of biomass. Perspective 5 is however not as critical as perspective 2, according to which all developments need to be stopped, as we cannot prevent negative impacts for developing countries. Perspectives 3 and 6 are both entrepreneurial perspectives. Perspective 3 is very critical about the role of the Dutch government and policy. Perspective 6 is more pragmatic and less idealistic than perspective 3, according to which the focus should be on small-scale, decentralized applications in the Netherlands. Perspective 6 does not promote a specific scale and type of application.

Table 1: Six Perspectives on Sustainable Biomass

Perspective 1: Keep all options open

This perspective focuses on knowledge development. Generic claims about the sustainability of biomass applications are not possible, because the sustainability of an application is very much dependent on the specific situation. Therefore, it does not make sense to exclude specific options in advance, or to embrace others. Biorefinery (refining biomass in order to use all valuable elements within the biomass) is seen as a promising development.

Statements: agree (+5): 60, 34; agree (+4): 53, 44, 20; disagree (–5): 7, 2; disagree (–4): 23, 22, 27.

Perspective 2: Hit the brakes

This perspective is very sceptical about the possibilities of sustainable biomass applications and calls for a halt. A growing international biomass market increases the risks for developing countries, with regard to environment, socio-economic situation, human rights and food supply. At the moment, there is no biomass that is sustainable for people, planet and profit. As long as we cannot guarantee sustainable biomass, we should halt the development of new applications.

Statements: agree (+5): 40, 2; agree (+4): 1, 29, 21; disagree (–5): 4, 5; disagree (–4): 18, 35, 24.

Perspective 3: Support small-scale innovative initiatives

The third perspective focuses mainly on small-scale and decentralized applications in the Netherlands. Initiatives by small innovative entrepreneurs are hard to get off the ground, because the Dutch government mainly has an eye for the large companies. However, we should not expect innovations from these companies, because they benefit from maintaining the existing fossil fuel based system. We should not keep putting money in research, but rather in implementation.

Statements: agree (+5): 17, 31; agree (+4): 42, 18, 60; disagree (–5): 35, 33; disagree (–4): 23, 49, 55.

Perspective 4: Security of supply with global, certified, 2nd generation biomass

This perspective has a strong market orientation. The most important incentive for the development of biomass applications is the replacement of fossil fuels, i.e. security of supply. This perspective is optimistic about the potential of biomass, especially the 2nd generation biomass, and states as a condition that the sustainability of biomass should be guaranteed by means of a certification system.

Statements: agree (+5): 52, 32; agree (+4): 46, 51, 15; disagree (–5): 33, 38; disagree (–4): 45, 18, 5.

Perspective 5: Efficiency the goal, biomass a means?

According to this perspective, we should not overestimate the potential of biomass. In the future, other renewable sources (e.g. solar, wind) will be better suited for our energy supply, because the availability of those sources is larger. We should be critical about the sustainability of biomass applications: the whole chain should be taken into account when assessing whether there is a positive energy balance. Energy-efficiency is key. Technology and market have not sufficiently been developed.

Statements: agree (+5): 52, 7; agree (+4): 51, 60, 37; disagree (-5): 9, 54; disagree (-4): 33, 23, 45.

Perspective 6: Just do it, step by step

This perspective is pragmatic. It underlines that we cannot know at this moment what will be the best option in the future. This means that we should act now with the knowledge that we have, instead of postponing actions. All options should be kept open; there should be a broad range of applications. The role of entrepreneurs is very important in this perspective.

Statements: agree (+5): 3, 57; agree (+4): 34, 51, 41; disagree (-5):23, 22; disagree (-4): 35, 33, 9.

Earlier in this article it was argued that the identification of perspectives should cover the true range of perspectives, taking into account more marginal perspectives as well. Looking at the six perspectives, we can conclude that the analysis succeeded in doing so. Perspectives 3 and 6 can be considered marginal, in the sense that these perspectives could not be recognized in the dominant political debate on biomass in the Netherlands at that time.

Use of the Results to Select Stakeholders

There are many considerations when selecting stakeholders to participate in a dialogue when the aim is to stimulate learning. It is, for instance, important to cut across networks when identifying stakeholders in order to increase the likelihood that people meet new people. Power relations should also be taken into account, as well as people's willingness to learn. I concentrate here on the criterion of diversity of perspectives in stakeholder selection. Diversity can be defined in terms of three dimensions: variety, balance and disparity (Stirling, 1998). Variety refers to the number of categories, for example the more variety of nationalities there is in a group of students, the more diverse is this group. Balance refers to the distribution of categories. So

when the variety is two, for example, UK and Dutch students, the group of students is more diverse if the number of UK and Dutch students is about equal than when there is only one Dutch student in a group of UK students. Disparity refers to how similar or different categories are. So for example, a group of students from the United Kingdom and Botswana is more diversified than a group of students from the United Kingdom and the Netherlands, as the latter two can be considered more similar.

The literature on how groups share and deal with information and create solutions shows that groups learn more when these three dimensions of diversity are optimized. Heterogeneous groups are more creative and produce better strategies than homogeneous groups (Hoffman, 1959; Hoffman & Maier, 1961). Furthermore, people learn from things that are new to them (Brodbeck et al., 2002), but they should not be 'too new'. This means that it is not only important to include a variety of perspectives in a dialogue, but that particular attention needs to be paid to the inclusion of marginal perspectives, perspectives that are not generally heard in the dominant debate on the issue (see for example, Dunn, 2001). In order to avoid the situation that there is too much disparity, or in other words, that other people's input is *so* new that someone is not able to fit it within existing frameworks and as a result cannot make sense of it, people with bridging perspectives or personalities should also be involved. Also balance appears to be important when stimulating learning within groups. It appears that groups in which variety is balanced are more likely to disseminate unshared information than unbalanced groups (Brodbeck et al., 2002). Furthermore, it has been argued that the balanced inclusion of perspectives reduces groupthink (Janis, 1972; Dryzek & Niemeyer, 2008).

Accordingly, a stakeholder selection procedure should enable a balanced representation of the variety of perspectives, making sure that disparate perspectives are included. Disparate perspectives are often more marginal perspectives that do not link directly to dominant policy discourses. We could see this as a specification of the notion of 'discursive representation' (Dryzek et al., 2008).

Out of the 75 stakeholders who completed Q sorts initially, 40 were invited to participate in the dialogue. For practical reasons, we could have only 30 from 75 respondents taking part in the dialogue (taking into account that not everyone we invited would be able and willing to participate). Following the rationale described above, the stakeholder selection procedure was geared towards diversity: a balanced representation of the variety of perspectives, making sure that disparate (marginal) perspectives were included. Based on the factor loadings we identified the stakeholders with the highest loadings on each of the

factors (and low loadings on the other factors). Furthermore, we identified the respondents who showed large similarities with each of the perspectives, on the basis of the interview data, and who had also agreed to take part in the Biomass Dialogue. These 40 people who represented the six perspectives in a balanced way were invited to take part in the Biomass Dialogue.

Evaluating Learning in the Biomass Dialogue

Method

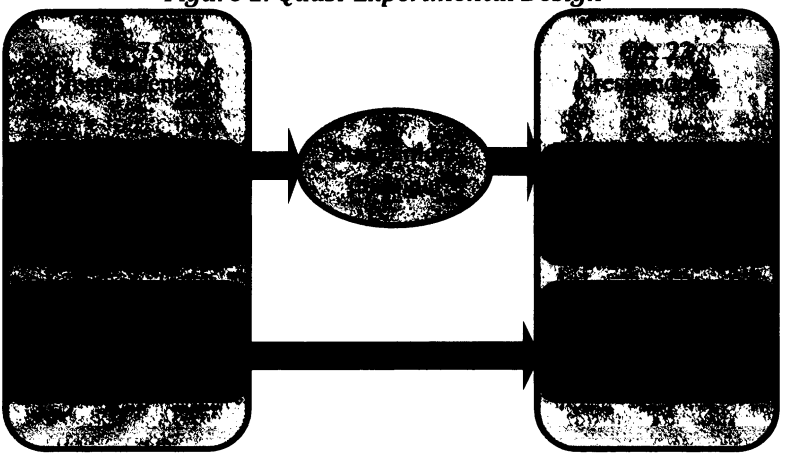
A quasi-experimental design with repeated Q measures was used to evaluate learning in the Biomass Dialogue. A quasi-experimental design is similar to an experimental design in that it includes a control group, but it lacks the key ingredient of an experimental design—random assignment of people to groups. Quasi-experimental designs are used in situations in which it does not make sense, or in which it is impossible, to use randomly selected groups. Participants in the Biomass Dialogue were selected because of their salient perspectives (based on the outcomes of Q methodology). Hence, assignment of participants to the quasi-experimental group was not (and could not be) random.

Twelve participants who attended at least two out of three workshops were invited to participate in a second Q interview after the dialogue (Q2). Eleven, labelled the 'quasi-experimental group' were able and willing to participate in a second Q interview. Of these 11 participants, two loaded on Perspective 1 ('Keep all options open') before the dialogue, five on Perspective 2 ('Hit the brakes'), two on Perspective 3 ('Support small-scale innovative initiatives'), one on Perspective 5 ('Efficiency the aim: Biomass a means?') and one on Perspective 6 ('Just do it, step by step'). Unfortunately, no participants from Perspective 4 ('Security of supply with global, certified, 2nd generation biomass') were involved in the Q2 interviews, as none of them took part in at least two out of three workshops. The control group was formed as follows. For each of the twelve Q2 participants, a respondent was identified whose initial Q sort (Q1) correlated most strongly with the initial Q sort (Q1) of the Q2 participant, but who had *not* participated in the Biomass Dialogue. So, each person in the control group was involved in the first round of interviews, but was not subjected to the intervention (the dialogue). Twelve non-participants were able and willing to participate in a second Q interview (see Figure 1).

The second round of Q sorts took place in July and August 2008. Interviews were conducted by telephone. After the appointment was made, the interviewer sent the Q statements and the Q-sort grid, printed on a sheet of paper, to the respondent. The Q statements and grid were

identical to those in the first round of Q interviews (see the previous section). When finished with the Q sort, respondents were asked by the interviewer to explain their opinions regarding the statements that were at the extremes of the distribution. Furthermore, the interviewer compared each Q sort with the first-round Q sort of that respondent. Where there were notable differences the respondent was asked to explain this.

Figure 1: Quasi-Experimental Design



In line with Brown (1977) and Niemeyer (2002, 2004), the 23 Q2 sorts (11 from quasi-experimental and 12 from control group) were added to the 75 Q1 sorts. This resulted in a total dataset of 98 Q sorts. To analyse changes with regard to the perspectives identified before the dialogue, six new factors were retrieved from this extended dataset by means of a Q-factor analysis in PQMethod, using centroid analysis and varimax rotation.

The six Q factors were extracted in the same way as in the Q analysis before the dialogue. To validate the new factors, correlations between the new factors and those identified before the dialogue were calculated in SPSS (the correlations for each for factors 1 to 6 were: 0.92, 0.97, 0.87, 0.94, 0.82, 0.74). These correlations and the defining statements suggest that the new factors can be interpreted as similar to the six perspectives as identified before the dialogue.

Data were analysed at the level of individuals and at the aggregate level. In order to analyse the overall effect of dialogue participation the main focus in the analysis is at the aggregate level. The analysis at the individual level concentrated on the number of significant changes in factor loadings (Q2–Q1) on each of the six perspectives, for the dialogue

and the control group (for more individual level results, see Cuppen, 2012a). As for the analysis of the overall effect of dialogue participation, a multivariate analysis of variance (MANOVA) was conducted in SPSS (this analysis is appropriate for a repeated measures design with two or more independent variables, and is an extension of univariate analysis of variance [ANOVA]). The MANOVA included three independent variables. The first (between subjects) independent variable is the 'group' variable and has two levels: 'dialogue group' and 'control group'. The second independent (within subjects) variable is the repeated Q variable and also has two levels: 'before the dialogue (Q1)' and 'after the dialogue (Q2)'. The third independent (within subjects) variable is the factor variable and has six levels: factor 1 to factor 6. The dependent variable is the factor loading on each of the six perspectives before (Q1) and after (Q2) the dialogue (see Appendix 2, notes 1 and 2.)

Results

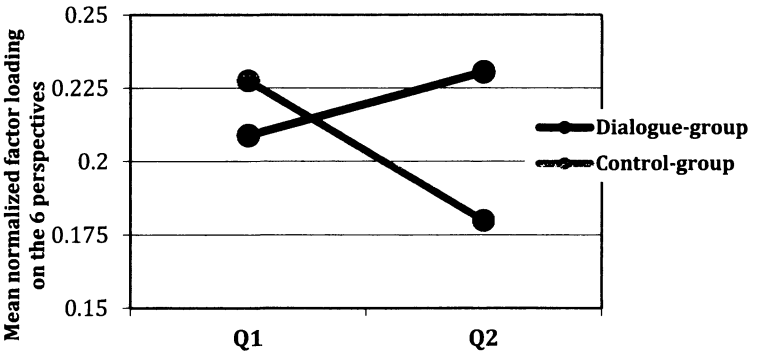
The analysis on the level of individuals shows among other things that the number of significant changes is higher for the dialogue group (8) than for the control group (5). It also shows that for participants the changes mainly concern *increased* factor loadings (6 out of 8), whereas for non-participants it only concerns *decreased* factor loadings. These results not only show that more participants than non-participants significantly changed in terms of the factor loadings on the six perspectives, but also that these changes in general concern increased agreement with the perspectives for participants, whereas they concern decreased agreement with the perspectives for non-participants.

None of three main effects in MANOVA appears to be significant (see Appendix 2, note 3). Out of the four interaction effects, the interaction effect of the 'group' variable and the 'repeated Q' variable is significant [$F(1,21) = 16.91$, $p < .01$] (see Appendix 2, note 4), which indicates that there is a significant difference between the dialogue group and the control group regarding the relation between their pre- and post-average factor loadings. Figure 1 shows the average Fisher's z-score of the dialogue group (black line) and the control group (grey line) before (pre) and after (post) the dialogue. The Y-axis represents the mean normalized factor loading on the six perspectives. This value is calculated as the mean of the six normalized factor loadings, averaged on the level of groups (dialogue and control). Hence, it is the average agreement of respondents averaged over the six perspectives. On the X-axis are the two measurements: before (pre) and after (post) the dialogue.

Figure 2 shows a clear effect. For the dialogue group the mean normalized factor loading increases, whereas it decreases for the control group. Hence, on average, the agreement with the six perspectives

increases for the dialogue group, whereas it decreases for the control group (See Appendix 2, note 5).

Figure 2: Comparing Dialogue and Control Group Mean Normalized Factor Loadings (Cuppen, 2012a)



The significant interaction effect from the MANOVA shows that participants were able to use the six perspectives to get to grips with the complexity of the issue. In fact, participants used the perspectives to impose structure upon the sixty Q statements. This contrasts with the control group and is consistent with the qualitative finding from the evaluation of the Biomass Dialogue that participants found the perspectives helpful in getting to grips with the complexity of the issue.

Based on the above analysis it can be concluded that participants gained a better understanding of the diversity of perspectives as a result of taking part in the dialogue (Cuppen 2012a).

Discussion and Conclusions

This article started by describing the notion of wicked policy problems. Policy as learning is adopted as a policy approach to deal with wicked issues. Stakeholder dialogue is a vehicle to inform policy making on wicked issues through problem structuring. Q methodology has been presented here as an appropriate method to select stakeholders on the basis of their perspectives and to evaluate learning.

The stakeholder selection procedure based on Q methodology allowed for the inclusion of stakeholders who truly diverge in terms of their perspectives on sustainable biomass, rather than using an inaccurate proxy (such as affiliation). Participants were invited in such a way as to include the variety of perspectives in a balanced way, including more marginal (disparate) perspectives. The repeated Q measures in a quasi-experimental design showed that the dialogue had a learning effect: participants gained an improved understanding of the

diversity of perspectives.

At least four other studies have relied on repeated Q measures to investigate the effect of a participatory process (Niemeyer, 2002; see also 2004; Walton, 2012; Pelletier et al., 1999; Raadgever, 2009). These studies have shown that repeated Q measures can provide good insights into shifts in factor loadings and factor solutions. Niemeyer's study (2002) is quite similar to the present study in that its emphasis is both on the methodological design of the dialogue (a citizens jury deliberating policy options for the Bloomfield Track, a controversial road within a World Heritage-listed rainforest) as well as on its effect in terms of changes of perspectives. Niemeyer concludes that there was a significant change in the participants' perspectives as a consequence of their participation in the citizens jury. His study did not include a control group. As a consequence, this conclusion should strictly speaking be made with some caution. The intervention, the citizens jury, covered a four-day period, in which (also) external events may have contributed to changes in perspectives. Also the study by Pelletier et al. (1999) had an emphasis on design of the dialogue (a 'search conference', which seems similar to participatory scenario or back-casting workshops, on scenario development for the local food system) but does not include a control group. As there were several weeks in between administration of the ex-ante Q interviews and the dialogue, and again several weeks in between the dialogue and administration of the ex-post Q interviews, there may have been all kinds of external factors in place.

Both Walton's (2012) and Raadgever's (2009) studies evaluate the effect of dialogue, without emphasis on the methodological design of the dialogue, but with inclusion of a control group. Walton's study (2012) was set up as an experimental design, in which the intervention entailed watching a video about the different viewpoints on policy for a coastal plain in Alaska (to create an oil reserve or designate it a wilderness area) and participating in a follow-up group discussion. Walton's purpose in including a control group in Walton's study was different from that in this study. Walton used the control group to test whether the ex-ante Q sort had an effect on the ex-post Q sort. The control group did not participate in the ex-ante Q interviews, but only in the ex-post interviews. As Walton found that the ex-ante Q interviews did not influence the ex-post Q interviews, and hence a test effect could be excluded, the analysis of changes was based solely on the Q interview data of the dialogue group. Changes for the dialogue group were not (could not be) compared to changes for the control group. Raadgever's study (2009) focuses on analysing changes in individual Q sorts as a result of two dialogue projects (one on future flood management in the Lower Rhine basin and one on groundwater management in Delft, the Netherlands). His study included a control group, which conducted both

ex-ante and ex-post Q interviews. Raadgever's level of analysis is different from the one in this study, as he focused on individual Q sorts rather than factor loadings on all factors (perspectives). He calculated correlations between individual ex-ante and ex-post Q interviews to analyse the number of significant changes of individual Q sorts, both for the dialogue and the control group. His analysis does not include measurement of significance of differences between the changes for the dialogue and control group, nor analysis of the question whether the dialogue and the control group were comparable samples at the time of the ex-ante Q interviews. Hence, although a control group was included, his statistical analysis strictly speaking does not allow for drawing conclusions about the effect of the intervention, namely, participating in the dialogue.

In conclusion, this repeated-measures study contributes to the work that has been done so far in four main ways. Firstly, this study was set up to evaluate a methodological approach to stakeholder dialogue. Hence, emphasis was both on the methodological design of the dialogue as well as on the evaluation of the methodological design. Secondly, the repeated Q analysis was applied in a quasi-experimental fashion that included a control group to investigate participants' changes in perspectives. Importantly, effort was put into composing a control group that was comparable to the dialogue group in terms of ex-ante Q sorts, which is necessary in order to exclude the possibility that external factors caused observed changes. Thirdly, the statistical analysis involved an analysis of significance of the effect of dialogue. The multivariate analysis of variance made it possible to statistically examine the comparability of the dialogue and the control groups in terms of their perspectives before the dialogue and whether changes in perspectives for the dialogue group were significantly different from the changes for the control group. Only when these two things have statistically been affirmed can changes be attributed to the intervention, that is, to participation in the dialogue. Fourthly, the repeated Q analysis was triangulated with qualitative data from the dialogue, specifically evaluation forms and observations from the project team. This triangulation enabled an analysis of which elements within the dialogue design were critical and contributed to the identified effects.

It is important to emphasise that Q was not only a method for analysis and evaluation, but also an intervention method. Not only were participants selected on the basis of the Q perspectives, but the perspectives also ran as a thread through the whole dialogue. Participants were presented with the perspectives through a report and they were repeatedly, and in different ways, confronted by and working with the perspectives. In the first workshop, the perspectives and participants' positions with regard to the perspectives

were presented to and discussed with the participants. The perspectives were furthermore used to structure the workshops. This included the formation of subgroups of 'like-minded' people for specific tasks and exercises in the dialogue, such as elaborating upon argumentations for the sustainability of specific biomass chains. Hence, diversity of perspectives was emphasized throughout the dialogue, as a consequence of which participants felt that they were 'allowed' to disagree. Also in the synthesis reports that were composed after each workshop analyses were made in relation to the perspectives. In this way, participants made themselves familiar with the perspectives and consequently used them in their thinking about the complex biomass issue. From the qualitative evaluation (evaluation forms, personal communications and an additional meeting) it appeared that stakeholders found the Q perspectives helpful for understanding the complexity of the biomass issue. When asked to indicate what they learned, participants often made referrals to other people's perspectives, ideas, and information. One participant stated for instance after workshop 1: '[I now have] a better understanding of the perspectives on the basis of which people talk about biomass'. Another participant stated: 'Even Shell thinks in a nuanced way' and 'let's think from another perspective'. And after workshop 3 participants indicated, for instance, that they learned 'about the diversity of understandings', 'about the perspective of other stakeholders, deepening and broadening of "my" environment perspective', and that they learned 'to listen'.

This immediately points to the need to combine a quantitative evaluation based on Q methodology with a qualitative analysis. The evaluation of learning as presented in the previous section is a sophisticated quantitative analysis, with clear advantages (such as ruling out the contribution of external effects). However, a good understanding of the quantitative results and translation of these results into recommendations for the design of stakeholder dialogue cannot be achieved without qualitative analysis.

The roles for Q as presented in this article are different in character. The identification of perspectives pertains to the 'traditional' role of Q as a sense-making methodology. In that role, it helps to map out and understand different perspectives, and the relations between people and those perspectives. Q has been applied in a more instrumental manner in the selection of stakeholders and the evaluation of learning. How this relates to and builds on the philosophy of Q methodology is a matter for further discussion. Yet in the field of public policy, in particular public and stakeholder participation, there is still a lot to gain in terms of (congruent and replicable) methods and tools. Q methodology is an important addition and unparalleled contribution to the toolbox of scientists and practitioners working in this field.

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Appendix 1: Q Statements

1 If the complete lifecycle is taken into account in the analysis, biofuels do not reduce as much greenhouse gas emissions as was hoped for.

2 If biofuels are being stimulated in the EU, this will definitively result in negative impacts on environment, socio-economic conditions, violation of human rights and food shortages in developing countries.

3 If there are no entrepreneurs who want to experiment with biofuel applications, nothing will happen.

4 If we want, we can drive clean and fly clean now with biofuels.

5 Within the Netherlands and the EU, the production of rapeseed oil should be taken seriously.

6 Bio-ethanol is more promising than biodiesel, because there are more possibilities for improving the process and the efficiency with ethanol.

7 Biomass is a temporary solution; in the end, solar and wind should be the main energy sources.

8 Algae are the biomass source of the future.

9 Biomass should be used only for electricity production and heat supply, not for transport fuels.

10 Bio-refining offers huge opportunities for small-scale and regional sustainable developments.

11 Criteria will not prevent that in the future there will be a number of large agro-companies, which supply biomass without taking social and environmental interests sufficiently into account.

12 Tax on fossil fuels should be increased.

13 The most important obstacle for biofuels is not the conversion, but the uncertainty in the future supply of biomass.

14 The availability of private capital is at the moment not a limiting factor for the development of a large-scale bio-based energy supply.

15 The competition between food, feed, and fuel will have a negative financial impact on people.

16 The European blending targets, such as 5.75% in 2010 and 10% in 2020, require significant import volumes from countries outside the EU.

17 The Dutch government mainly has an eye for large companies; there is not enough attention and support for small, innovative players.

18 The Dutch government should give tax exemption for biofuels.

19 The potential of degraded and marginal soils is so large that it can mean an economic boost in rural areas.

20 The issue of unsustainable land-use, for example in South America, Africa and South-east Asia also exist without biomass production.

21 The production of biomass is only sustainable if it contributes to the social-economic development of the local community.

22 The production of biomass should be restricted to within the EU to be able to control sustainable preconditions with regard to society, economy and the environment.

23 The cultivation of energy crops in the Netherlands will make the landscape monotonous, attract harmful insects and spread a dirty smell.

24 The cultivation of energy crops contributes to a colourful landscape and to the bee population.

25 The time of large-scale is over; we need flexible, decentralized energy systems.

26 Every form of subsidy on imported biomass should be stopped.

27 Cultivation of energy crops is not favourable because manure and irrigation are needed.

28 Cultivation of energy crops for the 2nd-generation biofuels will cause much less problems in developing countries than for the 1st- generation crops.

29 There is a need for generic policy aimed at all clean and efficient vehicles, instead of a policy that is aimed specifically on biofuels.

30 If the European fuel has to meet higher standards than the American, this results in unfair competition.

31 Too much money goes to research, and too little to implementation in the market.

32 Biomass delivers an important contribution to the security of supply, namely less dependency on geopolitical sensitive areas, and a higher degree of self-sufficiency for the EU.

33 Given the pace of the development towards more efficient cars, maybe we don't need biofuels for transport.

34 The distinction between 1st- and 2nd-generation is not as black-and-white as is often posed.

35 There is no use to develop niche markets; in the end we need large-scale biomass applications, and that niche won't help to reach that.

36 Stimulating biofuels has more to do with agricultural policy than with environmental policy.

37 The precarious Dutch energy policy has led to stagnation of the market development concerning biomass.

38 Biofuels can only succeed if the government subsidizes until the end of time.

39 Importing of end- or half-products is preferable to importing raw biomass.

40 In the formulation of criteria for certification of biomass stakeholders from the South should also be involved.

41 In the Netherlands, biofuels are discriminated against compared to fossil fuels when it concerns the calculation of CO_2 emissions.

42 Small-scale energy production with biomass can give a huge boost to security of supply in developing countries.

43 The Netherlands can supply a significant proportion of homes with sustainable energy by means of local residuals.

44 The Netherlands is strong in knowledge development in the area of biomass technology.

45 Dutch farmers will not benefit from a growing use of biomass.

46 Political pressure, at minimum on the EU level, is needed to make sustainability criteria function.

47 Because stakeholders did not succeed in forming a successful lobby, there is insufficient support for the development of biomass technologies.

48 Because the CO_2-reduction potential of 1st-generation biofuels is limited, we should not invest in 1st generation, but in 2nd generation.

49 Because, as a small country with limited means, we are forced to make choices, the government should support only the most favourable options.

50 Entrepreneurs are not only competitors: cooperation is required to learn from, and support each other.

51 In the long run, biofuels will compete on the world market with fossil fuels.

52 Over the whole biomass chain, there should be a positive score as regards economic profit, energy and CO_2 balance.

53 First, try to make high-quality products from a biomass source, and make energy from what is left.

54 Public resistance is an obstacle for local biomass applications.

55 Technology development is the key to large-scale use of biomass, not an active subsidy policy.

56 2nd-generation biofuels profit from stimulating the 1st-generation fuels (E85 and diesel variant E95) now.

57 2nd generation biofuels are for the time being not ready for large-scale application.

58 Consumers and end-users are increasingly interested in biofuels.

59 We can never compete on price with biofuels that are made in developing countries.

60 We should concentrate on the use of residuals for biofuel production.

Appendix 2: Technical Notes

1 A 'between-subjects variable' is varied *between* respondents rather than *within* respondents. That means that respondents are subjected to only one of the levels of the variable. The 'group' variable in this design is a 'between-subjects variable' because respondents belong either to the dialogue group or to the control group. This is in contrast to a 'within-subjects variable'. In the case of a 'within-subjects variable' respondents are subjected to all levels of the variable. The repeated Q variable and the factor variable are both 'within-subjects variables' because each respondent has Q- sort data for Q1 as well as for Q2, and for each of the six factors respectively.

2 An analysis of variance requires normally distributed data, and as factor loadings are not normally distributed, the factor loadings are first transformed into Fisher's z-scores. For this, the following formula was used (Brown, 1977):

$z_x = 1.15129 * \log\left\{\frac{(1+f_x)}{(1-f_x)}\right\}$ in which f_x is the factor loading on perspective x, and z_x the transformed Fisher's z-score for perspective x.

3 Main effects: 'factor': $F(5,105)=1.05$, n.s.; 'repeated Q': $F(1,21)=2.38$, n.s; 'group': $F(1,21)= .71$, n.s

4 Interaction effects: 'factor' x 'group': $F(5,105)=0.15$, n.s; 'factor' x 'repeated Q': $F(5,105)=1.01$, n.s; 'factor' x 'group' x 'repeated Q': $F(5,21)=0.27$, n.s.

5 Additional simple main effect tests in SPSS show firstly that the dialogue group and the control group were comparable samples before the dialogue (i.e. not different in terms of their mean normalized factor loading). Secondly, they show that after the dialogue, the dialogue group and the control group are significantly different in terms of their mean normalized factor loading. Thirdly, the tests show that the increase for the dialogue group is significant and, fourthly, that the decrease for the control group is significant.

A question that comes up when looking at Figure 2 is why the control group *decreased* in their average loading on the perspectives. After all, if nothing had changed for them, the line would have been horizontal. A hypothesis is that this has to do with the media attention to the biomass issue. In the year between the two Q interviews much negative news appeared, mainly in relation to the food crisis. At the same time, attention to climate change and security of supply had increased. As a result of this, the ideas may have become more diffuse. In contrast to the dialogue group, the control group could not use the six perspectives to get to grips with the biomass issue. The diffuse image may have been translated into a decreased agreement with the six perspectives.