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**MOBILISING HIGH-QUALITY KNOWLEDGE
THROUGH DIALOGIC ENVIRONMENTAL GOVERNANCE:
A COMPARISON OF APPROACHES & INSTITUTIONAL SETTINGS**

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Abstract

Associated with the willingness to classify environmental issues as 'wicked', is a wavering of confidence in analytical models of 'resource management' in favour of social process models of 'environmental governance.' There is an attendant shift in epistemological perspectives for the mobilisation of knowledge in support of society's collective deliberation and decision-making, with governance fields increasingly espousing a 'dialogic' approach. Looking through an 'interactive governance' lens, this article highlights the diversity of different forms of dialogue for the mobilisation of knowledge, before focussing on those forms that: (a) are inclusive of a wide spectrum of knowledge systems; (b) bring together knowledge through reciprocal dialogue; and (c) allow for the negotiation of knowledge quality in terms of 'credibility, salience and legitimacy.' It then unpacks and compares three specific approaches for the dialogic mobilisation of knowledge; deliberative democracy, collaborative learning and post-normal science, and suggests a dialogue framework that highlights the strong points of each as credible, legitimate and salient relative to limitations or 'blind spots' of the others.

Keywords:

Collaborative learning, Deliberative democracy, Dialogue, Environmental governance, Epistemology, Knowledge quality, Post-normal science

Résumé

Dans la mesure de l'acceptation d'une caractérisation des enjeux de changement environnementaux comme 'méchants', on constate un affaiblissement de confiance aux modèles analytiques de 'gestion rationnelle de ressources naturelles' et une disponibilité croissante vers des approches de la 'gouvernance environnementale' en termes de processus social. Il y a, par corollaire, un changement de perspective épistémologique concernant la mobilisation de connaissance pour aider la décision et la délibération collectives, avec la tendance vers des approches 'dialogiques'. Le présent article, dans une perspective de 'gouvernance interactive', insiste tout d'abord sur la diversité de formes de dialogue pour la mobilisation de connaissances avant de focaliser sur des formes qui (i) se veulent inclusives d'une large spectre de systèmes de connaissance ; (ii) visent à réunir de disparate contributions à la connaissance par mécanismes de dialogue réciproque ; et (iii) soutiennent la négociation en société de la qualité de connaissance en termes de crédibilité, saillance et légitimité. Ensuite, il expose et compare trois approches spécifiques pour une mobilisation dialogique de connaissance — la démocratie délibérative, l'apprentissage collaboratif et, la science post-normale — et, suggère un cadre dialogique qui met en évidence les points forts de chacune (comme crédible, saillante et légitimé) relatifs aux limites et points d'aveuglement des autres.

Mots Clés:

Apprentissage collaborative, Démocratie délibérative, Dialogue, Epistémologie, Gouvernance environnementale, Qualité de connaissance, Science post-normale

1 Introduction

As Socrates argued that he is wise who first admits ignorance, so post-modernity has seen a growing realisation of our ignorance in governing a complex world. But how do we get beyond nihilism and despair to mobilise knowledge as best we can to make better informed collective decisions as a society? What is the most effective ‘epistemology,’ or ‘way of knowing,’ for producing credible, salient and legitimate knowledge in support of decision-making? This article explores approaches to environmental governance that mobilise ‘high quality’ knowledge through inclusive and integrated dialogue across diverse perspectives, to fuel deliberation for collective decision-making.

Increasingly environmental governance thinking has started from a complex model of the world wherein Rittel’s (1973) ‘wicked problems’ are less the exception and more the rule (see e.g. Jentoft and Chuenpagdee (2009)). Such issues have been classified differently by different commentators across different fields of scholarship, but invariably they are represented by three broad properties (Amin and Hausner, 1997, Voß et al., 2008, Koppenjan and Klijn, 2004, Funtowicz and Ravetz, 1993): (a) Significant uncertainty (or indeed ignorance) associated with the issue; (b) A lack of consensus on the definition of the issue and its most appropriate ‘solution,’ owing to a plurality of legitimate yet intractable perspectives within society; and (c) The governing system as a complex network of political interactions between stakeholders, pressured by urgency and high stakes. The degree of uncertainty and unpredictability attached to the many possible future trajectories of these issues means the ‘modernist’ concept of ‘resource management’ – setting a future outcome and evaluating effective progress towards it – becomes more and more unlikely (O’Connor et al., 1996, Holling, 1995). Rather the future is continually ‘becoming’ through every choice made, at the expense of infinite other forgone futures (Funtowicz and O’Connor, 1999). As such, the latter half of the 20th Century saw a wavering confidence in the modernist model of Nature and its science-centric management, and an increasing appreciation for ‘governance’ models. Such models extend legitimacy beyond scientists and technocrats to a plurality of legitimate stakeholder perspectives on an issue, deliberated across diverse high-stakes institutional settings, in what governance writers like Kooiman (1999) label the ‘governing system.’ This necessitates the creation of adaptive settings for inclusive and integrated dialogue across all governing system stakeholders; including, (i) state actors, (ii) civil society, (iii) the private sector, and (iv) the scientific community. Society’s collective deliberation and decision-making becomes the culmination of all stakeholder interactions within and across multiple institutional settings.

Accompanying this debate on the most effective means of environmental governance in the face of wicked problems is an equally vigorous debate on the best means for mobilising the ‘high quality’ knowledge needed to support society’s collective deliberation and decision-making, and how this seemingly innocuous concept of ‘quality’ is determined. As Reid et al (2006) note, high quality knowledge does not guarantee better choices will be made, but it does provide a sound basis for making better decisions, and for holding decision-makers accountable. Cash et al (2003) and the US National Research Council (2007) note (as has been variously described elsewhere), to be useful in a

deliberative setting, knowledge needs to be (i) credible in terms of trustworthiness; (ii) salient to the issues; and (iii) legitimate in terms of the fairness and openness of the process in which it was generated and communicated. These three criteria form a very general measure of quality in the absence of any contextual and grounded measures, but will suffice for the theoretical discussion within this paper.

Funtowicz and Strand (2006) explain how in the modernist tradition the world is modelled as potentially completely knowable, with scientific research deemed the best means to access credible, salient and legitimate knowledge to allow decision-making in light of 'perfect knowledge.' All other forms of knowledge thus have their quality measured relative to the robust criteria of science. However, facing wicked problems necessitates reflection on how we as humanity talk about 'knowing' Nature; are we able to loosen our Cartesian standards of knowledge to accommodate inherent uncertainty and relativity? This has implications for who governs and who provides knowledge in support of decision-making, given a complex system cannot be completely 'known' from the reductionist scientific perspective alone, irrespective of how robust the method. Those writing on environmental governance, such as Reid et al (2006), and Berkes (1999), therefore recommend a dialogic epistemology; bringing together a plurality of perspectives from across diverse knowledge systems, including local and indigenous knowledge for example, within institutional settings that nurture reciprocal dialogue. In this way stakeholders collectively define the issue and what constitutes credible, salient and legitimate knowledge.

Within the wider auspices of dialogic governance one can conceive of multiple institutional settings that variously frame dialogue for governance, which while complimentary, are derived from different philosophical foundations and place emphasis on different aspects of dialogue. This article specifically explores those institutional settings that:

- (a) mobilise knowledge through dialogue to support decision-making for wicked issues;
- (b) are inclusive of the plurality of knowledge perspectives;
- (c) integrate plural perspectives in co-existence through reciprocal dialogue;
- (d) Allow for the collective negotiation of knowledge quality according to credibility, salience and legitimacy.

To this end, it introduces a 'tetrahedral' framework to differentiate across the various forms of dialogue between the four key sectors of governing system actors; whether it be across the 'science-policy interface,' within the 'co-management' arena, or through 'social learning' for instance. Following this conceptual framework, three specific perspectives are unpackaged; (i) Deliberative Democracy, (ii) Collaborative Learning and (iii) Post-Normal Science. The article finishes by comparing and contrasting these approaches and their institutional settings in terms of the way they mobilise credible, salient and legitimate knowledge for decision-making.

2 *Epistemological approaches to environmental governance: From Technocratic to Dialogic*

2.1 The emergence of dialogic governance

When looking at the nature of knowledge for environmental governance, a natural starting point is with the broad dichotomy between what Fuller labels the 'philosophical' and the 'sociological,' or dialogic, paradigms (for a comparison see Fuller (2007)). The Cartesian 'philosophical' paradigm is at the basis of 'normal science,' as observed by Kuhn (1962), with particular influence over the way knowledge is represented in the natural sciences. This paradigm seeks to gain universal knowledge of the world by collecting knowledge according to a logical positivist epistemology, which places emphasis on objective observation, guided by a strict normative code. It operates according to an ontologically realist model of the world as stable and linearly determinant, with actors said to always act in an instrumentally rational manner. According to a number of authors, including Ravetz (1971), Funtowicz and Strand (2006), and Allison and Hobbs (2006) for example, this scientific paradigm has gained prominence throughout the Enlightenment to become perceived as the most valid form of knowledge for modernist resource management. Thus governance since the Enlightenment has been described, by Friedmann (1987) and Allison and Hobbs (2006) for example, in terms of the interplay between science, a technocratic 'command and control' state structure, and representative democracy, according to two closely related streams of thought; 'social reform' and 'policy analysis.' Both have a positivist epistemology that it is better to arrive at decisions through imperfect science than through fickle unmediated politics (Friedmann, 1987, Sarewitz, 2004). As a consequence, where a problem persists, it can always be overcome through the collection of more science (Sarewitz, 2004).

Counter to the positivist epistemology is the paradigm of knowledge as socially derived, as encapsulated within Hegel's idea of 'dialogic knowledge' and continued through sociology (Fuller, 2007), which has gained credence through the post-modern movement. Rather than prescribing normative standards for how knowledge 'ought' to be collected, it seeks to describe how knowledge 'is' negotiated in political arenas, and explore the diversity of subjective knowledge perspectives. The sociological paradigm argues that all knowledge is normatively loaded; with the validity of knowledge judged according to the quality of the social negotiation, rather than logic or rationality. Its epistemology, and indeed in the extreme its ontology, is relativist; arguing that knowledge is fluid and contextual rather than universal. By viewing knowledge as socially derived, rather than an exercise in objectivity, this ceases to give preference to any one group of stakeholders or their knowledge system; all forms of knowledge are extended a degree of legitimacy. This is particularly the case where an issue can be described as complex, uncertain, or 'wicked;' given no one perspective can possibly have access to the totality of knowledge. With a plurality of legitimate knowledge systems, rarely in agreement, the knowledge used to inform decision-making must be negotiated as evidence for value-positions within a political arena.

By accepting that there are a plurality of perspectives of reality rather than one universally 'true' version, this introduces another challenge as raised by O'Connor (1999); how best to integrate, or bring together, diverse perspectives? O'Connor discussed two contrasting notions of reconciliation. The 'Laplacian' perspective attempts to reconcile different perspectives within a single internally consistent framework, in some ways simulating the Cartesian epistemology, with perspectives assembled to build a single, collective, socially sanctioned version of reality. Alternatively, the 'Dialogical' perspective relativises the plurality of perspectives in co-existence and collective understanding. It accepts that the multiple perspectives in society are often irreducible to one single vision, or immeasurable according to one measure of validity, and allows them to exist side by side.

Friedmann (1987) notes that last century saw 'dialogic' governance gain prominence, which sought to incorporate multiple perspectives through inclusive and integrated deliberation for collective decision-making. Based more in the 'sociological' epistemological traditions, with influences from Dewey's pragmatism and Marx's social criticism, Friedmann termed this broad stream of governance 'social learning.' The broad concept of 'governance as dialogue' (or interaction) developed to a large part in reaction to the perceived inadequacy of the technocratic model to cope with complex and uncertain, or 'wicked' issues, and inspired parallel developments across a number of fields. These developments included within fields focused on facilitating one specific form of dialogue within one specific institutional setting, such as through; planning (see e.g. Innes and Booher (2004), and Lane (2005)), policy analysis (see e.g. Colebatch (2005)), deliberative democracy (see e.g. Dryzek (2002)), post-normal science (see e.g. De Marchi and Ravetz (1999)), corporate social responsibility, and collaborative learning (see e.g. Keen, Brown and Dybal (2005)). It also included more comprehensive governance models, which sought to construct an integrated composite of all different forms of dialogue across multiple institutional settings, including; interactive environmental governance theory (see e.g. Jentoft (2005), Kooiman and Bavinck (2005)), governance of the 'commons' (see e.g. Ostrom (1990)), institutional ecological economics (see e.g. Paavola and Adger (2005)), adaptive governance (see e.g. Armitage (2005), Berkes, Colding and Folke (2003)), and other 'applied' environmental governance fields such as Integrated Coastal Management (see e.g. Glavovic (2008), Jentoft and Chuenpagdee (2009)).

2.2 The multiple imperatives for dialogic governance

Those writing broadly on 'governance as dialogue' describe it as a multi-faceted approach for addressing 'wicked problems.' Importantly, dialogue is understood as the totality of governance; with the interactions to mobilise knowledge for governance inseparable from the political interactions over values, which are inseparable from the interactions that put knowledge and values into action. Therefore dialogue is at once an inclusive and integrated epistemological approach, an exercise in democracy, and the basic unit within a formal decision-making process (see e.g. Amin and Hausner (1997), Kooiman and Bavinck (2005)). Advocates of dialogic governance therefore point out that there are multiple imperatives for dialogic governance, (see e.g. Pahl-Wostl (2002, , 2005), Reid et al (2006)), with these imperatives corresponding loosely to the three facets of 'wicked problems' discussed in the introduction:

- (1) *Substantive imperative to address uncertainty*: given wicked problems are likely to have some facets that are fundamental unknowable according to scientific standards, in epistemological terms the inclusion of multiple perspectives is likely to yield a broader and more complete knowledge of the issue.
- (2) *Normative imperative to address plurality*: by maximising participation according to democratic principles, all values are given consideration, the decision-making process is legitimised and decision-makers are held accountable.
- (3) *Instrumental imperative to address high-stakes politics*: the participation of diverse actors within a governance system increases communication and understanding; building trust, reducing conflict, improving chances for consensus, and aiding the implementation of decisions into action.
- (4) *Social Learning imperative encouraging participants to learn about the issue, other actors values, and the decision-making process*: many governance writers, particularly those writing on adaptive governance, emphasise that within a complex world where change is inevitable though unpredictable, 'learning-based' adaptation is the only realistic governance option open to society.

2.3 Ensuring high quality knowledge through a dialogic epistemology

While accepting that all dialogue is loaded with values, politics and power, this article focuses specifically on how high quality knowledge is mobilised within dialogic governance settings to support collective deliberation and decision-making; *the substantive imperative*. As noted, this article discusses quality broadly in terms of *salience*, *legitimacy* and *credibility*. In general dialogic models of governance, with their dialogic epistemology, tend to (a) represent an inclusive approach to knowledge collection, which (b) attempts to integrate diverse perspectives through principles of reciprocity and co-existence, and (c) negotiate the quality of knowledge according to the above three criteria. Firstly, by including diverse perspectives, dialogue increases the amount of salient knowledge within a context, with Fabricus et al (2006) showing that local and indigenous systems of knowledge are often more 'fine-grained' at the local scale than formal science for instance. Secondly, the incorporation of multiple knowledge systems lends legitimacy to decisions, such that stakeholders are accepting of decisions and their rationale. If a local governing system is mobilising knowledge for decision-making, then the local problem definition is likely to be defined as more legitimate than a scientifically derived one for example. Thirdly, dialogue improves the credibility of the knowledge, with stakeholders able to negotiate the trustworthiness of knowledge, communicate any areas of uncertainty, and where there are conflicting accounts, which perspective should be used to support decisions (Fabricus et al., 2006). However, it would be a mistake to assume that dialogue for governance is uniform.

3 Navigating the environmental ‘governing system:’ classifying the diversity of dialogue and institutional settings

3.1 Environmental governance through the lens of ‘interactive governance’

As noted, concepts of ‘governance’ have grown in popularity with an increasing awareness that the state is not the only crucial actor in addressing wicked problems; that many issues are complex and inter-linked, meaning that different societal actors are similarly interdependent. Kooiman (1999), a leading governance theorist, noted that this popularity has translated into multiple different interpretations of the term ‘governance’ across at least 11 disciplines (as touched on in Section 2.1 above). This article will describe governance in terms of ‘interactive’ or ‘social-political’ governance, as developed by Kooiman (1999). This model of governance usefully reveals the diverse forms of dialogue that constitute society’s governance and the multiple institutional settings which frame this dialogue; enabling the disassembly of the various perspectives on mobilising knowledge dialogically.

Kooiman and Bavinck (2005) provide a definition of interactive governance as:

“Governance is the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them.”

Society’s interactive ‘governing system’ is therefore modelled as a self-organising and adaptive network of interactions (including dialogue) that transcends the state to include civil society and private sector stakeholders, with the scientific community in a supporting role. Lemos and Agrawal (2006) argue that environmental governance represents the totality of these interactions, for while some stakeholders are more powerful than others none alone are completely dominant nor have an adequate overview of an issue to be able to provide a clear direction on how to resolve it; introducing the paradox of plurality and interdependence. Interactions are contextually structured by a multitude of institutions settings, which simultaneously frame the interactions of stakeholders with each other and the natural environment; and may range from informal cultural norms, to the market, to state-organised deliberative fora for instance (Jentoft, 2005). Institutional settings are spaces which influence how interactions are allowed to unfold, while being simultaneously re-built according to them; introducing interactions and institutions as two underlying symbiotic concepts of governance thinking. Society’s collective deliberation and decision-making is therefore the sum of simultaneous interactions within and across multiple institutional settings.

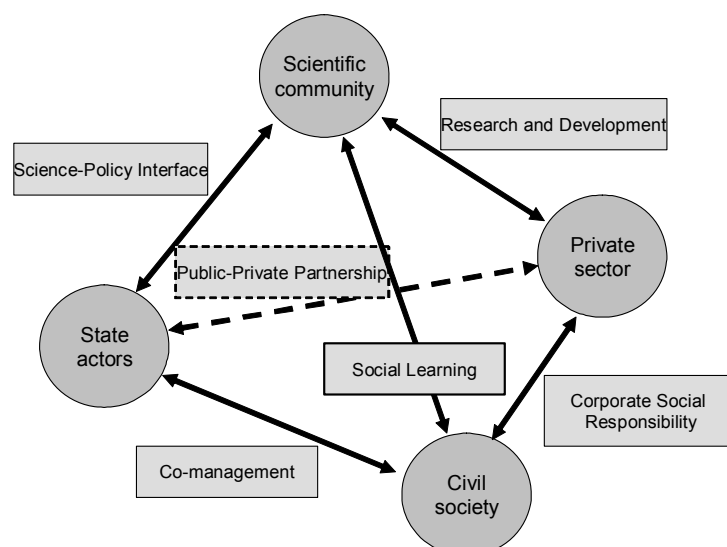
By viewing governance through an ‘interactive’ lens, one can consider that different knowledge is held by the full spectrum of stakeholders, and is communicated and revealed through different forms of dialogue, within different institutional settings; from the court-room to the board-room to the back-room. Therefore, it is not enough to simply talk of a dialogic epistemology for environmental governance; one must realise the myriad ways in which knowledge is revealed through dialogue.

Each of these different forms of dialogue and institutional settings represents a rich store of theory and practice. The next section attempts to map these perspectives.

3.2 Mapping the array of approaches to framing dialogue for mobilising knowledge

Having established that knowledge is mobilised for governance across diverse forms of dialogue, this section aims to ‘map’ these dialogic approaches and their institutional settings; that is, tease out the tangled forms of dialogic means of mobilising knowledge, or epistemological approaches. This article introduces a conceptual tetrahedral framework (see Figure 1), adapted from O’Connor’s (2006) ‘Four Spheres’ sustainability framework, which maps the totality of interactions within a governing system between the four broad categories of stakeholders and across different institutional settings. Figure 1 reveals all four categories of stakeholders interacting within their own institutional settings, and dialogue between stakeholder categories within separate institutional settings. For instance, private sector actors can be depicted as active within the market setting; civil society actors active within social/cultural settings; state actors active within political/state settings; and scientists active within their disciplinary settings. Dialogue between two different categories of stakeholders can be represented by separate institutional settings, where a unique ‘conglomerate’ form of dialogue is employed, under-pinned by its own broad academic traditions. This framework requires a caveat; it must be noted that within a complex governing system it is fundamentally meaningless to treat any stakeholders, institutions or dialogue in isolation from the others, and recognised that the pair-wise classification of dialogic approaches is didactic but artificial. This heuristic is a simplification because in reality the divisions between dialogic approaches are not so discrete; in real-world practice there is unlikely to be dialogue that can be described ‘purely’ in terms of Corporate Social Responsibility for instance. This framework is designed to distinguish between theoretical perspectives, as frameworks of analytical concepts and normative theories, to enable a comparison.

Figure 1: Conceptualising six forms of dialogue between four categories of governing system stakeholders.



Regarding Figure 1, one can note that all four broad categories of stakeholders construct knowledge through dialogue within their own unique institutional settings; effectively representing their own closed knowledge systems. One can also see six broad institutional settings within which a dyad of stakeholder groups engage in dialogue, including though not usually exclusively, for the mobilisation of knowledge. These settings are designed to open stakeholders' closed knowledge systems via dialogue, and mobilise their knowledge in a form accessible to other governing system stakeholders, to support collective deliberation. Each of these 10 settings produces a distinctive opportunity for dialogue, revealing different forms of knowledge used to different ends in governance; however the settings for mobilising knowledge across categories of stakeholders are the focus of this article, rather than the closed knowledge systems. Where two groups of stakeholders are engaged in dialogue, new relationships emerge, and the boundaries between these two 'spheres' are renegotiated (Sarewitz, 2004). New principles and institutions emerge, which are accompanied by new academic terrains. This article found each of the six different forms of 'bridging' dialogue to possess a rich literature on mobilising knowledge via dialogue - with a varying discussion of inclusiveness, integration and knowledge quality - often spanning multiple fields of inquiry, and ranging from theories to more practical expressions and methodologies. The six forms of dialogue are summarised:

State – Civil Society. This dialogue is best represented within the broad literature on 'co-management' (see e.g. Lemos and Agrawal (2006)). It includes dialogue that mobilises the diversity of knowledge contained within civil society alongside their values and preferences, to inform collective decision-making. This dialogue is nurtured through approaches like 'conflict management' (Bruckmeier, 2005), 'collaborative management' (Armitage et al., 2007), and 'deliberative democracy' (Dryzek, 2002).

State – Private Sector. This dialogue is represented under the umbrella of 'public-private partnerships,' often through discussion on the use of market and incentive-based mechanisms in environmental management (Lemos and Agrawal, 2006). One central mechanism, of interest to this article, is the transparent sharing of knowledge on the activities of the private sector; 'information as policy.'

Private Sector – Civil Society. This dialogue is represented significantly within the scholarship of 'corporate social responsibility' (Lemos and Agrawal, 2006). It involves a two way dialogue between private sector enterprise and the wider civil society stakeholders it impacts upon, as a deliberate inclusion of the 'public interest' in corporate decision-making, and can extend to the inclusive mobilisation of knowledge. Conversely, the perspective of civil society is often communicated through activism and protest.

Private Sector – Science. This more closed dialogue is represented under the heading of 'research and development,' but could also be called 'product development,' with the objective of arriving at profitable outcomes.

State – Science. This dialogue is represented by the literature on the 'science-policy interface,' broadly looking at the ways in which scientific knowledge is mobilised for society's decision-making. This literature is both a source of analytical description on the socio-political interaction between these two groups of actors; and a source of theory and methodology on ways to better integrate the best knowledge with a decision-making process. This dialogue is nurtured through the practice of

approaches including ‘participatory integrated assessment’ (Van Asselt-Marjolein and Rijkens-Klomp, 2002) and ‘post-normal science’ (Funtowicz and Ravetz, 1993) for example.

Civil Society – Science: This dialogue can be described in terms of the ‘social learning’ literature. It describes the collective learning that occurs around an issue when diverse knowledge systems, are communicated within a participatory process of dialogue and reflection (Keen et al., 2005). Such dialogue may be as part of, or independent of, a decision-making process. It is nurtured through the practices of ‘collaborative learning’ (Daniels and Walker, 2001), and ‘trans-disciplinarity’ (Max-Neef, 2005) for example.

By dividing dialogic governance into its constituent dyads, this article found that the broad literatures associated with ‘co-management,’ ‘social learning,’ and the ‘science-policy interface’ contain the most sophisticated discussion on the dialogic mobilisation of knowledge, specifically:

- a) They all include a focus on mobilising knowledge through dialogue for wicked issues;
- b) They include discussion on the inclusion of all knowledge systems, espousing a ‘participatory democracy’ imperative;
- c) They include discussion on integrating, or bringing together, disparate knowledge systems for a common understanding through reciprocal dialogue;
- d) They include discussion on the collective negotiation of the *credibility, salience and legitimacy* of knowledge.

In this way, all three traditions include epistemological approaches for mobilising knowledge from across all stakeholder categories, and integrating it through the principles of reciprocal dialogue and co-existence. In so doing, these approaches have evolved from their previous focus on bridging a stakeholder ‘dyad’ to take on a far more participatory form inclusive of all four categories of stakeholders. However that noted, the authors assert that each approach has an inherent bias towards one certain type of dialogue (one dyad), reflected in their different philosophical backgrounds, their different theories, and their different institutions for framing dialogue. This bias towards a ‘first moment’ or ‘home’ dialogue colours each approach’s treatment of dialogue, even when an institutional setting is opened up to more inclusive and integrated dialogue. For instance, while these three traditions share the same four broad imperatives (substantive, normative, instrumental and social learning: see Section 2.2), they differ in terms of the emphasis they put on each of these.

This article will therefore finish by unpacking and comparing three approaches emerging from the broad academic terrains of co-management, social learning, and the science-policy interface: respectively the approaches of ‘deliberative democracy,’ ‘collaborative learning,’ and ‘post-normal science.’ It should be noted that this paper stereotypes these three positions in order to draw clear boundaries within what is an indistinct area of study. Within each approach there are a variety of positions held, and therefore rarely are the divisions between these positions so discrete. Again this is a theoretical discussion of analytical concepts.

4 Introducing three epistemological perspectives in dialogic environmental governance

4.1 Deliberative Democracy

Pierre and Peters (2000) describe deliberative democracy as a conscious expression of participatory democracy, that dictates the creation of institutions better enabling of free deliberation by all of society, as equals in a non-coercive environment, for collective decision-making. It emphasises to Dryzek (2002) that the true nature of democracy is through the deliberation of citizens, rather than simply voting. In this way, Bohman (1998) roots deliberative democracy in a critique of the standard practices of liberal democracy; it rejects the aggregation and strategic behaviour of voting and political bargaining respectively, in favour of the free public reasoning of equal citizens. It appeals to the democracy and rationality of the 'forum,' rather than the 'market' of strategic political pluralism (Bohman, 1998). Pierre and Peters thus describe the 'Athenian City State' as the ideal deliberative democracy forum.

Deliberative democracy theorists take society's unavoidable, and often irreducible, plurality as the point of departure; providing both epistemic and moral challenges. From the epistemic side, pluralism precludes any knowledge of the 'public interest' via aggregation, such as through voting mechanisms. From the moral side, deliberative democrats argue that the strategic behaviour associated with bargaining between personal interests precludes consensus and does not espouse the normative values of democracy (Bohman, 1998). Combining plurality with the liberalism of a free and equal society introduces a tension between individual plurality and popular control, which prevents substantive consensus in many cases. Faced with this dilemma, deliberative democrats turn to a robust process for the moral and epistemic justification of democracy, as embodied within 'constitutional liberalism.'

Deliberative democracy promotes constitutional principles that acknowledge plurality, and set the 'rules' of deliberation for the reconciliation and aggregation of predetermined interests, in seeking overlapping consensus (Dryzek, 2002). Rawls (1993), an early advocate of deliberative democracy, thus proposed 'free public reason' as a steering principle, or attitude of participation, incorporating both 'guidelines of inquiry' and 'virtues of reasonableness.' By employing 'free public reason,' Rawls argued citizens were able to go beyond their personal interests and consider the wider public interest from their personal point of view, moving him to comment that 'a good constitutional democracy is a deliberative democracy.' In terms of a dialogic epistemology, Rawls 'guidelines of inquiry' steered the use of evidence and judgement among citizens, recognising the plurality of knowledge systems engaged in deliberation, and providing rules on their reasonable application. In this way, Rawls recognised 'rationality' to extend beyond the instrumental form so popular in modernist traditions; echoing Habermas' communicative rationality. Dryzek (2001), while agreeing with the constitutional liberalism of deliberative democracy, advocates for more social and interactive principles; critiquing

Rawls focus on deliberation within the courts and legislature where participation is restricted to those capable of exercising 'public reason.' Dryzek argues for a more inclusive democratic setting steered by principles of participation, equity, reciprocity and reflexivity.

Dryzek (2002) discusses deliberative democracy as creating a constitution for the creation of a public deliberation setting; one where all who choose to participate can, without obligation. Within such a setting equity is essential, Dryzek noting that the only power should be "the forceless force of better communication," while ceding that citizen's capacity to participate will never be equal (Dryzek, 2002). Accepting that within a pluralistic world 'consensus' is unattainable, unnecessary and undesirable, deliberative democracy allows citizens to discuss the public interest in terms of their private interest, before agreeing on a course of action for different reasons. Deliberative democracy provides the opportunity for citizens to hear the perspectives of others, reflect on their own perspective and values, before collectively arriving at a decision as a community. The dialogue within a deliberative democracy setting is therefore steered by procedural principles of reciprocity and reflection, which distinguish it from other co-management theories that see participants as having pre-conceived positions that are non-negotiable, and the basis for strategic power-games and bargaining. Reflexivity through dialogue also encourages social learning of the many perspectives and values surrounding a debated issue. According to such principles, Dryzek asserts that deliberation and decision-making is both procedurally rational (fair, equal, reciprocal, free from coercion, deception, and manipulation) and substantially rational (more rational outcomes).

Dryzek (2002) argues "deliberative democracy may be the most effective political means currently available to solve complex social problems, because it provides a means for coherent integration of the variety of different perspectives that are the hallmark of complexity." To this end, Dryzek bases deliberative democracy in an epistemological perspective linked closely to Habermas' communicative rationality. It legitimises all forms of communication; reducing the status of the scientifically rational argument to a supporting role rather than the lead actor. Rhetoric, narrative and other forms of communication are also allowed providing they are non-coercive, able to be supported by some rational justification, and capable of linking the individual's perspective to a community perspective (Dryzek, 1994).

Finally, Bohman (1998) introduces a debate on whether a deliberative democratic setting is best described as epistemic or moral; is it rather a setting for the production of 'reliable' knowledge and preferences to inform decision-making, or a 'fair' setting for the legitimate inclusion of all perspectives. Bohman (1998) notes, "...if (deliberative democracy) establishes its moral credentials of legitimacy via an ideal procedure, it cannot underwrite its epistemic claims; if it establishes its epistemic claims, they can only be underwritten by standards that are not only procedure-independent, but also independent of deliberation." While concepts of Rawls 'public reason' and Habermas' 'communicative rationality' go some way to resolving this tradeoff, deliberative democracy seems to emphasise normative imperatives over substantive imperatives.

4.2 Collaborative Learning

‘Collaborative learning’ is an approach derived from the wider literature on ‘social learning’ for environmental governance, which as Pahl-Wostl and Hare (2004) point out, broadly asserts that collective decision-making for complex issues is preceded by learning among stakeholders. Keen, Brown and Dybal (2005) offer up a broad definition of social learning as “a process of iterative reflection that occurs when we share our experiences, ideas and environments with others.” For authors such as Daniels and Walker (1996), Friedmann (1987) and Koppenjan and Klijn (2004), this is learning that occurs across three dimensions: (i) the plural framings of reality and more specifically the issue; (ii) the plural values among stakeholders; and (iii) the strategic political behaviour within a governing system. Those writing on the broad social learning tradition, including Keen and Mahanty (2006), Daniels and Walker (1996, , 2001), and Plummer and Fitzgibbon (2007) therefore argue that a learning approach requires a shift from our conventional reliance on narrow bodies of knowledge to more collaborative methods that accommodate the wide range of stakeholder perspectives. Daniels and Walker (1996) argue that this necessitates an emphasis on the importance of the learning that occurs within collaborative deliberation, however learning has often remained poorly defined and measured in collaborative deliberation (Keen and Mahanty, 2006, Armitage et al., 2008). While many authors define social learning as a side-effect that accompanies problem-solving (Dillenbourg, 1999, Keen and Mahanty, 2006), this article argues that social learning can occur separate to a formalised collective decision-making process and is therefore portrayed as a dialogue between civil society and scientific communities.

As an approach in social learning, collaborative learning is not confined to those writing on environmental governance, with a much greater literature within the psychology and education fields. Dillenbourg (1999) provides a widely-cited overview of collaborative learning; describing collaborative learning as the creation of a situation wherein certain forms of interaction are more likely to occur, in order to stimulate additional cognitive mechanisms within a group of stakeholders than would be available to them individually. Dillenbourg goes on to describe a collaborative learning as a physical and institutional ‘setting’, rather than a ‘method,’ where there is a degree of symmetry in terms of participants power and influence, shared goals, and a low division of labour. Within this context, learning occurs through ‘interactive, synchronous negotiation’ between participants.

Daniels and Walker (1996) note that collaborative learning is based in a critical, pragmatist epistemological tradition that follows Dewey, Lewin and Piaget, recognising learning as something that is actively engaged in for problem-solving by mobilising concrete experience. This led Plummer and Fitzgibbon (2007) and Armitage et al (2008) to frame collaborative learning as an experiential and reflective, ‘learning-by-doing’ process. Stakeholders ‘learn’ relative to both their ongoing experience with their environment, and through negotiating with other stakeholders; therefore feedback from the environment and from other stakeholders is essential to the learning process. Collaborative learning also has constructivist influences through its recognition that all stakeholders have a ‘filter’ which shapes the way they experience the world (Daniels and Walker, 1996). Armitage et al (2008)

differentiate between three different conceptions of the learning mobilised within a collaborative learning situation; experiential learning, transformative learning, and social learning. Experiential learning describes the learning of each individual participant, as they reflect on their concrete experience (and that of others), conceptualise an abstract model to explain phenomena they experienced, and test that model as a hypothesis. Transformative learning (Mezirow, 2000, as cited in, Armitage et al., 2008) similarly focuses on the individuals learning, where through critical reflection on experience and the experience of others, they are able to transform the filter through which they experience the world. Finally, social learning (Argyris and Schon, 1978, as cited in, Armitage et al., 2008) places an emphasis on the wider social context, and how iterative reflection is possible through dialogue. As Armitage et al (2008) note, “both individual and group (social or institutional) learning is necessary. Individuals learn, not organizations, yet a focus only on the individual neglects the social context in which individual learning takes place.”

Keen and Mahanty (2006) identify three key learning concepts within collaborative learning; (i) systems thinking, (ii) negotiation and (iii) reflection. Firstly, collaborative learning has a ‘*systems orientation*’ which shapes learning relative to the interaction of social systems with ecological systems. Secondly, dialogue within a collaborative learning setting is framed as *negotiation* across plural and often irreconcilable perspectives. Conflict is accepted as inevitable, and indeed a catalyst for significant learning opportunities according to Dewey, with consensus not sought. Thirdly, collaborative learning emphasises *reflection*; on the part of individuals, and as a group. This is reflection on action, values and beliefs, allowing for different ‘loops’ of learning as noted by Argyris and Schon (1978, as cited in, Armitage et al., 2008); ranging from learning from actions (single loop), to rebuilding society’s fundamental values and assumptions (double loop), to building competency within a governing system to more effectively deliberate around complex issues (triple loop). Collaborative learning fora are described in terms of a learning ‘community,’ where competence is built across its members, akin to Haas’ (1992) ‘epistemic community.’

Finally, as noted by Dillenbourg, within a social learning forum, all knowledge and experiences are accepted on an equal footing; bringing with them their own strengths and weaknesses, which act complimentary to each other for stimulating social learning. Thus authors like Fabricus et al (2006) describe local and indigenous experiential knowledge, rooted within deep social memory, sitting alongside more short-term experimental science. However this raises many questions on the role of ‘normal science’ in governance, especially in terms of how its advice compares to, or interacts with, other more obviously normatively-charged perspectives. For some authors, including Carolan (2006) and Berkes et al (2005), science is often seen to ‘trump’ other forms of knowledge, due to its previously privileged place within science-based management, and its perceived superior ‘rigor.’

4.3 Post-normal science

The post-normal science (PNS) epistemological approach focuses on evaluating the quality of knowledge for informing governance in the face of wicked problems (see e.g. Funtowicz and Ravetz (1993, , 1997), De Marchi and Ravetz (1999)) and is thus most active at the science-policy interface.

Funtowicz and Ravetz (1993), as the initial proponents of PNS, attempted to find new scientific principles that emphasised “assumptions of unpredictability, incomplete control and a plurality of legitimate perspectives”. PNS thus begins from a model of the world as complex intertwined social and natural systems, and implicitly endorses a similarly complex network dialogic model for its comprehensive and holistic governance (Ravetz, 2006). PNS accordingly has a particularly acute respect for complexity through its recognition of a multiplicity of legitimate perspectives, which renders governance inherently uncertain even to the ‘epistemological core’ (Funtowicz and Ravetz, 1990). That is, we are uncertain of even which epistemology is best placed to begin to understand the issue, necessitating a dialogue across epistemologies (Funtowicz and O’Connor, 1999). Faced with uncertainty, “Quality...becomes the organising principle of post-normal science because the old ideal of scientific truth is no longer attainable or relevant for policy” (Funtowicz and Ravetz, 1994). While ‘truth’ informs decision-making behind a closed door, Funtowicz and Ravetz asserted (1993, , 1994, , 1999) that by bringing the uncertainty and quality to the fore, this leaves the door open to new scientific norms of evidence and discourse. Thus dialogue and participation is promoted by Funtowicz and Ravetz (1993) less for normative or instrumental reasons, and more for the substantive furthering of knowledge.

Those writing on PNS, like Funtowicz and O’Connor (Funtowicz and O’Connor, 1999, O’Connor, 1999), emphasise knowledge as a fundamental component of our shared ‘social reality.’ Within such a social reality, facts and values are inseparable, and no one perspective can be ‘true’ as no one has lived the totality of social reality; therefore O’Connor argues controversy between disparate perspectives is so inevitable that it can be mapped as a scientific fact. PNS so conceived necessitates extending legitimacy within a knowledge forum beyond scientific experts, to include other perspectives of complimentary validity (Van de Kerkhof, 2006). This noted, the founders of PNS Funtowicz and Ravetz (1997) are quick to point out that it goes beyond simple constructivism, by grounding science in reflexivity and dialogue to evaluate quality. In this way Luks (1999) defines PNS as influenced by pragmatism, and also ideas of communicative rationality.

How then does one integrate these perspectives? Within PNS, Funtowicz and Ravetz offer up a perspective on integration according to a dialogic process which is committed to methodological pluralism. That is not to say that it attempts to combine the many voices and reduce them to a single consensual view, which would be impossible given the irreducible plurality of epistemologies. Rather, the process ‘relativises’ contradictory perspectives and encourages their co-existence according to an ethic of reciprocity; if not through reconciliation, then at least through common understanding (O’Connor, 1999). This draws significant parallels with Habermas’ communicative rationality, and is subject to the same criticisms from those who warn of the power underlying all dialogue (O’Connor, 1999, Luks, 1999); in particular the dominance of normal science.

Though there are multiple epistemological perspectives, they are not all equally good for informing governance. Evaluating knowledge quality has traditionally been evaluated within the context of a

single internally consistent framework, which is associated with a particular perspective. Such frameworks are not usually commensurable. However, from the PNS perspective, knowledge is assessed only partly according to its own internal norms, and more in terms of wider community criteria relevant to an issue (Funtowicz and Ravetz, 1993, O'Connor, 1999, Ravetz, 2006). Therefore quality is judged in terms of the uncertainty associated with the various perspectives, their salience to decision-making for an issue, and their perceived legitimacy (see e.g. Frame and Brown (2008), Clark and Majone (1985), Funtowicz and Ravetz (1993)). Moreover it is quality not only in terms of the knowledge '*product*,' but also the *process* followed to derive the knowledge, the *people* who generated it, and its *purpose*; Funtowicz and Ravetz' (1993) so-called '4-P' approach. As Clark and Majone (1985) note, knowledge is appraised subject to multiple lists of indicators, drawing on: (a) rational criticism, (b) practical criticism, and (c) ethical criticism; with these meta-lists collectively formulated by an 'extended peer community.' As members of an extended peer community, stakeholders learn competence at the interface between politics, science and decision-making (Van de Kerkhof, 2006), develop reflexivity and learning, and develop trust for the other stakeholders within the extended peer community (Pahl-Wostl, 2005, De Marchi and Ravetz, 1999).

The extended peer community represents a widening of the circle of 'critics' of knowledge for decision-making, to lend legitimacy to those stakeholders previously not recognised in this role (De Marchi and Ravetz, 1999, Frame and Brown, 2008). These critics work together as 'co-investigators' (Frame and Brown, 2008, Funtowicz and Ravetz, 1993) in a pluralistic collaboration; examples of which include 'focus groups,' 'citizens juries,' and 'consensus conferences' (De Marchi and Ravetz, 1999). Importantly, all participants enter on an even footing, with equal rights and responsibilities to engage in critiquing knowledge. Such a peer community is nested in an institutional environment that tolerates the at-times ambiguous responses in such a forum, and is guided by policy-makers as knowledge-brokers, or 'mid-wives of problems' (Williams and Matheny, 1995, O'Connor, 1999, Van den Hove and O'Connor, 1997). Within this extended peer review process, knowledge is called upon as evidence to support different perspectives, with the burden of proof placed on the participant calling the evidence (Ravetz, 2006, Frame and Brown, 2008, Funtowicz and Ravetz, 1994). Importantly, this process does not attempt to rob any knowledge system of its legitimacy; rather, it is complimentary to each knowledge system which is allowed to co-exist under the close scrutiny of all of its peers.

PNS is science with a long-term strategic focus, rather than a short-term puzzle-solving focus. It begins from a discussion of the common resolve to a committed course of action, and the plurality of values that define this course (Ravetz, 1999, Van der Sluijs, 2002). By being issue and long-term oriented, with a focus on sustainability rather than progress, this provides a 'social contract' for science (Funtowicz et al., 1998, Moss, 2002). Moreover, according to O'Connor and others (1996), within the context of post-normal science, decision-making is undertaken according to procedural rationality rather than substantive rationality; establishing a legitimate procedure for decision-making that allows social learning via open dialogue between all forms of knowledge, while recognising

uncertainty, and the importance of adaptive management to avoid irreversible mistakes (O'Connor et al., 1996). With the emphasis on procedure, Pahl-Wostl (2002) argue one is less concerned with ensuring 'progress' as they are with 'unending reciprocity.'

5 Comparing dialogic epistemological perspectives

Under the umbrella of dialogic governance, this article has identified three distinct epistemological perspectives with a sophisticated literature on the mobilisation of high quality knowledge through inclusive and integrated dialogue; deliberative democracy, collaborative learning and post-normal science. By unpacking these approaches, this article is able to compare the ways in which these three different perspectives give treatment to the mobilisation of credible, salient and legitimate knowledge for governance. However, these three theories of dialogue are not rivals; indeed they are, in our view, complimentary if not compatible. By emphasising different dialogic imperatives, they each bring a different and enriching justification for governance as dialogue in the face of complexity. Indeed, the interplay between different perspectives is at the very heart of dialogic governance, and so we can say that the complimentary use of perspectives on dialogue is internally consistent with the philosophy each espouses. To this end, there are a number of comprehensive dialogic approaches to governance that comprise a number of these different dialogic perspectives in concert with each other. This may be through connecting different institutional dialogic settings in an integrated manner, or through facilitating one deliberative forum that gives attention to all forms of dialogue. For example, the scholarship of adaptive governance, or adaptive co-management, has evolved as a comprehensive governance approach with a focus on social learning, while employing dialogic approaches from the science-policy interface and co-management traditions (see e.g. Berkes et al (2005), Armitage, Berkes and Doubleday (2007), Plummer and Fitzgibbon (2007)).

This article will finish by comparing the three candidate approaches to mobilising knowledge according to the four broad measures noted in the introduction: (a) the degree to which the dialogic setting focuses on knowledge; (b) the inclusiveness of the setting; (c) the integration within the setting; and (d) the means for evaluating knowledge quality; particularly relative to salience, credibility and legitimacy. Some of the main elements of this comparison are summed up in **Table 1**, "*Comparing the characteristics of post-normal science, collaborative learning and deliberative democracy*".¹

5.1 Dialogic imperatives and the treatment of knowledge

While the three theories of deliberative democracy, collaborative learning, and post-normal science all represent attempts at mobilising knowledge through a dialogic epistemology, they are all derived from different 'first moment' dialogic perspectives, with different emphasis on the imperatives of dialogue, and different philosophical influences (see Table 1). This has consequences for each approach's treatment of deliberative fora. Within deliberative democracy, the forum is modelled on the 'Athenian

¹ For reasons of formatting convenience, Table 1 is found at the end of this document.

city state,' with the primary purpose of free and equal deliberation between all citizens for collective decisions for the common good. Alternatively, within collaborative learning the deliberative forum is modelled on an 'epistemic community,' with participants sharing their experiences reflexively, and building competence for learning and dialogue. Finally, within post-normal science, deliberation occurs within an 'extended peer community,' wherein knowledge is collectively evaluated for its quality and pertinence to the issue. Therefore this reiterates three different dialogic imperatives within deliberation; respectively, participatory democracy, reflexive learning, and knowledge quality assessment.

Knowledge is valued differently across the three deliberative fora. Deliberative democracy evaluates the usefulness of diverse contributions according to their ability to contribute to a collective vision of the issue and its solutions in 'the public interest,' with the goal of progressing society toward an agreed course of action. Within the post-normal science perspective, knowledge is valued for a number of different qualities which are collectively assembled by those participants providing knowledge, including the knowledge 'product', though also the legitimacy of the process and persons associated with the knowledge, and its level of uncertainty. Knowledge is mobilised according to the degree to which it meets those qualities that stakeholders deem important for the issue at hand. Finally, the collaborative learning approach values knowledge for the learning it brings about, both within individual participants and collectively. Knowledge is valued not only for 'first loop' learning, whereby stakeholders 'learn from doing,' with each governance intervention an opportunity to learn about the reaction of the system-to-be-governed. Knowledge is also valued for the way in which it re-shapes the 'filter' through which stakeholders experience reality, including their values and assumptions (second loop learning), and on to the increased competence of stakeholders to interact and learn within a learning community.

5.2 Inclusive of all knowledge systems

All three of the described deliberative fora provide an inclusive setting where all different knowledge systems are able to be communicated as legitimate and salient to support deliberation and decision-making. All three fora begin from an ethic of reciprocity, whereby all participants recognise the legitimacy of each other and enter into non-coercive, open negotiation. Related to this, all three approaches recognise that power will inevitably infiltrate dialogue to some degree, but attempt to minimise the effects of power through the creation of an effective institutional setting, and through an effective process. That noted, deliberative democracy is far more zealous in its attempts to eliminate any forms of coerciveness and create the ideal conditions of communication espoused within communicative rationality. This has led a focus across all three approaches on procedural rationality (rather than substantive rationality), with the process generally described as iterative and reflexive, with a long-term focus.

5.3 Bringing together disparate knowledge systems

While all three fora are inclusive of all knowledge systems, the way in which this knowledge is brought together or reconciled varies. In the broadest sense, all three fora share a participatory ethic of reciprocity, which encourages integration across disparate perspectives through dialogue and negotiation (see O'Connor's (1999) Dialogic vs Laplacian discussion). However, on closer inspection deliberative democracy appears to also share a 'Laplacian' influence; reconciling the plurality of citizen perspectives in a search for a degree of overlapping compromise on the 'public interest,' and collectively desired courses of action. Deliberative democracy therefore accepts all knowledge perspectives as contributing to an aggregated community perspective, and judges it rational according to constitutional principles steered by 'public reason' or 'communicative rationality.' In this way, plural experiences are where possible reconciled within one internally consistent collective vision of the issue and the 'public interest' – accepting full consensus as impossible and undesirable. The puzzle analogy of Kuhn (1962) can be extended, with each perspective a jigsaw piece roughly fitting with its adjoining pieces, and the policy-maker as assembling the puzzle. The post-normal science approach sees uncertainty as epistemological, and thus irreconcilable within a single framework. A forum can only seek to relativise the different perspectives and encourage their co-existence through reciprocal dialogue or negotiation. In this way, each participant brings their knowledge as 'evidence' of their individual perspective. Collaborative learning also encourages a co-existence of diverse perspectives through negotiation, as a source of reflection.

However, where conflicting perspectives are simply left to co-exist, and no perspective can claim access to the 'truth,' this does not address the dilemmas of pluralism, and may not render a coherent or agreed upon understanding of an issue to support deliberation. Where there are no means to reconcile inconsistent knowledge systems, there is the danger that knowledge fora will lapse into entrenched pluralist politics, and power will prevail over reciprocity. Similarly, where reconciliation between two conflicting accounts is not possible, there must be means for collective negotiation amongst stakeholders over which perspective has more credibility for supporting deliberation for an issue, or pluralism will again prevail. Unlike collaborative learning, post-normal science seeks a second degree of integration; moving from a focus on 'truth,' to focus instead on 'quality.' Quality, as collectively negotiated, becomes a second means for integrating plural perspectives, while simultaneously allowing for a measure of the credibility of knowledge accounts. With a focus on knowledge quality for decision-making, a 'puzzle-piece' is evaluated for its credibility, salience and legitimacy, while accepting that the resulting picture may be a more abstract melange of multiple perspectives; akin to cubism. The 'quality control' via extended peer review acts as a bridge across multiple epistemological frameworks, by allowing incommensurable knowledge systems to be evaluated via a common framework. Quality becomes a common thread that links knowledge perspectives, and provides an alternative to stakeholders retreating to the safety of their own knowledge system framework.

5.4 Evaluating the quality of knowledge

Finally, knowledge is variably judged credible, salient and legitimate for governance, across the three fora. Within the deliberative democracy forum, knowledge is judged salient and legitimate by virtue of the participatory process that is inclusive of all knowledge systems, and credible to the extent that it is deemed rational according to the framework of communicative rationality. Within the collaborative learning forum, knowledge is again judged salient and legitimate according to the participatory process, as well as the degree to which it gives effect to a systems-based framing of the issue. Credibility is less well addressed in the collaborative learning approach, with each form of knowledge deemed credible according to its own incommensurable criteria, and few ways of bridging these criteria. Reflexivity is the primary tool by which other knowledge systems are deemed credible; allowing participants to collectively reflect on and compare knowledge systems. Finally, the post-normal science forum determines credibility, salience and legitimacy through an extended peer review process, according to a number of criteria (e.g. product, process, person and purpose) agreed upon by all stakeholders.

6 Conclusion

This article begins from the notion that a ‘dialogic epistemology’ provides an effective means of mobilising knowledge in support of collective deliberation and decision-making for ‘wicked problems,’ and to this end has formed the foundation for many dialogic approaches to environmental governance. Looking through an ‘interactive governance’ filter, this article revealed a diversity of different dialogic epistemological perspectives, each beginning from dialogue between different configurations of stakeholders within different institutional settings built on different schools of thought. This article is specifically interested in those perspectives that: (a) focus on the mobilising knowledge through dialogue, in a form able to support deliberation and decision-making; (b) include all knowledge systems; (c) integrate diverse perspectives through dialogue according to principles of reciprocity and co-existence; and (d) allow for collective negotiation on the quality of knowledge; defined here in terms of credibility, salience, and legitimacy. To these ends, the article found the broad traditions of ‘co-management,’ ‘social learning’ and the ‘science-policy interface,’ to contain the most sophisticated literature, and led to a detailed comparison of three epistemological approaches, respectively; ‘deliberative democracy,’ ‘collaborative learning’ and ‘post-normal science.’

By strictly categorising the three approaches, the article is able to discern and compare the novelty within each approach, while accepting that all three approaches are often utilised simultaneously in a complimentary manner within more comprehensive governance models, such as ‘adaptive governance.’ All approaches are found to offer a valuable perspective on the dialogic mobilisation of knowledge to support governance, however the post-normal science approach can be deemed to provide the most robust treatment of the way high quality knowledge is mobilised around a given ‘wicked’ issue, through dialogue within a governing system. Originating from the science-policy

interface dialogic setting, post-normal science has from the beginning placed the focus on the *knowledge* mobilised through dialogue, while accepting the accompanying values, power and politics as inevitable, and sought to frame this knowledge in a form best able to support deliberation and decision-making. This distinguishes post-normal science from other dialogic institutional settings, which either place a less central focus on knowledge (deliberative democracy), or less explicitly tie this knowledge to deliberation (collaborative learning). Moreover, according to its founding authors Funtowicz and Ravetz (1990, , 1993, , 1994), post-normal science provides an approach specific to ‘wicked’ problems, and takes as a point of departure the systems representation popular in describing an increasingly perceived complex and uncertain Nature. Finally, by placing the principle of knowledge ‘quality’ rather than ‘truth’ at the centre of inquiry, post-normal science demonstrates a more explicit treatment of quality than the other two perspectives

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Table 1: Comparing the Characteristics of Post-normal science, Collaborative learning and Deliberative democracy

	Characteristic	Post-normal Science	Collaborative Learning	Deliberative Democracy
1.	<i>'First moment' dialogue</i>	'Science-policy interface' Scientific community and state	'Social learning' Civil society and scientific community.	'Co-management' Civil society and state
2.	<i>Dialogic emphasis</i>	Substantive	Social learning	Normative and instrumental
3.	<i>Epistemology</i>	Dialogic	Dialogic	Dialogic
4.	<i>Deliberative forum</i>	'Extended Peer Community'	'Epistemic Community'	'Athenian City State'
5.	<i>Primary purpose of the forum</i>	Evaluate the quality of disparate knowledge systems for addressing an issue	Stimulate learning through the sharing of experiences, ideas and environments	Free and equal deliberation between citizens for agreement on a course of action for the public good
6.	<i>Ethic of participation</i>	Reciprocity	Reciprocity	Reciprocity
7.	<i>Power</i>	Inevitable, but where possible neutralised	A source of learning, but where possible neutralised	Neutralised as primary objective.
8.	<i>Knowledge as...</i>	...Evidence in support of a value-based argument.	...Individual and collective reflection on experiences.	...a means for linking an individual's perspective to a community perspective.
9.	<i>Inclusive of all knowledge systems</i>	Yes	Yes	Yes
10.	<i>Treatment of plural perspectives</i>	Relativise and encourage co-existence	Relativise and encourage co-existence through negotiation	Relativise and where possible reconcile in the public interest
11.	<i>Knowledge valued for...</i>	...Its quality, as judged through extended peer review	...Its reflexivity – by challenging participants to alter the filter through which they experience reality, and build competence for learning and dialogue	...Its complementarity for building a common picture of an issue for collective decision-making.
12.	<i>Knowledge judged credible, salient and legitimate</i>	Peer review process, according to agreed criteria.	Participatory process, 'systems-based' knowledge and reflexivity.	Participatory process and communicative rationality, as steered by constitutional principles
13.	<i>Reflexive</i>	Yes	Yes	Yes
14.	<i>Iterative</i>	Yes	Yes	Yes
15.	<i>Procedural or substantive rationality</i>	Procedural rationality	Procedural rationality	Procedural rationality
16.	<i>Long-term approach</i>	Yes	Yes	Yes