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SUSTAINABLE AGRICULTURE IN AOTEAROA: SOCIAL LEARNING THROUGH PIECEWISE DELIBERATION

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Sustainable Agriculture in Aotearoa:
Social Learning through Piecewise Deliberation

M. O'Connor, B. Small & M. E. Wedderburn

Abstract

This paper presents and illustrates design principles in a programme of applied science and stakeholder consultation on sustainable agriculture in New Zealand. We report procedures and tools for building deliberations around agriculture performance, societal responsibilities and regional planning challenges, focussing on the question of how effectively to mobilise knowledge from different sources and at different scales about environmental and economic systems to address sustainability policy challenges. A five step framework for stakeholder-based integrated appraisal of collective resource management challenges, called "INTEGRAAL", is used as a basis for identifying different types of deliberation tasks carried out through dialogues facilitated by social science researchers and consultants, engaging scientists, decision-makers and other stakeholders. These tasks can be considered as components in comprehensive integrated assessment procedures. We highlight, with examples from workshops engaging representatives of New Zealand farming and regional government stakeholder communities, how the individual deliberation tasks can be effective as "piecewise" contributions to social learning and capacity building for addressing the dilemmas and complex information needs of contemporary sustainability challenges. In this way, integrative perspectives can be applied progressively, at modest cost and in a decentralised way, adapted to local circumstances and changing needs.

Cet article présente et illustre des principes de design d'un programme de science appliquée et de consultation autour de l'agriculture soutenable en Nouvelle Zélande. Nous détaillons des outils et procédures pour des délibérations sur la performance de l'agriculture, des responsabilités vers la société au large et, des défis d'aménagement de gouvernance territoriale. La question clé est comment mobiliser les connaissances des diverses sources et à des échelles différentes afin d'affronter les défis de soutenabilité économique et environnementale. Nous exploitons une démarche en cinq étapes, nommée INTEGRAAL, pour mobiliser les scientifiques, la science sociale, les décideurs et les acteurs du monde rural en tant que parties-prenantes dans plusieurs types de tâches de délibération sur des questions de choix social sur l'utilisation et la protection de ressources environnementales. Moyennent des exemples des ateliers de délibération, nous démontrons l'efficacité d'une délibération « par morceaux » pour contribuer à un processus cumulatif d'apprentissage social et de renforcement de capacités pour s'adresser aux dilemmes et aux besoins d'information stratégiques pour un développement agricole soutenable. Des pratiques intégratives peuvent ainsi être développées, nous suggérons, progressivement, à de coût modéré et de manière décentralisée avec adaptation à des circonstances particulières et à des besoins qui émergent.

I. Introduction

For more than twenty years, "sustainability" has become a household term, entering into every field of public policy, business strategy and debate about societal goals and lifestyle. This ubiquitous status also dilutes the term's meaning. On the one hand sustainability is for everything and for everybody; on the other hand, there is often a 'gap' between principles enunciated in scientific and policy circles (e.g., respect for future generations, intergenerational equity, precaution, maintenance of environmental functions, critical natural capital…) and the myriad pragmatic concerns expressed by the actors of economic development and community (at local, national and global scales).

Our focus here is agriculture and sustainable development in New Zealand. There are many factors, legislative as well as geographic, that ensure a high visibility of "sustainability" as a challenge for New Zealand agriculture. First of all, maintaining environmental integrity is crucial for New Zealand's long term well-being because the biological basis of a large part of the nation's economic production (agriculture, forestry, fisheries). Products of biological origin contribute nearly 2/3 of New Zealand's export earnings, a feature that creates significant competitive advantage in international trade and that underpins the nation's economic growth for well over a century (MAF, 2008). But, these advantages are not easily maintained. New Zealand's high quality environment is important for a variety of functions including beauty, biodiversity, wildness, comfort and productivity. In any given area, these functions can be in conflict or, at any rate, are often imperfectly reconciled (PCE 2004; MFE 2007; and Huser 2010a, 2010b for territorial governance agency views).

Thus, if the efficient utilisation of natural capital is a key to delivery of economic and social well-beings, the acknowledgment of natural resource limits and the environmental impacts of current production systems raises the question of what a long term sustainable development might look like. In this context of generalised scarcity (environmental as well as economic), communities at all scales — from local to international — are increasingly demanding that environmental sustainability credentials be proven. This means the demonstration that environmental management practices satisfy a multitude of performance goals expressed by and for a diversity of constituencies at different scales. For example, in New Zealand:

- Regional councils are charged under the Resource Management Act 1990, with management according to sustainability principles of their regions' natural resources; and in this regulatory context, environmental policies aimed at regulating emissions from agriculture have been developed and implemented with growing frequency as environmental deterioration trends have increased.
- Simultaneously local councils operate under the Local Government Act 2002 that provides a broad role for them to promote the social, economic, cultural and environmental well being of their communities. They are charged with the production of Long Term Community Council Plans (LTCCP's) in consultation with their communities to address the "four well-beings".
- How to ensure an outcome that allows a 'win-win' between all four well-beings, in a country that is highly dependent on its natural capital, highlights the dilemma of sustainable development. Land owners, farmers, environmental groups, and urban dwellers are all impacted by policies that manage emissions from land and water use.
- Given the structure of New Zealand farming the stakes are high for individual farm owners as are the risks to public good natural resources. Tensions run high therefore between individual and community values particularly when (unlike in Europe), no government payments are currently given to farmers to supply environmental goods.

These are situations of scientific as well as political complexity (cf., the papers presented in FLRC 2006; and the review by Dodd, Wilcock & Parminter 2009). The consequences or effects of environmental degradation in relation to agricultural activities often manifest themselves at a distance from the source of the agent causing them, in both space and time. For example, in the Lake Taupo catchment (Australasia's largest fresh water lake), it is estimated to take up to 30 years for nitrate deposited as fertiliser or animal waste, to move from the land into ground water systems before it has an impact on the lake water quality. There are thus considerable discrepancies between the operational decision frames of individual actors (e.g., farmers) and, the scales of observation, analysis

and interpretation that are required to address the territorial water quality issue (e.g., at the catchment or regional scale of governance, and at the entire agricultural sector scale for technology or other performance regulation).

These features provide a challenging operating environment for science to inform agribusiness, policy and the community where, in the terms popularised by Funtowicz & Ravetz (1990), knowledge is incomplete, values are in dispute and stakes are high. We must deal with complex dynamic coupled social and ecological systems where relationships and systemic interactions unfold across many different organisational scales that defy 'silver bullet' solutions. Reconciling the immediate welfare and profitability preoccupations of stakeholders with the long-term objectives of environmental quality and public good science is thus one of the major challenges for sustainability[1].

Implementing a sustainable development strategy under such conditions of complexity requires the ability to build and act on knowledge integrated across social, cultural, economic and environmental issues in space and time with multiple stakeholders. As argued in diverse contexts since the 1970s, better integrated knowledge of coupled ecological-socio-economic systems can, in principle, assist policy development and planning in moving towards sustainable development by permitting the assessment of the viability and potentialities of those systems relative to the needs and performance goals (well beings) of current and future generations. However, the fulfilment of these hopes for integrated assessment depends not only on effective and pragmatic systems analyses as the science base, but also on the embedding of systems science in collective learning (Rutledge, Wedderburn & Huser 2009; Wedderburn et al., 2009). This is dependent on the sourcing of knowledge in many forms from a range of people and the acceptability of the resulting conditions deliberated by a number of affected stakeholders before final decisions are implemented.

In this context, the traditional concept of expertise and extension — that is, top-down policy supplemented by a largely one-way flow of information from experts to the public — has proven insufficient. In a variety of ways, this rather authoritarian vision of governance for the public good is contested, with arguments for it to be countermanded or at least complemented with procedures for more reciprocal partnerships among those involved in the knowledge-action process (Funtowicz, Ravetz & O'Connor 1998). Such partnerships are necessarily constructed through the active dialogue and co-operation of scientists and technical experts with policy makers, implementers and stakeholders, including the full participation of those carrying local knowledge in relevant communities, districts, regions or countries. This cannot happen with a cloistered approach to science and technology, and requires an expanded and pluralistic view of our knowledge resources. People in all places and all walks of life have expertise — both knowledge and judgement — in a range of practical matters. Correspondingly, mobilising knowledge for sustainable development requires attention to the varied forms and formats of knowledge, their contexts, their complementarities (and sometimes antagonisms), and the avenues of knowledge sharing that might be available or proposed.[2]

For all these reasons, we need to develop a framework for deliberation about sustainability that accommodates multiple scales and multiple actors. Sustainability is a multi-dimensional concept whose realisation can be achieved only through accepting, in a deliberative perspective, to work simultaneously with a plurality of indicators, along economic, social and environmental dimensions and at different scales (cf., O'Riordan & Stoll-Kleeman 2002; O'Connor & Spangenberg 2007; Frame & O'Connor 2010). Section II below gives a selection of further references on this methodological orientation).

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[1] On the general problem of far-reaching and uncontrolled environmental effects of economic activity conceived with short-term goals, see Norgaard (1988, 1994). On the consequent dilemmas of collective decisionmaking and responsibility, see for example, O'Connor (2002); Guimaraes Pereira & O'Connor 1999); Faucheux & O'Connor (2005).

[2] These arguments have been developed widely in the sustainability and integrated assessment literatures since the 1980s. Their roots in political philosophy, social theory and social sciences epistemology are complex, with strands that can be traced back hundreds and even thousands of years. The environment crisis and resulting sustainability agenda has, in effect, given some new twists to age-old dilemmas and debates. For some (of the many possible) literature reference points on the perspective adopted here, see: Funtowicz & Ravetz (1994); Holland (1997); Rittel (1982); Norgaard (1988; 1994); Dryzek (1994); O'Connor (1997, 2000); Verweij et al. (2006); O'Neill (1997, 2007).

We thus seek, as a collaborative learning process, to provide frameworks for analysis and evaluation that enable people in their professional, research and decision-making contexts, to become comfortable with a pluralistic way of framing the observation and governance of sustainability — indeed to realise that this seemingly more complex way of organising description and appraisal can often provide more satisfactory guideposts than attempts at rationalising all information into a single analytical system. With this in mind, our purpose in this paper is to expose some of the design principles being put to work in a programme of applied science and stakeholder consultation on sustainable agriculture in New Zealand.

Section II outlines our methodology. Our specific focus is on the exploitation of deliberative indicator-based evaluation procedures and tools for building deliberations around agriculture performance, societal responsibilities and regional planning challenges.

Section III is the heart of the paper, and illustrates our practice of "piecewise deliberations". We draw on two empirical case studies from existing research, collaborative learning activities and expertise, focused on regional planning and agricultural sustainability within New Zealand, whose purpose was exploring the conditions and possibilities for design and practice of building knowledge partnerships through multi-stakeholder dialogues. These are:

- **Creating Futures** (initially called Choosing Regional futures, CRF), a publicly funded project led by a regional council (Environment Waikato), and incorporating a consortium of research providers, that aims to provide councils with processes and tools to assist in long term integrated planning for the Waikato region in the North Island of New Zealand. The project had two objectives: (1) developing deliberative processes to support the LTCCP process; and (2) development of a spatial decision support system to support both the deliberation and LTTCP process.[3]
- **Pastoral 21 Environment** (P21), a programme addressing the needs of the New Zealand pastoral sector in their ability to continue to remain profitable while mitigating adverse impacts of their activities on the environment. The purpose of this research is to develop tools and processes for the evaluation of the impact of policies, directed at environmental management, across a range of social, economic, environmental and cultural values held by agribusiness and others in the community.[4]

Section IV builds on the empirical examples and deepens the methodological discussion, linking the tasks of framing social choice problems and indicator selection back to the underlying theme of collaborative social learning and capacity building for sustainability.

[3] Full documentation is available on the project website: http://www.creatingfutures.org.nz/. The approach to SDSS development is outlined in several published papers and conference presentations, including Rutledge et al. (2008); Huser et al. (209); van Delden & McDonald (2010); van Delden et al. (2010). By comparison, the present paper is the first published exposition of the experimentation of deliberative procedures that have complemented the SDSS objective within the CRF project. A conference paper by Wedderburn et al. (2009) gives a sketch of the "integrative" ambitions of the project as a whole, and a discussion of options for embedding SDSS integrated assessment tools and methods within wider deliberative processes, is found in O'Connor (2011) which in methodological terms tries to make the bridge between the two CRF objectives.

[4] To date, the science outputs of the **Pastoral 21 Environment** programme are found in unpublished reports, for example Small (2007); Wedderburn, Blackett, Smith & Kelly (2009). These unpublished reports are our main primary sources. There is not a dedicated website for **Pastoral 21**.

II. Methodology

2.1. Social Learning through Participatory Evaluation

We adopt the view that, for a wide variety of "stakeholders" in society — including decision makers in public administration and company management roles — learning about environmental governance challenges can effectively be achieved by **participation in procedures (real or simulated) of selection and deployment of indicator systems for an evaluation activity**. Examples are the evaluation by stakeholders (including management, employees, shareholders, commercial partners and customers) of a company's performance against specified corporate social responsibility criteria; the evaluation of public policy options such as alternative scenarios for land use or water resource use and quality assurance, or hazardous waste stockage, and so on.

Our chosen approach is grounded in participatory multi-criteria assessment methods that, in different ways, have been developed and deployed since the 1990s in a wide variety of policy fields.[5] In particular, we draw on recent work by O'Connor and Spangenberg (2007) combining methodological and empirical components, which has outlined operational procedures for indicator-based sustainability assessment procedures (henceforth SA). They argue for sustainability assessments to be organised in a parsimonious but multi-level way. Sustainability assessment information can be placed at three main levels (*Table 1*), which are articulated by moving "upwards" and "downwards" relative to a deliberatively derived set of SQPMBLs (*Sustainability Quality-Performance Multiple Bottom Lines*).

Framework for Deliberative Sustainability Assessment

LEVEL	*OUTCOME*
Characterising "Sustainability"	Agreement about vision of "Sustainable Development" or "Governance for Sustainability" as the pursuit or achievement of a coevolution of interdependent systems respecting simultaneously multiple "bottom lines".
Articulating relevant "Bottom Lines": Sustaining of What, Why and for Whom?"	Agreement by Stakeholders on the set of Performance/Quality considerations that are affirmed as "Bottom Lines" for the specific policy situation or class of management challenges being addressed.
Proposing and Mobilising Baskets of Indicators of Quality or Performance	Consensus about baskets of appropriate indicators to be mobilised in each category of SA, as a function of issues, stakeholder diversity and the range of sites, scales and options under discussion.

Source: O'Connor and Spangenberg (2007).

This multi-layered discursive approach considers sustainability goal specification and indicator development as a deeply social decision-making process for which a diversity of viewpoints must be brought together in a strongly schematically structured way. The objective is to produce, through a process of stakeholder dialogue with a spectrum of stakeholders and including tasks of identification and exploitation of a selection of indicators, an evaluation that responds transparently to the spectrum of performance issues (the multiple bottom lines) and stakeholder perspectives.

Implementations of this procedure have been carried out by European research teams, notably at the former C3ED (now REEDS) where, for the organisation and communication of the evaluation, use is

[5] Examples of analyses that have informed our own approach, or that are broadly comparable in evaluation methodology and political theory terms, include: Simos (1990); Munda (1995, 2004); Jacobs (1997); O'Neill (1997, 2007); De Marchi et al. (2000); Fleisher Trainor (2006); Procter & Dreschler (2006); Frame & Brown (2008); Bremer (2011).

made of an online deliberation support tool kerDST (described in detail by O'Connor et al. 2007).[6] The kerDST system permits a stakeholder community, working on line or in proximity, to declare indicators as a function of perceived pertinence in a specific context. In methodological terms, the process consists of three main steps. The first phase is to "build the problem" by defining the 3-D array of (1) actor classes, (2) performance issues and (3) options or situations to be evaluated. The second phase is for each class of stakeholder to declare a judgement for each option or scenario, relative to each criterion or performance issue. The third phase is to deepen the assessment through motivating each judgement by reference to indicators. Reflecting on the pattern of judgements built up, the user is encouraged to appreciate the pros & cons of each option (or the relative merits and deficiencies of each situation) and also, the cogency and limits of each category of information (or speculation) mobilised as an indicator.[7]

As the empirical work reported by the C3ED and their collaborators shows, implementing a stakeholder-based evaluation procedure is not a trivial task. There are not only the requirements of methods, tools and data, but also those of mobilising and organising the interactions of stakeholders in order to achieve a meaningful result. Recognition of this has led those researchers to highlight participatory evaluation as a multi-step process and to put the accent as much on process design requirements as on tool selection for each step. In particular, they have been led to formulating participatory evaluation as a "integrative" process centred on problems of social choice.

2.2. The *INTÉGRAAL* Procedure for problems of social choice

We adopt the following six-step schema that, following the C3ED terminology adopted since 2007, we refer to as the *INTEGRAAL* procedure.[8] The general sequence is as follows:

- Step ONE — Identification by the stakeholder community of 'our common problem', this delivers the context, the scale, and the dynamics;
- Step TWO — Organise 'our common problem' in terms of the actors concerned, the situations or options being assessed, and value criteria. This means developing in a pragmatic way, typologies or classifications of (1) the stakeholders who are impacted by the problem or by the impact of the means of addressing it; (2) the policies, strategy options, and scenarios to be appraised; and (3) the values or principles of acceptability that the stakeholders hold. The Deliberation Matrix (see below) is used to organise the interfacing of the options for evaluation relative to the stakeholders and relative to the performance criteria.

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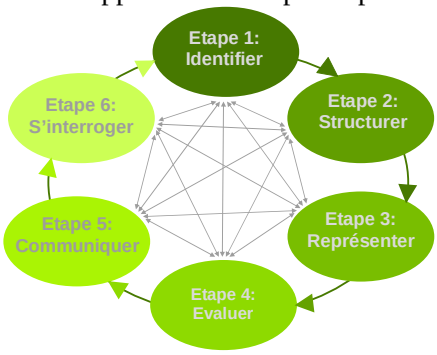
[6] The acronym kerDST refers to "KerBabel™ deliberation support tool", a system available on-line during 2006-2009 at www.kerdst.c3ed.uvsq.fr and, from 2010 onwards at kerDST.KerBabel.net maintained by the "KerBabel" team based at the international centre REEDS at the UVSQ. The origin of the Deliberation Matrix and its prototypes in the GOUVERNe and VIRTUALIS projects is described in O'Connor (2006b). Step-by-step exposition for the use of the different variations of kerDST is found in Reichel et al. (2007abcd).

[7] These various facets of the evaluation process with kerDST are documented in several published papers and unpublished theses and reports, including: Chamaret (2007); Chamaret, O'Connor & Récoché (2007); Chamaret, Reichel & O'Connor (2008); Maxim & O'Connor (2009); Da Cunha et al. (2010). Overviews of the range of C3ED deployments of the Deliberation Matrix during 2006-2009 are found in Raharinirina & O'Connor (2010) and O'Connor et al. (2010).

[8] The six-step schema that we outline here, was formulated by researchers in the C3ED and FONDaTERRA (not Fonterra!) during 2006 as a way to situate the use of the kerDST multi-criteria multi-stakeholder evaluation tool within a wider social process of problem framing, stakeholder participation and communication. Building on the VALSE project vision of environmental valuation as a collective social process in which formal tools are 'embedded' in wider contexts for negotiating meaning and purpose (O'Connor 2000; De Marchi et al. 2000), it draws also on experience since the 1990s with participatory integrated environmental assessment (see O'Connor 2006; Munda 2004; Douguet et al. 2009), and with participatory indicator-based approaches to CSR reporting (Faucheux & Nicolaï 2004a, 2004b, leading to O'Connor & Spangenberg 2008). Expositions of the *INTÉGRAAL* procedure for territorial applications are found notably in French language reports by Chamaret, Reichel & O'Connor (2009); Reichel, Chamaret & O'Connor (2010); and Da Cunha (2010). The name itself is a play on words that reflects the objective of an "integrative" process, the researchers' adoption of Celtic symbolism for their key concepts and creations, and the virtuous but utopian (Holy Grail) status of consensus solutions to 'impossible' social choice problems.

- Step THREE — Identify and mobilise tools for system representation (e.g., maps, models of processes and systems) that can help to 'ground' the deliberations in a robust knowledge base and, more particularly, that will assist in populating catalogues of indicators representing the stakeholders' reference points when working to evaluate situations and scenarios.
- Step FOUR — Mobilise actors for tasks of deliberation. This step depends on the frameworks and information developed in steps 1-3 above. Using (or mimicking on paper) the spectrum of functionalities of the kerDST Deliberation Matrix on-line, it produces outcomes in the formal sense of a multi-actor multi-criteria evaluation. It also provides insights and learning to participants via the discussions that take place and observation of the respective positions adopted and of how these evolve through the collective learning that occurs.
- Step FIVE — Communication of Results & Recommendations. This step includes, but is not limited to, the final reporting stages of an evaluation exercise. It also includes all tasks "along the way" of information sharing relating to the design and preparations of deliberations, documentation of discussions and intermediate results.
- Step SIX — Reflection on the outcomes obtained and, in an iterative sense, return to Step ONE of the process in order to review the entire evaluation sequence or, as seems fit, to formulate new specific evaluation problems.

Although presented here as a sequence of steps, *INTÉGRAAL* is not to be conceived as a rigidly linear process. The principle is to constitute a "deliberation forum" that offers opportunities to participants to explore progressively, or in parallel, different aspects of the agreed problem. In the view of the C3ED team, deliberation exercises can be iterative, allowing participants to go deeper and to gain or exploit more detailed information (e.g., in the choice and mobilisation of different indicators). It can be expected, as collective learning continues, that new policies for addressing the issue or sub-issues will be identified, new issues, stakeholders and values may be declared, and new information or analysis requirements may be highlighted.



2.3. The Deliberation Matrix and the on-line system kerDST

Within the *INTÉGRAAL* framework, a great variety of specific tools might be employed for different facets of system representation, identification and description of the options to be assessed, cataloguing of indicators and communication of results. Equally, a variety of techniques might be employed for carrying out participatory multi-criteria evaluation. For the New Zealand agriculture problematic, we have adopted the evaluation framework and procedure offered by the C3ED team, with the **KERDST** deliberation support tool available on line (formerly www.kerdst.c3ed.uvsq.fr, and since 2010 at http://kerdst.kerbabel.net). However, in the work reported here, we do not exploit the **KERDST** tool directly on-line with stakeholders. Rather, we have utilised the same method with physical pencil-and-paper media (that is, including blackboards, whiteboards, highlighter felt pens, coloured stickers, etc., etc.). In this way, we have explored the effectiveness of the KerBabel™ layered multi-criteria multi-stakeholder evaluation framework, as a methodological framework for stakeholder consultations and social learning activities.[9]

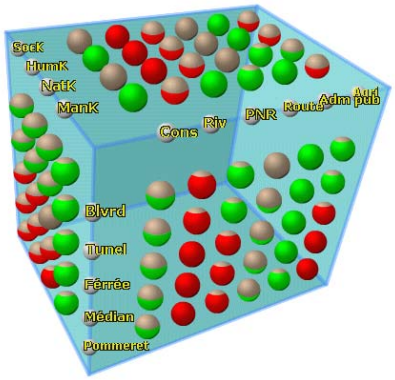
[9] The question of the relation between on-line multimedia procedures and pencil-and-paper exercises, their differences, their complementarities, their relative value-added (etc.) has been posed by the C3ED researchers and partners since the first prototypes of the European GOUVERNe and VIRTUALIS projects (see O'Connor 2006b; also Guimarães Pereira, Gough & De Marchi 1999). Recently these analysts have published a reflexive appraisal of "the first three years" of experience with the kerDST on-line system (O'Connor et al., 2010). We consider that the on-line tools bring substantial value added for communication, and documentation purposes. Even when screen-based work is not conducted by the participating stakeholders themselves, there can be clear benefits in using the multimedia tools for registering, reporting and accompanying the deliberation processes. There can also be benefits for the future transfer and adaptation of one evaluation framework, and of indicator sets, to a new terrain or topic. However, we do not go into these points in the present paper.

KERDST — AN ON-LINE DELIBERATION SUPPORT TOOL FOR MULTI-STAKEHOLDER MULTI-CRITERIA EVALUATION

The evaluation exercises or tasks are organised with a "grid" or array in three dimensions, built up by specifying, for a chosen problem:

- **The Evaluation/Governance Issues:**
  A small number of distinct Quality/Performance concerns
- **The Major Types of Actors or Stakeholders**
  A pragmatic demarcation of "interests" and collective identities
- **The Policy Options or Possible Futures:**
  A small number of Options for Action and/or Decision Scenarios

If the task is to evaluate a specific activity or to compare several situations, then the user can specify a SITE or SITES rather than SCENARIOS.



The core of the **KERDST** procedure is to express a judgement, by each class of actor (or stakeholder), for each option (site, scenario, action, etc.), relative to each performance category (principle or criterion). This is referred to as a cell-level judgement. Several levels of judgement are however possible. The full (2006-2009) **KERDST** on-line system integrates two major features within the basic multi-stakeholder multi-criteria comparative evaluation framework.

- The first is the **mobilisation of indicators** as a basis for the cell-by-cell judgements; these indicators are catalogued in a "KerBabel™ Indicator Kiosk" (**KIK**), which can be accessed through on-line interfaces with the Deliberation Matrix.
- The second is the accommodation of **multiple participants as members of the deliberation community**, each participant being associated with one of the stakeholder categories and contributing to the building up of composite judgements for the cells of the **DM** corresponding to that particular stakeholder category.

By combination, we obtain the four types of exploitation of the **KERDST** system's possibilities, as summarised in the tabular presentation below.

KERDST© **Typology of Deliberation Processes with the "KERDST" Deliberation Support Tool** **© KerBabel™ C3ED (2006)**		**ROLE OF INDICATORS IN THE EVALUATION**	
		NO INDICATORS **"Colouring in the Cells" (with or without commentary** *For each Cell, a single judgement (by colour) is registered for each stakeholder category (via discussion or expertise)*	**WITH INDICATORS** **The judgement for each Cell of the Matrix is informed by a "Basket of Indicators".** *The colour of the Cell depends on the signification and relative weighting attributed to each indicator in the 'basket'*
USER COMMUNITY	**CLOSED** **The deliberation is not open to an extended community.** *A single (synthetic) judgement is registered for each actor/stakeholder category*	**A. QUALITATIVE MULTI-STAKEHOLDER MULTI-CRITERIA ASSESSMENT**	**C. NON-PARTICIPATORY INDICATOR-BASED ASSESSMENT**
	OPEN **An extended user community.** *Multiple participants within each stakeholder category may contribute to the evaluation*	**B. QUALITATIVE MULTI-ACTOR PARTICIPATORY ASSESSMENT (WITHOUT INDICATORS)**	**D. MULTI-ACTOR PARTICIPATORY INDICATOR-BASED ASSESSMENT**

The Four Variations of kerDST. Source: **kerDST Users' Manual** available in French and English (Reichel, Bureau, Legrand, O'Connor & Sunde 2007).

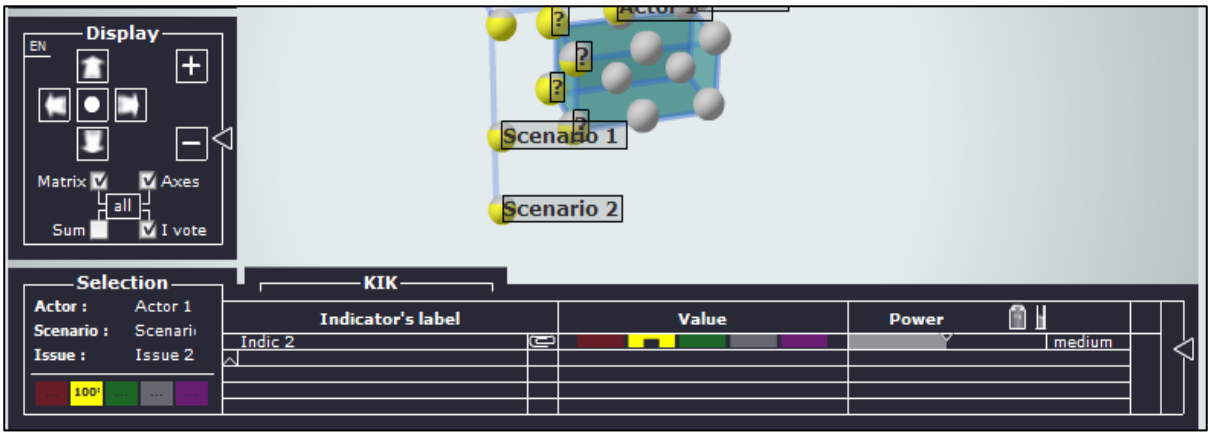
In this paper's **Section III**, we present illustrations of the possibilities of the **KERDST** system in supporting piecewise deliberations in the field of sustainable agriculture. Our purpose is to show how things can look in practice, the indicator lists, evaluation process and outcomes being built up progressively, through 'piecewise' procedures, loosely articulated to each other, but each exercise engaging several layers of data, declarations, choices and judgements. Within the *INTÉGRAAL* process as a whole and, with each of the variations of **KERDST** on-line, there are sets of deliberative tasks in the course of which the user or users can form an overall impression and compose piecewise comparisons (between scenarios, between stakeholders, etc.) via the array of coloured cells in the Deliberation Matrix.

The on-line **KERDST** offers four main variants, as signalled above. The simplest procedure is that of "Colouring in the Cells" for a qualitative multi-stakeholder multi-criteria assessment of a situation or of options for action, etc. (this is Variation 'A' in the above schema). This opens up naturally to the Variation 'C', a "non-participatory evaluation supported by indicators", which is the procedure that is the most directly relevant for the deliberation exercises that we report in the present paper, linking indicators to societal goals (or values, or quality-performance-responsibility challenges, or whatever other terminology is adapted to needs).

The simplest version of **KERDST** (the Variation 'A') uses colour codes to build up a three-dimensional array of qualitative judgements.[10] Building on this, the **KERDST WITH INDICATORS** (Variation 'C') allows the user to incorporate a descriptive basis for the judgement (colour) proposed in each cell of the Deliberation Matrix, through the selection of a **'BASKET' OF INDICATORS** taken to characterise relevant attributes of the scenario/choice or activity/site/territory under scrutiny.

- It is permitted to choose UP TO 5 DISTINCT INDICATORS for each "basket" corresponding to a Cell.
- For each indicator placed in a basket, the user must specify the JUDGEMENT [by choice of colour code] and the relative WEIGHT compared with other indicators.

Thus, in this Variation 'C', the judgement at the cell level in the Matrix is obtained not by a simple choice of colour for the cell, but as a weighted "amalgam" of the qualitative judgements assigned to each indicator in the "basket". We give a simple illustration below, where we see displayed on screen, the **ACTOR** 1 engaged in making a judgement on **SCENARIO** 1 with reference to performance **ISSUE 2**. Only one indicator (labelled **Indic2**) has so far been put in the "basket", its colour code being *YELLOW* (black mark visible in middle column 'Value"). Therefore, the "basket" at this stage is registered as 100% YELLOW (see coloured box schema on far bottom left).



In general, the colour (or composite) of each Matrix cell is a function of the relative weight and significance attributed to each indicator in the corresponding basket.[11]

[10] The **kerDST** system on-line proposes certain judgement categories and colours as default options, e.g., [red = bad], [yellow = not so bad], [green = good], [white = no idea], [blue = don't care or not applicable]. But the user can modify both the categories and the colours as and if desired.

[11] Working in **kerDST** on-screen, there are two ways to specify the weights (that is, the relative importance) of the different indicators that contribute, in the "basket", to the overall cell judgement. One way is to propose a weight expressed in absolute figures for each of the indicators; the alternative way is to specify

Cell by cell, as the deliberation process is pursued, the Deliberation Matrix becomes more and more colourful, each cell's colour profile being generated by the indicator basket composed for it.[12] An overall impression of the choice problem is then obtained by appraising the patterns of colour differences — from scenario to scenario, from actor to actor, from issue to issue. Reflecting on the pattern of judgements as it is built up, the users/participants in the deliberation are encouraged to appreciate the pros & cons of each option (or the relative merits and deficiencies of each situation) not only from their own point of view but also as signalled by the other participants/stakeholders in the system.

The **kerDST** system was conceived by its KerBabel™ designers as a tool for collaborative learning.[13] The currently available versions of **kerDST** are, compared with most multi-criteria evaluation systems, very user friendly. A student or researcher can learn how to compose and carry out autonomously a qualitative (Variation 'A') evaluation in less than an hour and, developing an indicator-based (Variation 'C') evaluation for a simple problem, with a small list of candidate indicators, is a matter of several hours of work (not several weeks!). Many features of the on-line **kerDST** system — such as the facility for changing the choice of indicators in the cell baskets (including adding in new indicators to the system), for changing the weights accorded to each indicator, and then re-visualising outcomes of the process — are powerful for building up users' understanding and "appropriation" of the evaluation tasks

Nonetheless, for many participatory situations, there are disadvantages with immediate use of on-line tools, due to the unfamiliarity with the various on-screen manipulations.[14] The Internet technologies bring revolutionary possibilities for interactive multimedia learning, but it is still necessary to appraise carefully the conditions for success in any particular social context. In developing the piecewise deliberations reported in Section III of this paper, we have adopted the procedure of starting the processes of problem construction (composing the axes of the Matrix), of qualitative cell-by-cell judgement (the Variation 'A'), and of indicator definition and selection (etc.) not directly on-line but, rather, using "classical" media such as coloured pens and paper, or blackboard/whiteboard, flip charts and so on. In this sense, we have adopted the **kerDST** *method* for participatory processes, with the on-line tools themselves in the background, used for documentation and ex post communication tasks.

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directly a weight expressed in relative (percent) figures. As an example, with the specification of absolute weights, one might choose figures between 0 and 100. Suppose that the figure of 50 is specified for two indicators, and then 100 for a third one. Expressed as relative (percentage) weights, these figures are normalised into 25%, 25% and 50% respectively, summing to 100%. The result of the process of indicator mobilisation for one cell is visible on-screen in an array that shows the percentages for every colour "summed up" across the indicators in the "basket".

[12] Given that each indicator is individually attributed a qualitative significance (via its colour code), it follows that there must be some sort of rule for the 'aggregation' or 'amalgamation' of the indicator 'signals', and also some choice of convention for visualising the 'amalgam'. Numerous conventions might be adopted. The 'default' convention offered within the existing (2006-2009) kerDST on-line is that the "ball" takes the colour that has the highest percentage in the "basket of indicators", this colour being shown for the proportion of indicator weight in the cell having that colour (the rest appearing as grey).

[13] In the GOUVERNe Project, the first prototype Deliberation Matrix on-line was the centrepiece of the "Champigny DST" (deliberation support tool) offering users the opportunity to learn about challenges of integrated water resource management in a French territorial context (see O'Connor 2006b). The second prototype, developed in 2003-2004, was embedded as a component of the pedagogic multimedia deliberation support tool *VIVIANE (Visite Virtuelle à Notre Environnement*, see Douguet et al. (2005)) addressing questions of chemical pollution associated with intensive agricultural activity in a territorial perspective. These first experiences led the KerBabel team to systematise the design of modular on-line systems, with the different components linked in confounded hierarchy allowing a multitude of "learning pathways" (O'Connor 2006b), formalised by the acronym *SMMAAD (Système Multi-Média d'Apprentissage et d'Aide à la Délibération)* for research, decision support and teaching applications.

[14] Although the navigation is developed to permit 'stepwise' learning, there are subtleties with understanding the evaluation concepts and procedures themselves (with all their different layers), and seeing to where they are leading. Experience shows that for many (though not all) people, the blackboard, and pencil-and-paper media are highly effective in the first cycles of learning and, in some cases less intimidating….

2.4. Task Types within the *INTEGRAAL* Framework

The *INTÉGRAAL* procedure outlined in sub-section §2.2, is wider in its scope than the evaluation framework provided by the **kerDST** system itself. To complete our methodological framing we need to situate the formal evaluation tasks within our wider social learning perspective. Given the iterative, distributed and sometimes parallel nature of the activities that make up the *INTÉGRAAL* deliberation cycle, it is helpful to think of the process in terms of task types rather than mechanical steps.

- **Task Type 1 — "Build a Collective Learning Process**".
  This means to determine the key decision, evaluation & communication challenges and, more specifically, to plan, design, "construct" in social process terms, and maintain a multi-event "deliberation forum" facilitating learning & action.

Formally, this can be seen as 'Step One', the task of identifying collectively the policy or strategy challenge to be addressed. Although this can have a quite precise outcome at a moment in time (e.g., agreement to focus on water quality at a regional scale), the agreement around "our common problem" is merely a pointer to the deeper challenge of building an ongoing collective learning process for the individuals and stakeholder groups concerned.

Within this overarching concept, all other task types contribute to building up and maintaining the collective learning process. Following the *INTÉGRAAL* schema, there are four further task types that can be sequenced or woven together as contributions to social learning. These are:

- **Task Type 2 — Determine the Spectrum of Stakeholders, Values and Objects of evaluation.**
  These are the tasks of specifying the "social choice" problems to be addressed. The kerDST framework for appraisal of a situation and of options for action, is organised as a multi-actor multi-criteria 'matrix' of judgements. And so, getting to such a representation of a "social choice" problem requires that stakeholder categories, performance criteria and options for comparison/action be specified. The identification of these categories can, in principle, be carried out through any mix of stakeholder deliberation, discourse analysis and other expert inputs to typologies. However, comprehensive typologies with subclasses can be unwieldy. In practice, and in line with the discursive SA considerations mentioned previously, it is likely that simplified lists of stakeholder classes, performance concerns will be appropriate, as a function of context. Similar remarks hold for the objects of evaluation. For example, a great variety of policy options might be considered across a region, but only a few will have 'generic' pertinence everywhere, and many will be site-specific in their significance.

- **Task Type 3 — Representing the System; Motivate and Prepare the Use of Indicators.**
  The kerDST framework for multi-actor multi-criteria evaluation defines roles explicitly for indicators to assess performance and quality for any existing situation and for scenarios of policy or investment actions. This implies the need for agreed descriptions or representations of the situation and options, as a basis on which to build up and mobilise banks of indicators pertinent to the monitoring and appraisal needs. In reality, this may be a permanent and piecemeal process. However there are high points where (i) analysts work, perhaps with other stakeholders, to develop analytical model representations of the system(s) under scrutiny; and (ii) stakeholders and/or specific experts work to compile lists of indicators to be employed in a specific social choice evaluation exercise. This leads to recognition of (iii) the need for documentation of the models of whatever sort (e.g., maps, input-output analyses, etc.) and (iv) the need for the management of indicators (cataloguing, etc.) with a view to their exploitation.[15]

- **Task Type 4 — Undertake Assessments or Evaluations:**
  Following the kerDST « Deliberation Matrix » [Actors-Issues-Options] format, deliberation exercises of current performance or future options, are undertaken in a multi-stakeholder multi-criteria perspective at appropriate scales (e.g., from farm to region to nation…), corresponding to defined contexts or "theatres" of collective debate and action. There may, in principle, be many discrete evaluation exercises — hence our term "piecewise deliberation" — that can be loosely coupled by engaging common typologies of stakeholders and performance values, or by considering the same or analogous strategies.

[15] These challenges of information management and documentation, and their relation to contexts of indicator use, are discussed at length in O'Connor (2011). Detailed case studies of indicator system development and exploitation are provided by Chamaret (2007) and Maxim (2008).

- **Task Type 5 — Communication.**
  Communication must and will take place around all aspects of the social learning process and its outcomes (e.g., the framing of evaluation tasks, the selection of indicators, the determination of reference values (by whom, for whom?), and the reporting of outcomes of multi-criteria evaluations). A great number of documents might be produced, many destined to remain unpublished in a process punctuated by higher-profile benchmark & strategic reports, brochures, and scientific publications. Management of these products (e.g., with CMS technologies on a website) becomes a significant task in itself.

In **Section III** that follows, we give examples of deliberation tasks carried out under one or other of the CRF and P21 programmes, engaging AgResearch scientists and their partners. None of these exercises gives a 'complete picture' of the challenges facing the actors for sustainable agriculture. However, this is precisely not the intention. Our desire is to explore to what extent, and in what ways, cumulatively this process of *piecewise deliberation* can be effective as a way of building collective capacity for addressing complex societal challenges that are often regarded as being too specialised for meaningful public participation.

III. Piecewise Deliberations

3.1. Case Description

In this section, we report on empirical case studies from existing research, collaborative learning and evaluation activities, based on piecemeal deliberations. Through this, we appraise the conditions and possibilities for design and practice of building knowledge partnerships through multi-stakeholder dialogues for agriculture and territorial sustainability questions. The research has, as outlined in the Introduction, been undertaken as part of two New Zealand Foundation of Research and Science and Technology (FRST) programmes, titled "Creating Futures (acronym CRF,[16]) from the initial title "Choosing Regional Futures"); and 'Pastoral 21' (acronym P21).

- **Creating Futures**, led by the regional council Environment Waikato, has engaged a consortium of research partners with the overall aim of building experience with processes and tools that can assist in long term integrated planning for actors of territorial development in the Waikato region. The project had two specific objectives: (1) to develop, demonstrate and document deliberative processes to support territorial planning processes; and (2) development of a spatial decision support system to support the deliberation and planning processes.
- **Pastoral 21**, led by AgResearch and engaging a wide spectrum of research organisations, has a more specific agricultural sustainability objective, that of framing the multiple performance challenges of the New Zealand pastoral sector and, in particular, their concerns to remain profitable while mitigating the adverse impacts of their activities on the environment (notably, but not only, chemical runoff and nitrates from intensive animal production). The purpose of this research is to develop tools and processes for the evaluation of the impact of policies, directed at environmental management, across a range of social, economic, environmental and cultural values held by agribusiness and others in the community.

Both cases are therefore focused on regional planning and agricultural sustainability within New Zealand. However, the spectrum of stakeholders engaged is quite different for each of these two programmes. In the case of 'Creating Futures', an end user group of five people, being a cross section of Waikato regional, district and health planners interacted with the research team throughout the life of the CF project. By comparison, the participants in the 'P21' project consisted of a cross-section of dairy industry actors (including farmers, farm consultants, agro-food process industry representatives and so on). These distinct profiles are quite significant for determining the style of the piecewise deliberations in each case.

3.2. Case Study A — Deliberations about Regional Futures

Our first terrain of deliberation tasks comes from stakeholder workshops undertaken in the context of the New Zealand FRST funded research programme "Choosing Regional Futures" led by Environment Waikato (with regional planning and resource management responsibilities and in which AgResearch participates as leader of the stakeholder interface activities). As summarised in one of the project's intermediate reports (Wedderburn, O'Connor, Small & Barnard, April 2008),

> *To ensure sustainable development of the Waikato Region requires a realisation of the impacts of market and non-market influences across social, economic, environment and cultural outcomes. The Long Term Community Council Plans (LTCCP's) are a means through which the community can identify what they value (the well beings) and how they can measure (indicator) the performance of that value as various influences impact on them. The Choosing Regional Futures programme recognises the complexity of exploring various pathways towards the region's future and is researching ways of ensuring this exploration is informed, available and easily accessible to the community and allows for collective learning. Deliberation assists us to face up to the dilemmas of action and to weigh up the insights from different knowledge sources. We are using tools and processes to enable deliberation around the impacts of decisions, which will impact on the range of sustainability outcomes. These*

[16] Information about the 'Creating Futures' project (Foundation of Research, Science & Technology Project ENVW0601) is available on the Internet: http://www.creatingfutures.org.nz/

tools and processes involve the identification and use of indicators of performance of the values that are important to the community and the programme is developing a spatial decision support system that will inform these indicators.

The CRF project work was initiated in 2007, and developed in several parallel strands. These included design and implementation of a spatial decision support system (SDSS) with land use, environmental change and economic sectoral components (see Rutledge et al., 2008), the elaboration in narrative terms of a set of four contrasting scenarios for the Waikato region (see Delaney & Huser 2008, and presentations on the CRF project website at: http://www.creatingfutures.org.nz/waikato-scenarios/), and a series of workshops bringing together stakeholders of the region to contribute to goals of the project (including SDSS and scenario framing) and to develop capacity in deliberative processes.

The first major CRF Deliberation Workshop was held on the 11th of March 2008, and had as its purpose to introduce people working in policy to the tools and processes that would enable them to:

- Build a "deliberation forum" for evaluating policy;
- Be exposed to new insights and the need for further detailed information on the indicators as the deliberation exercise deepens;
- Simplify complex behaviours;
- Undertake an integrated sustainability analysis.

The CRF project researchers were looking for feedback into how the deliberation support tools and processes brought into the project might work in practice, and what added value this approach may be able to bring to regional sustainability policy. The approach adopted was to build up a set of sub problems around the key questions being posed, so as to explore different facets of the complex challenges facing the region.

In line with Task Type 1 of the *INTÉGRAAL* schema (Section 2.4 above), it was necessary first of all to decide the planning problematic to be addressed; and then (as Task Type 2) to formulate problems in terms of specific situations or options to be assessed, criteria of performance or societal goals, and stakeholders affected or engaged. We present the framing choices made for this workshop.

Agreement about the focus of deliberation was quick to obtain. The problem of "deteriorating water quality of the Waikato River" was chosen, as the river was identified by all concerned as a key resource for the region. This strategic importance was, for example, expressed in all of the four scenarios developed for the Waikato region (see http://www.creatingfutures.org.nz/waikato-scenarios/) and, it was readily agreed that the status quo reflects a trend of water quality deterioration.

The *INTÉGRAAL* schema Step 2 requirement is then to compose one or several "social choice" problems, framed as an evaluation of a range of policy options by a spectrum of stakeholders against the set of performance criteria agreed as relevant. This falls within Task Type 2. The specification of the stakeholders, the policy options and the performance criteria gives the axes of the Deliberation Matrix for each problem.

First of all, who are the stakeholders who are impacted by deteriorating water quality and who might be impacted by the implementation of the strategies? To provide an answer to this question, social scientists engaged in a scoping exercise, with a range of stakeholders, leading to a typology of stakeholder classes at different scales, from farm to national level (Small 2007). In the CRF Workshop context, it was then chosen to work with a simplified set of stakeholder categories:

- Farming industry
- Utility companies
- Recreational river users
- Urban dwellers
- Land use Tourism, Conservation, life style

Two policy propositions were then identified as among those potentially relevant to addressing the Waikato River water quality problem: [17]

[17] The identification of two options was sufficient to enable the deliberation framework to be developed and trialled by Workshop participants. Later work in the same vein, which is the object of a separate paper, addressed a fuller range of policy options (see Wedderburn et al., 2009).

- Strategy 1. Cap nutrients (mainly nitrogen) leaving farms, at the year 2000 level;
- Strategy 2. Replace or remove dams on the Waikato River in order to increase water flow and supplement with wind power.

As a reference framework for determining performance criteria in the piecewise deliberations, a compilation was made of Waikato Regional Futures Outcomes. This set, shown in the tabular format below, was substantially based on a synthesis of "community values" lists in pre-existing Environmental Waikato documents, augmented and restructured through consultation and synthesis processes during 2007 within the CRF and Pastoral 21 programmes (see Small 2007). These are set out in the table below.[18]

Community Outcomes	***Environment***	***Economy***	***Quality of Life***	***Participation & Equity***
"Working with our communities for a better environment" Table of Objects that are valued	**Air**	**Productivity**	**Safety and security**	**Equity**
	Land and soil	**Prosperity**	**Health**	**Civic participation**
	Water	**Employment**	**Paid work**	**Treaty of Waitangi**
	Landscape	**Infrastructure**	**Recreation & leisure**	**Political/social trust**
	Biodiversity	**Tourism**	**Knowledge and skills**	**Human rights**
	Biosecurity		**Social connectedness**	**International treaties**
	Kaitiakitanga /stewardship		**Housing**	**Identity and status**

The 11 March 2008 CRF workshop was conceived principally as a way of introducing stakeholders to the deliberation concepts and tools. Several further simplifications were imposed.

First, within the above mentioned spectrum of regional development performance issues, a sub-set was selected for the Workshop exercise, as follows:

WATER QUALITY	SOIL & LAND	PRODUCT-IVITY	PROSPERITY	HEALTH	LEISURE & RECREATION

Second, the above-mentioned set of stakeholder categories was re-considered, and a selection made down to 3 types of stakeholder: *Farmers; Utility companies*; and *Recreational river users*.[19]

These decisions provided the basis for specifying the 3 axes for a multi-criteria, multi-stakeholder evaluation of the specified strategies. The corresponding Deliberation Matrix, composed by *[3 Stakeholders] x [2 Strategies] x [6 Performance concerns]*, has 36 cells. The deliberation then proceeded by requesting workshop participants to work in groups, each group taking the role of a category of stakeholder to propose judgement for an array of (2x6) cells corresponding to their assessment of each strategy against the performance criteria.

On this foundation of problem structuring, it becomes possible to move towards Task Type 4 (evaluation exercises) and also towards Task Type 3 (identification of information bases as supports for the deliberation). In these regards, the Workshop deliberation exercise was organised in two phases. Participants were organised in small groups (of about six people per group) which worked in parallel with each other on the two allocated tasks.

Task A was to identify what impact the two strategies would be expected to have on the level achieved for each of the performance goals (viz., the societal values selected as reference criteria). In

[18] Ongoing work carried out by AgResearch for the P21 Environment programme, continues the development of comparable typologies of values, and associated indicators (for example, unpublished work by Blackett et al., 2010).

[19] In other exercises during 2008 and 2009, the same researchers have engaged different configurations of these stakeholder categories, including urban dwellers and tourism sector actors (see, for example, the 14 March P21 Deliberation Exercise with farmers and agriculture sector stakeholders, features of which are mentioned below).

operational terms, the instructions were (i) to note down the reasons for the judgement and (ii) to allocate a colour judgement [*red =bad or worse; yellow =moderate or no big deal; green =good or better; blue =does not matter*]. Thus, in the first phase (Task A), the instructions given were:

As a group you will COLOUR in each of the cells with YOUR OPINION of the impact of the strategy on the performance criteria.

- **If you think the performance will be good or improved (on that criterion), then colour the cell green.**
- **If you think the performance criteria will be bad or get worse then colour the cell red**
- **If you think the performance criterion is not important to you, colour the cell blue**
- **If you have no strong opinion then colour the cell yellow.**

As you colour the cell please note the REASON why you have chosen the colour.

In effect, the groups carried out a paper-and-pen version of the kerDST qualitative evaluation (Variation 'A'). After accomplishment of this first task, the participants were brought back into a plenary discussion to share results and to communicate the reasons for choosing the colours in each cell. Then, the workshop participants were invited to go deeper into the deliberation by choosing indicators that, for them, signal features that are important for assessing each of the performance criteria.

The idea here, is to start the participants off with information and tasks that are very accessible to them as stakeholders in the problem, and then progressively offer opportunities for the stakeholder interactions to become "deeper", for the types of knowledge and interpretation challenges to become more complex and in this way progressively to allow for collective insights and outcomes to emerge.

In Task B, the stakeholders had to identify, for each of the 'cells' of their (2x6) evaluation matrix, up to 5 indicators that, according to the group, signalled some facet of the policy option's performance relative to the reference criterion of that cell. These indicators could be selected from a list that was provided to them (which was based on pre-existing regional planning documents), or specified by the group members themselves based on their own experience and stimulated by the discussions in Task A. [20]

Thus, in Task B the workshop participants in their respective groups undertook a paper-and-pen version of the kerDST indicator-based evaluation (Variation 'C'). They were instructed to choose a maximum of 5 indicators per cell of their matrix (that is, 5 indicators for each performance criterion applied to a given water resource strategy) and, each indicator was to be accorded a colour signalling the performance assessment. The groups were asked to colour the cells again, but this time on the basis of the 'weightings' implied by their chosen indicators. This raised the obvious question of an indicator's relative weight. For simplicity, it was proposed that each indicator in a basket should be considered to have the same weight (so that, if 5 were selected, each carried 20% of the total score). Thus, if three out of the five indicators were judged to be at an acceptable level, the group would colour the cell 60% green and 40% to correspond to the other signals. However, the choice of colour scheme was finally left over the the group members themselves.

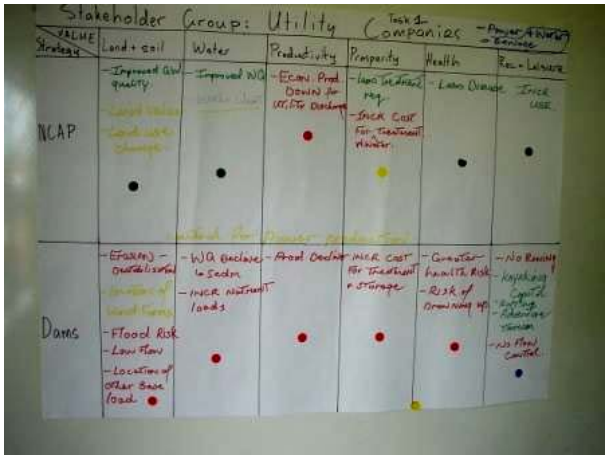
After completing this exercise, spokespersons for each group reported back in plenary session the reasoning for their choices of indicators and the assessment results for each of the strategies relative to the community sustainability performance criteria. The two snapshots (below) illustrate the colour production of results in the groups; the indicators themselves are reproduced in a schematic tabular format (on a separate page.

Within the overall *INTÉGRAAL* process, the Deliberation Matrix has several roles, including that of representing a social choice problem (the choice options and their significance for different stakeholders) and, by the comparison of options, for assessing trade-offs. Depending on the extent to which, and ways in which indicators are mobilised, this assessment can be made in qualitative or quantitative terms. An important feature of the method is that it allows a progressive development of a complex evaluation problem, beginning with a qualitative structuring, proceeding through a scoping of

[20] For the exercise reported here, the lists had been compiled by Small (2007). Comparable typologies of values and associated indicators are prepared as required (for example, unpublished work by Blackett et al., 2010, which is the basis for ongoing AgResearch stakeholder deliberation workshops on land and water resources use options.

descriptive indicators relative to normative concerns, and then deepening the estimation, measurement and calculation where this is relevant.

The Raw Deliberation Results: CRF Workshop (AgResearch, 11 March 2008)



Thus, these experimental deliberation exercises, although not intended by the Workshop facilitators nor by the participants to be decisive, nonetheless permit immediately to anticipate opportunities for Task Type 5, interpreting and communicating with the results. In particular, the colour-coded results allowed Workshop participants themselves to identify the "trade-offs" that different policy options might imply, and to formulate recommendations about the needs for quantification of key policy variables through scientifically based indicators.

For stakeholder deliberation, the qualitative structure of the evaluation process seems, very often, to be at least as important in collective learning as are the detailed quantifications (but, we will come back to the questions of lack of information in Section IV later on). This procedure allows the key performance questions and "trade-offs" to be clearly portrayed by the participants' own actions; and it is relative to this "impressionistic" picture that quantification, reliability, uncertainty and other knowledge quality considerations will be raised.

Consider the array of judgements provided by the 'Farmers' group in the second indicator-based exercise (Task B). We had the following colour conventions for the Matrix cells.

Better	No Opinion	Worse	Not important

With the paper-and-pen kerDST system, the groups obtained a composite picture that can be made the basis a basis for piecewise comparison of scenarios along the lines of the tabular array below. For example, if we isolate *Water Quality* and *Prosperity* as two key societal concerns, we obtain the following 2x2 sub-matrix:

	Water Quality	*Prosperity*
Nitrogen Cap Scenario (N)	**Better**	**Worse**
Dam Replacement Scenario (D)	**Maybe Worse**	**Maybe Better**

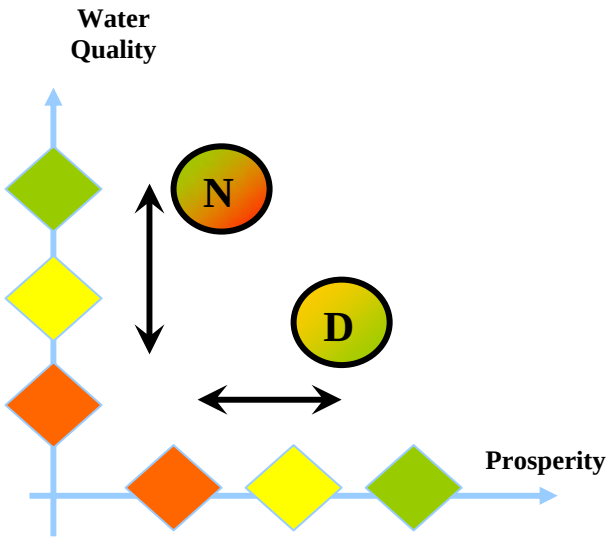
Indicator Selection and Valuation Results for the Stakeholder Group 'Farmers' (CRF, 11 March 2008, Task B)

	Land & Soil	Water	Productivity	Prosperity	Health	Recreation/Leisure	
NCAP	Stocking Density ↓ Rural Subdivision ↑ more options. Soil quality ⇔ Soil erosion ⇔ Kg DM ↓	Ground H^20 quantity and availability ⇔ Nutrient levels on H^20 (Does the cap work in ground & surface H^20) ↓ River H^20 qual for recreation. No more blooms. ↑ (Does the cap work?) Less hypox in streams. Lakes H^20 quality (bloom) less H/pox in lakes. Not expecting a dramatic change in SQ, but we want proof of what happens.	Agric. Sector prod'vity ↓ On farm productivity ↓ Whole economy productivity. ↓ Environmental efficiency per unit product produced e.g. kg N / kg MS Less N inputs for same amount of MS ↑	Wealth ↓ Individual income level ↓ Regional GDP ↓ Rural vibrancy. ↓ Population - number of services. Disposable income ↓	Social deprivation ↓ Overall quality of life ↓ Barriers accessing GP's ↑ Life expectancy at birth ↓ Avoidable mortality ↑ Stress etc.	Engagement with community ↓ Health and rural clubs ↓ Farmer markets ↓	
	Land & Soil	**Water**	**Productivity**	**Prosperity**	**Health**	**Recreation/Leisure**	
Dams	Flood occurrence – important measure ↑ Reclaimed land ↑ Rural subdivision ⇔ Stocking density ⇔ Soil erosion ↑	H^20 quantity more of an issue with dams (can't control stocks of H^20) Surface water quantity ↓ Ground water quantity ↓ Surface water quality (blooms disappear) ↑	Flooding of low lying agric. Land (better than above) ↑ Relocatability of energy ↓ Agric. Sector prod. ⇔ On farm productivity ⇔ Whole economy productivity. ⇔	Cost of energy ↑ Wealth ⇔ Individual income ⇔ Regional GDP ⇔ Disposable income (energy costs) ↓	Social deprivation ⇔ Overal Q?? ⇔ Barriers to accessing GPs ⇔ Life expectancy at birth ⇔ Avoidable mortality. ↑ (flooding hazards)	Fishing more available. ↑	

Source: Wedderburn, O'Connor, Small & Barnard (2008)

Notes: The indicators selected for each cell come from two sources: either the list of candidate indicators prepared by the CRF research team on the basis of a prior programme of collection and consultation (Small 2007), or suggestions from members of the Workshop group.

In our multi-criteria perspective, it is possible to interpret at a glance that, as perceived by the farmers' group, Scenario N (nitrogen cap) favours **Water Quality** at the expense of economic *Prosperity*; whereas Scenario D (replace dams) seems not to threaten **Economic Prosperity** but may have adverse consequences for *Water quality*.



Several points are immediately apparent through this sort of piecewise qualitative comparison between scenarios.

First of all, the workshop participants are sensitised to the question of the "trade-off" or "opportunity costs" of pursuing one objective at the expense of others. This is valid even while the participants themselves highlight the uncertainties associated with their own speculative evaluations.

This may seem a rudimentary outcome; yet it is important, as it illustrates the pobssibility of 'bridging the gap' between experts and lay people not habituated to formal concepts of economic analysis and evaluation. Indeed, the workshop participants sometimes discussed in quite sophisticated ways, the difficulties of achieving consensus within their own groups, and across society as a whole, around the resource, land and water management questions.

Second, participants are sensitised to the question of the basis for and reliability of their judgements. Will the indicator variables really behave as they speculate? If two stakeholder groups formulate divergent judgements, is this because they have different visions about what is likely to happen or because things matter differently to each group?

Once again, this may seem a rudimentary outcome but in a collective social context it is important. In this way, without interfering with the conceptual clarity of the evaluation process (which can proceed at a qualitative level), the participants are pushed to consider the sources of information and the roles and priorities for research in improving the quality of the information and modelling base. There is a 'bridge' set up between the questions intelligently posed by 'lay' stakeholders from different walks of life, and the more formal systems science and measurement preoccupations of analysts and data managers.

3.3. Case Study B — The 'Pastoral 21' Workshop (P21)

A complementary feature of social learning through "building a problem" is illustrated in a deliberation exercise undertaken also in early 2008, within the Pastoral 21 programme, with a spectrum of farmers and agriculture sector stakeholders. The theme of this P21 Deliberation Exercise, on 14 March 2008, was "Working with our Communities for a Better Environment".

As in the piecewise deliberations reported in the preceding pages, the *INTÉGRAAL* process Steps 1 and 2 were the reference points, with water quality being agreed as the common problem.

- Two strategies were identified for comparative appraisal: *§1 Business as usual (**BAU**); §2 a regulation that would put a quantitative cap on nutrient emissions leaving the farm (**Rule 11**).*
- Five stakeholder categories were retained: *Farmers, Recreationists, Urban dwellers, NGO's, Scientists, Dairy industry.*
- As regards the performance concerns, the participants had first to determine priorities across the complete range of societal values presented to them (see the Deliberation Format reproduced on the following page) and then, if time permitted, to assess the two strategies relative to the performance criteria given priority.

Thus, the participants worked through a Task Type 2, Task Type 2, and elements of Task Type 4. For this exercise, workshop participants were divided up into small groups, each group identified with a

specific stakeholder class. In some cases this was a more-or-less natural identity, but in most cases the participants were required to be "playing a role". Within each small group, the participants were to work together to carry out a set of tasks using a tabular format (on A3 sheets) provided to them.

- [Sub-Task A] : Within your Stakeholder Group, you should decide weighting (%) across the 4 Outcome Classes signalled across the top of the table (ENV, ECON, QUALIFE, POL-CULT), so that sum of the weightings is 100%.
  [In the example Table, reproduced overleaf the weights are ENV 50%, ECON 35%, QUALIFE 15%, POL-CULT nil. The total is 100%.]
- [Sub-Task B] : Now consider each column of the Table, for one of the Outcome Classes. Running down the column, you should give weights (%) to each Object within the Outcome Class, so that the sum of the weights in the column is the same as the weight given to that Outcome Class.
  [In the example Table, for the ENV Outcome Class, two Objects are significant: Natural Heritage & Landscape (35%), and Biodiversity (15%). The subtotal is 50% as required for internal coherence.
- [Sub-Task C] : Declare the group's judgement about the current situation by giving a « score » for each of the Objects in the Table. This is done through use of a colour code, by sticking coloured spots onto the corresponding cells of the Table.
  [In the example Table, again for the ENV Outcome Class, the Stakeholder judgement is "good" (GREEN) for Nat Heritage & Landscape, and "good" (GREEN) for Biodiversity. So it might be proposed that the Overall ENV judgement is GREEN (bottom cell of column). The other Objects within this column are signalled "doesn't matter" (BLUE) because their weighting is zero.]
- [Sub-Task D] : Consider now the consequences of applying "***Rule 11***" relative to ***BAU***. Declare the group's judgement about the quality of the situation that might be attained under ***Rule 11***.
  [Note: In the example Table, we have not signalled any changes relative to the current situation.]

  For each of [Sub-Task C] and [Sub-Task D], the qualitative colour code was applied by sticking coloured spots onto the cells of the Table, as follows: [*Red] = Bad or Worse ; [Yellow] = Moderate or no big deal ; [Green] = Good/Better ; [Blue] = Doesn't matter.*

We show, on the next page, the table of performance issues filled with fictitious data (attributed to « *Offshore Tourism Operators* » as an out-of-scope Stakeholder category) permitting assessment of "***Rule 11***". This exercise engaged people from a wide spectrum of professions and, it brought out clearly the opportunities for — and also limits to — this strategy of collective learning. The groups struggled to complete the exercise whose several steps were felt to be novel and challenging. Yet, subsequent plenary discussions brought out a variety of strong insights about the difficulties of arriving at consensus (even in a small group), about dilemmas of seeking to prioritise key objectives without excluding other legitimate concerns, and about the character of the deliberation process itself.

We give our attention here not to the detailed substantive outcomes (whose meaning is very specific to the participants' professional and geographical context), but to the insights about the deliberation process expressed by workshop participants themselves.

At several points in the P21 Workshop process, participants acting as members of a stakeholder group were required to arrive at a consensus view — expressed as a percentage weighting, a colour code, etc. — in order to express a judgement. In some cases, group consensus was reached easily; but in others it was observed by the group members to be difficult because of the variation in perspectives and/or personal beliefs held by individuals.

In the subsequent plenary discussions, concerns were expressed by spokespersons for some groups, about their inability to reach consensus within the groups, due to the fact that individual participants held divergent views and it was not obvious how to find a consensus position. This brought the participants spontaneously to reflection about the social learning and political process goals of the deliberation. From a theoretical standpoint, the point of a multi-stakeholder deliberation process is not necessarily to achieve full agreement at all levels, rather (as in a peace process) it is (i) to highlight conflicts and dilemmas that can arise in collective choice situations and (ii) to set the scene for exploring possible 'compromise' solutions.

Format for Deliberation Exercise: P21 Programme (14 March 2008) *(DATA FOR FICTITIOUS "OFFSHORE TOURISM" STAKEHOLDER !)*

COMMUNITY OUTCOMES	ENVIRONMENT			ECONOMY			QUALITY OF LIFE			POLITICS & CULTURE		
WEIGHTING BY OUTCOME CLASS	50 %			35 %			15 %			0 %		
Working with our Communities for a Better Environment SETTING PRIORITIES FOR THESE OBJECTS [Task 1] : Decide weighting (%) for Outcome Classes (ENV, ECON, QUALIFE, POL-CULT) so that sum of weightings is 100% [Task 2] : Give weights (%) to each Object within Outcome Class [Task 3] : Declare level of satisfaction with the current situation for each Object [Task 4] : Declare the level of satisfaction attained under Rule 11	*Air Quality* [_ _ %]			*Farm/Ag Sector Productivity* [5 %]			*Safety and Security* [_ _ %]			*Equity* [_ _ %]		
	Land and Soil [_ _ %]			*Societal Prosperity* [5 %]			*Health* [5 %]			*Civic Participation* [_ _ %]		
	Water Quality & Quantity [_ _ %]			*Employment* [5 %]			*Paid work* [5 %]			*Treaty of Waitangi* [_ _ %]		
	Natural Heritage & Landscape [35 %]			*Transport Infrastructures* [_ _ %]			*Recreation & Leisure* [_ _ %]			*Political/Social Trust* [_ _ %]		
	Biodiversity [15 %]			*Tourism* [20 %]			*Knowledge & Skills* [_ _ %]			*Human Rights* [_ _ %]		
	Biosecurity [_ _ %]			*(Other Sector Prosperity/Productivity)* [_ _ %]			*Social Connectedness* [_ _ %]			*International Treaties* [_ _ %]		
	Kaitiakitanga /stewardship [_ _ %]						*Housing* [5 %]			*Identity & Status* [_ _ %]		
CHECK : Weightings across Table sum to 100% across all classes of Value Objects (YES !)	Overall ENV	Actual Situation	*Result of RULE 11*	Overall ECON	Actual Situation	*Result of RULE 11*	Overall QUALIFE	Actual Situation	*Result of RULE 11*	Overall POL-CULT	Actual Situation	*Result of RULE 11*

In this regard, comments from participants within their small groups and in plenary discussion, highlighted that the stepwise deliberation exercises were effective in building awareness of the difficulties of getting to an agreed judgement or decision. Participants found that adopting a 'role' of a specific stakeholder type, was useful as a way to draw out a wide cross-section of views. Although sometimes starting in self-conscious caricatures (e.g., the prejudices and tunnel vision attributed to "urban dwellers"), the exchanges of perspectives within a group and between groups encouraged the sharing of relevant knowledge and expertise. Participants highlighted moments where individual views changed as other individual's positions were revealed, or as they were confronted with perspectives from other groups: *"After discussion individuals took on board the comments and reasoning of the other participants and individual positions often changed"*. Consideration of others' viewpoints (both real and simulated) led to real changes in thinking and understanding and, overall, to sharpened awareness that reaching "balanced" decisions on agriculture and territorial policy issues is far from straightforward.

3.4 Participants' Insights from the Piecewise Deliberations

According to our underlying hypotheses (see Sections I and II above), appropriately designed deliberative process can facilitate collective learning and empower participants as actors in political processes of social choice. So we turn now to a summing up of significant outcomes of the CRF and P21 deliberation exercises considered as social learning and political empowerment opportunities.

A Systemic View of Policy Effects and Societal Goals

One of the key features of the deliberation tasks set before the workshop participants was the obligation to consider different facets of a strategy, in terms of multiple performance criteria (the 'Value objects') or in terms of different stakeholders' likely positions and the reasons behind their divergences.

- For example, in the P21 Workshop, participants were confronted with the challenges of rating the relative importance of the Value objects (or societal goals) and then of making a judgement about the level of their actual or possible future attainment. In setting about this task in the small groups, workshop participants became aware that the different Value objects are not independent from each other and that the change in state of one would have repercussions on or correlations with others: *"…"We started on the first Value Object and then began working progressively through the value objects. After a while when working on a particular value object, interconnections with other value objects became apparent, and so multiple value objects were worked on all at once"*. The participants were thus drawn into the perspective of dealing with a system rather than discrete variables, with attention given to understanding the relationships.

Stakeholder Diversity and the Effectiveness of Role playing

The participants in both Workshops took on the role of actors for particular stakes. This was found to be challenging in at least two respects: (i) the challenge of remaining in role and (ii) imperfect understanding of the views and reasons the reference stakeholder group. However these challenges were not simply obstacles, they offered opportunities that gave a new perspective to the participants own positions.

- The role play process (notably in the P21 Workshop) made participants aware of how little was known about the position and perspective of the "other", and that ignorance and prejudice were obstacles to dialogue at least as much as direct conflicts of views. As mentioned just above, individuals' views often evolved as other individuals' or groups' positions were revealed.
- It became clearer to participants that policies will be judged by different stakeholder groups against strongly different reference points, e.g., different histories in an area, different geographical knowledge, time frames, as well as more tangible financial and lifestyle value concerns. The reference points for policy assessment, including historical conditions and perceived current trends, thus need to be the object of prior clarification, so as to avoid confusion that can have a major impact on the judgements made of the effectiveness of a policy.

- Participants were pushed to think in practical ways about problems of democratic political process. For example, who determines the spectrum of stakeholders and the makeup of groups? Any given stakeholder group is not homogenous and there will be a range of positions, beliefs, attitudes, perceptions and perspectives within one group, and so what rules or procedures should be proposed to deal with this?

Difficulties with Consensus Building

The political theory that underlies deliberative process design, implies a complex view of consensus seeking. For example, whereas full agreement across stakeholders about the "best" course of action is not expected, there can be zones of agreement such as (a) identification of the key conflicts and dilemmas of the social choice situation, and (ii) common understanding of conceivable 'compromise' solutions and of the reasons for and against them.

- As already mentioned, concerns were often expressed by P21 and CRF Workshop participants about their inability to reach consensus within their groups with each participant taking a position. In the P21 Workshop, participants did not always reach agreement within a group about the weights to give to Value objects or the consequences of policy. In the CRF Workshop, the same phenomenon was observed in the judgements about effectiveness of the policy options and, in that case, as the deliberation was deepened to include the indicator sets, obtaining consensus became more difficult.
- The allocated tasks and processes did, however, allow for robust debate with a feeling of significant "progress" in the understanding of the decision stakes on the part of most participants. Also, they accepted spontaneously that part of this "progress" was not the disappearance of conflict but the insights and learning to participants via the discussions that take place and observation of the respective positions adopted and of how these evolve through the collective learning that occurs.

Importance of Well-Structured Process and Time Management

As a general rule, reaching consensus at specific levels of deliberation tasks is partly a function of time.[21] In the CRF and P21 workshops, groups expressed quite divergent views about the extent to which the session time constraints were a factor in not reaching full agreement.

- There was a general consensus that reaching an agreed outcome required an "iterative" approach, with participants going back over their early decisions and reassessing them. For example, in the case of the CRF Workshop, this was facilitated by the choice of indicator and also the iteration of the process that allowed for greater exploration at a deeper level and observing greater interconnectivity of the value objects: *"The second task allowed more detailed consideration of initial thoughts identified in task one; it allowed greater awareness and re-examination of those thoughts"*.
- This can be interpreted as highlights that participants were developing ways of positioning their decisions within the specific framework of the sequence of deliberation tasks and, as their experience of the process increased, they reassessed the adequacy of earlier decisions. However, it raises the question of the transparency and the accessibility of the deliberation process design.
- At a "nuts and bolts" level, the procedure of using coloured spots on paper or white boards (etc.) to display the participants' judgments about a situation or policy option, was very effective for most of the Workshop participants. (The procedures were adopted in groups without significant difficulties). In this regard, the effectiveness was confirmed of the kerDST conventions of building two- and three-dimensional arrays of colour codes for visually evaluating and gaining an overall impression of the (likely) impact of a policy.
- Overall, the mood of the Workshop participants as well as the satisfaction expressed with their results, suggests that the "bite-size" task sequencing adopted for both Workshops was effective as a way to stimulate discussion and to permit deepening of insights and questioning. The structured step-wise processes acted as effective catalysts for, and frameworks for step-by-step synthesis of outcomes of the deliberation. They enabled participants to handle a lot of information and tackle complex issues meaningfully in short periods of time.

[21] From an action-research point of view, another important part of the deliberations is that it allows the researchers to capture the reasons behind the judgements and to encourage dialogue. Achieving these documentation goals also requires time for the process to progress.

The Information Base of deliberation

Workshop participants were able to grasp the sequencing of different tasks and also interpreted positively the succession of tasks as a learning opportunity. As participants informed their judgements through the choice of indicators, there was generation of new ideas and changes of judgement. However, there are limits to this learning dynamic, some of which were identified by participants.

- In the deliberation exercises discussed here, the judgements about policy effectiveness depended largely on participants' existing beliefs and knowledge base, supplemented by the group discussions. When it came to choosing a colour code for an indicator or criteria, this situation was spontaneously commentated as "too subjective" and dependant on the makeup of the stakeholder group (or those playing the role). Several times, in both the P21 qualitative exercise and the CRF indicator-based evaluation, participants stated that they "*did not have enough knowledge or understanding of the issues to make a well reasoned judgement*".
- This highlights the requirement to undertake an iterative process, where initial deliberation tasks (such as those presented in this paper) allows the participants to realise for themselves the requirements for information, thus motivating the mobilisation of information from a range of different sources (including science and social science). For example, in the CRF Workshop exercise, a prepared list of indicators was offered to the participants. Although the sources were known to the participants, the list itself did not have much detail. As soon as the deliberation process moved to step of indicator selection and use, it entered into a technical realm relative to which participants' readily admitted limits to their own knowledge.
- The discussion about indicators also highlighted the importance of two points in the indicator selection process: (i) the importance of allowing participants in the first instance to contribute their own suggestions of appropriate indicators; and (ii) the necessity for acceptability to participants, that the supplied indicator information be "transparent" (and hence credible).

Perceived Pertinence of the Deliberation Process

Workshop participants were asked to state whether and in what ways, the deliberation processes seemed useful for their own professional situation. Public policy participants, in particular, saw potential value in the procedures demonstrated in the workshops.

- They provided a structured approach for gathering views in consultation for instance "*Getting stakeholders to give their point of view in a structured way and in a way that doesn't ask them for solutions up front (helps understand why rather than just what)*".
- The process will "*… make evaluating policy options more comprehensive and efficient particularly continued reflection on and ideas for how to bring economic/social/labour/environmental/cultural issues and actions together*".
- It will also be a way in which "*to hold and facilitate workshops; Greater indicative awareness of positive and negative and so impacts to different sectors of the community*".

IV. Piecewise Conclusions

4.1 Deliberation as a Catalyst for Social Learning

This paper reports social science action-research seeking to contribute to the improved quality of environmental and territorial governance processes and, in particular, to improved understanding of the conditions for success in bringing together science, agriculture sector, business and territorial governance stakeholders in "knowledge partnerships" for agricultural sustainability.

In the AgResearch context of our research, particular attention is paid to advancing the uptake of research information. In effect, our work seeks to leverage improved economic, social and environmental information management for agriculture through attention to context and process in a way that complements research content and product.

- Applied research needs to do more than simply analyse or represent agricultural systems and their environmental impacts. It needs to facilitate improved linkages and interactions between economic bio-physical research, and the decision support needs of a wide variety of end-users.
- Achieving this involves, necessarily, developing a shared understanding among researchers and those different stakeholder representatives that they engage with, helping to ensure that the resulting science is most relevant and responsive to end-user needs.

Accordingly, we are exploring the effectiveness of techniques that can help to create a favourable social environment — at farm, district and regional levels — in which science and social science knowledge can be developed, and used. Of course, research teams can, at best, work directly with only a few representatives of stakeholder groups. This is particularly true in environmental management issues characterised by large geographic scales, many players, multiple perspectives on the situation and in which science and other information is subject to contested interpretations.

This is why, in the work reported in this paper, we place the accent on action-research as a collective learning opportunity and, in particularly, we are concerned with *tool development and process design* for deliberative exercises that can help stakeholders, including scientists, to interpret their working relationships with others. [22]

We have already outlined in Section II, the main features of process design adopted for our present phase of experimentation. We have illustrated in Section III the opportunities for "piecewise deliberations" that can build up stakeholders' (including scientists) insights into the challenges of sustainability policy design and decision-making. We now wish to round out this view of a "stepwise" approach to social choice problems with some brief remarks on the ways that the mobilisation of indicators can be considered as an opportunity for social learning and for building knowledge partnerships in the sense just outlined above.

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[22] Of course, we are not alone in this concern. Consider, for example, the following definition of social learning (at http://www.landcareresearch.co.nz/research/research_details.asp?Research_Content_ID=38) in work by Landcare colleagues: *"Social or collaborative learning acknowledges that each interest group brings different information, values, capacities, perspectives, methods of learning, and stores of historical experience to any problem situation. In essence collaborative learning is integration of these diverse knowledge bases in ways that advance the collective decision-making capability of all."* Two pertinent Landcare reports that summarise work in the environmental management domain are: (1) Using participatory and learning-based approaches for environmental management to help achieve constructive behaviour change. Landcare Research report prepared for the Ministry for the Environment; and (2) Sustainable Development Extension: Part II: Current Theory and Practice, and a Recommended Direction for Sustainable Development Extension. Landcare Research report prepared for the Ministry of Agriculture and Forestry. Bremer (2011) provides a theoretical discussion of collaborative learning and deliberative democracy as institutional formats for knowledge mobilisation.

4.2 The Roles and Status of "Indicators"

In the Task B of the CRF 11 March 2009 Workshop, the participants in an evaluation exercise were required to select a "basket" of indicators relating to each cell of the Deliberation Matrix (viz., the judgement that an actor gives about a situation or a selected scenario with regard to a selected performance concern). This highlights three important points about indicator information and its management.

- First, there is a need to determine the sources of "candidate indicators" that might be exploited by the participants in an evaluation process. In particular, in the process of selecting indicators for "baskets" in the cell-by-cell appraisal, the persons or group undertaking the assessment can either choose indicators from amongst those already defined and made available to them, or contribute their own indicator suggestions as inputs.
- Second, the indicators themselves must be managed in some sort of catalogue. For a simple ad hoc exercise this might be a list or a set of tables on a sheet of paper. But, for complex and ongoing evaluation processes the needs for documentation and accessing of information become heavier, and specific tools must be employed.
- Third, as participants' experience grows, they may be led to formulate observations about absences of important information or uncertainties about key variables (past, present or hypothetical future). These observations must themselves be documented and, there must be mechanisms for the catalogue of indicators to be updated and expanded on a progressive basis.

In sum, there arise a series of questions about the mechanisms for managing indicate data and meta-information, and about the roles, if any, that might be played by stakeholders as contributors to indicator concepts, data and meta-information. We do not further discuss, in this paper, the data and indicator management questions, which nonetheless are fundamental for any comprehensive and in-depth integrative assessment process (see, on this point, O'Connor 2011). We do wish, on the other hand, to make some observations on the mobilisation of indicators from the social learning and capacity building perspective.

The **kerDST** procedure as outlined in Section 2.3, whether on-line or in a pen-and-paper (or blackboard) version, does not oblige the user to make or use an explicit estimate of the indicator's value. When an indicator is selected for a given "basket" within the Deliberation Matrix, it is attributed a qualitative significance, expressed in form of the selected colour value and its relative weight (or power) in the final result of the cell. These features may seem curious for a tool of science-based policy assessment. But there are several reasons for this angle of approach, and their elucidation highlights important methodology considerations relating to the need for a progressive approach to the selection of indicators and their application.

At the early stages of a deliberation, different persons will have quite contrasting perceptions of the challenges being faced and of what information might be needed. They will have very imperfect awareness of what information is available, held by whom, in what formats, and so on. They will have divergent and often vaguely formulated perceptions of the information that could or should be obtained, at what cost, and with what degrees of precision. These sorts of 'imperfections' can be remedied partially through time, but never comprehensively. Even if there is widespread consensus about the pertinence of certain indicators, people may make quite different estimates about current values, about ranges of values that might arise in the future, and about what acceptable levels should be.

The *INTÉGRAAL* procedure insists on the priority to be given, in a participatory deliberation process, for achieving conceptual clarity in the structuring of the evaluation process as a *problem of social choice*. As we have shown in the preceding sections, this can (and perhaps must) proceed at a qualitative level. Then, progressively, as discussions about tensions and trade-offs develop, the participants are incited to consider the limits to their own knowledge, possible sources of information, gaps in existing information, and the roles and priorities for research in improving the quality of the information and modelling base.

This is why the priority in the early phases of an *INTÉGRAAL* assessment exercise, is to carry out explicit but purely qualitative processes of identification of "candidate indicators" and judgements about their "fitness for purpose". The on-line **kerDST** system allows indicators simply to be declared

(with a maximum of 5 per "basket) as concepts (descriptors or "observables") that are relevant for the assessment process, without necessarily their values being yet known, specified or estimated. This can be seen as a sort of *alignment exercise*, where indicators, through being placed in "baskets", are being linked (by or on behalf of different actors) to specified categories of performance or social values. The focus is placed on why (and by whom) this or that indicator is considered to signal something of importance in the social choice problem (cf., Douguet et al., 2009).

4.3 Knowledge Quality and 'Fitness for Purpose'

This question of the alignment of information categories towards problems highlights a more general point. The challenges of sustainability — notably the integration of environmental, social and economic dimensions in our criteria of quality and performance and in our priorities of governance — are partly about generating appropriate knowledge (e.g., about complex environmental change processes and human contributions to these), ***but more particularly are about mobilising our knowledge in society***.

- How do we navigate between scientific certainties and uncertainties, e.g., what hopes should we place in technological innovation, and what significance should we accord to long run systems change, risks and uncertainties (e.g., climate change, biodiversity loss, biotechnologies, production and disposal of toxic wastes)?
- How to bridge the 'communication gaps' between different components of our communities (and also sometimes between different 'compartments' of our knowledge and commitments as individuals — as consumers and in our recreations, as members of communities, as professionals in science, politics and industry, in recreation between science and politics…)?
- What forms of interface and dialogue to seek between 'informal' and formal knowledge, between purposes and priorities affirmed from divergent (explicit or implicit) cultural grounds, between 'expert' and 'lay' domains of competence, between belief and enquiry, between theory and practical concerns?

These are challenges of *building knowledge partnerships for sustainability* that return to the pragmatic character of deliberative assessment and to the question of knowledge quality as one of "fitness for purpose". Following the arguments developed by O'Connor (2006b), Frame & O'Connor (2011) and by Douguet et al. (2009), we identify *scientific validation* and *pertinence to stakeholders* as complementary aspects for knowledge quality. They are not disjoint nor opposed, but are irreducible in character. The framing of information or concepts for management or decision support thus always has two complementary quality dimensions:

(1) the scientific and technical considerations of rigour, coherence, measurement validation and sensitivity testing for the sequences of data transformation, aggregation and modelling; and

(2) *the user-oriented considerations of pertinence for framing an evaluation process or decision problem and for supporting a multi-user learning activity.*

For situations of 'policy relevant science' addressing issues of sustainability and complexity, *both of these quality considerations are essential*.

We have seen in our **Section III** examples, that an interactive evaluation procedure can seek not only to achieve a selection of indicators and a signalling of the performance assessment associated with the chosen indicators, but also — and perhaps more importantly — to create opportunities for real dialogue and debate between stakeholders who will learn about what matters to the others and why.

The considerations that stakeholders bring to bear for judging the pertinence (or otherwise) of a candidate indicator, evidently relate to the respective contexts of their activities and responsibilities. So fitness for purpose cannot be decided in isolation, has to be a matter of deliberation in the context of social choice. The Deliberation Matrix provides, in this regard, a framework for selecting indicators that motivate and justify evaluation judgements about performance, policy options or scenarios. A dialogue is set up, whereby the users of information make their appraisals of the pertinence of each candidate indicator as a guide or motivation for their judgements. The choice to include a specific information category as a 'criterion' in the Deliberation Matrix framework, reveals a

quantum of the "social demand" (or absence of demand) for this or that element of information and, in the ongoing social process, contributes to the evolution of this demand.

In other words, the Deliberation Matrix multi-criteria multi-actor evaluation procedure, through the cell-by-cell process of mobilising indicators in "baskets", permits — and indeed obliges — judgements to be made about ***fitness-for-purpose***, as a function of actor class, evaluation issue and situation or scenario. It provides a framework for "feedback" to the scientific community and to modellers, about the perceived quality and usefulness of their work. Its "indicator baskets" act as a "filter" for a process of indicator choice respecting the principle of a parsimonious 'representative diversity' across the spectrum of options (scenarios or sites), of stakeholders engaged in the assessment, and of performance criteria. The societal pertinence as well as the scientific qualities (including uncertainties, controversial character of underlying hypotheses, etc.) of the different 'candidate indicators' are made the object of an open deliberation.[23]

In this way, questions of scientific quality that are normally debated as 'internal' concerns of the scientific community — rigour, coherence, measurement validation and sensitivity testing for the sequences of data transformation, aggregation and modelling, and so on — are set in relation to the society's declared needs of and roles proposed for the knowledge: *What situation of societal action are we seeking information about? What are we using the information for? What are society's purposes and preoccupations? Why do uncertainties matter (or not matter), and to whom?*[24]

4.4 Social science and capacity-building: Summing Up

The work reported in this paper, building on a base of social science and societal reflection, portrays ***empirical case studies from existing research, collaborative learning activities and expertise*** in order to demonstrate the potential for building knowledge partnerships through multi-stakeholder dialogues. The pursuit of our collaborative learning goal means making interfaces between the different spheres of knowledge and practical competence our communities — research and education professionals, the business world, public administration and civil society.

These sorts of interfaces cannot be constructed abstractly, they have to emerge and be sustained around specific themes and on specific terrains of action. In this regard, our focus has been on agricultural sustainability at the scales of farm practice and as a territorial governance challenge enshrined in New Zealand legislation.

What we are asserting, in sum, is that (1) expert inputs to decision support cannot, on their own, achieve the reconciliation of divergent interests and principles of judgement, but (2) multi-stakeholder dialogue about the challenges and dilemmas of sustainable development can reasonably be hoped to facilitate the emergence of robust and satisfactory policy actions.

In this paper, we have tried to use social science based methods to highlight in a pragmatic way, some of the distinctive features of these contemporary knowledge partnership challenges. These include:

- The challenges of social choice and community building, not science, are what drives the process;

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[23] This role has been envisaged methodologically by O'Connor & Spangenberg (2008), and demonstrated empirically by Chamaret (2007) in a comprehensive stakeholder-based indicator selection process for corporate social responsibility performance assessment, and by Maxim (2008; see also Maxim & O'Connor 2009) on biodiversity risks. This also highlights the need, as a complement to the Deliberation Matrix, for a permanent documentation of indicators in terms of their (perceived) pertinence, as a complement to documentation of data sources, models, and scientific reliability of data and estimations. In the KerBabel™ developments of on-line tools, this role is attributed to an on-line meta-information system called the KerBabel Indicator Kiosk (KIK) whose structure is explained in O'Connor (2004) and whose various uses in an integrative assessment process are discussed in O'Connor (2010).

[24] Although it is not the purpose of the present paper, we do note that this reflects specific ideals of knowledge quality assessment in a *deliberative democracy* where the various protagonists communicate their interests and value judgements to others, and also come to appreciate better the positions of the others, in the process of weighing up alternatives and formulating the crucial decisions (cf. Guimares Pereira & O'Connor 1999; O'Connor 2000; O'Connor & Frame 2009).

- Social learning is possible via "piecewise deliberations" that can be carried out in business, in territorial governance, in research, in community-based initiatives (and at the interfaces of all these spheres);
- Piecewise deliberations, notably for indicator selection, can be used to help assess the "fitness for purpose" of available information and, thus, to identify priorities for science and technological expertise to "fill the gaps" in the science base for policy.
- For effectiveness, deliberation processes must be well structured and strongly focused with accessible tasks; but they must also be presented with a clear relation to the "wider picture. In general, people cannot deliberate meaningful in a vacuum.

Our piecewise approach to deliberation has demonstrated the value of applying the process in an iterative manner over several workshops with a committed set of participants. The collaborative learning that occurs throughout the process is the most important outcome and the challenge is how to expose a large number of people in a manner that will expose them to the viewpoints of other stakeholders and allow for informed deliberation around some of the challenges in achieving sustainable development pathways.

Sustainability and regional development (etc.) are complex processes. Agricultural policy and practice span very different spatial and organisational scales. An important feature of the *INTEGRAAL* method proposed via the *kerDST* system is that it seeks to provide for a progressive development of a complex evaluation problem, in a way that remains accessible to a wide spectrum of stakeholders as well as experts and that can be broken up into bite-sized activities that nonetheless cumulate over time.

A feature of kerDST is that the same procedure for problem framing can be used, whatever the facet of the larger question being posed. In this way the people involved develop a familiarity with a common tool, a common procedure and — more fundamentally — a common appreciation of the nature of "social choice" as a multi-actor multi-criteria decision situation involving trade-offs and dilemmas.

None of the "pieces" gives a complete picture of the challenges facing the actors for sustainable agriculture. However, cumulatively this process of piecewise deliberation seems to be effective as a way of building collective capacity for addressing complex challenges.

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