Social dimensions in integrative research: internal and interactive aspects

Response to 'Integration and social processes: a review of challenges and best practice' - discussion paper by Elizabeth Kington and Anna Littleboy.

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It is timely to reflect on the role of social processes in integration, thanks to the opportunity provided by this National Academies Forum on Sustainability. Kington and Littleboy's paper, drawing both on experience within the CSIRO and literature review, canvasses many of the issues which have been observed by others, and casts some new light. I will not repeat the paper's many observations or references to literature here, but try to complement them from two little-known integrative frameworks, and personal experience. Where Kington and Littleboy focus on social processes occurring within research teams (the 'internal' referred to in my title), I also consider the *interactions* with research users and their needs.

What does the 'social' encompass?

The neatness of the popular three-part framework of sustainability, as comprising social, economic and biophysical environmental aspects, invites one to gloss over the great diversity of disciplines, issues, processes, knowledge, and even paradigms, within each of these dimensions. 'Social' is generally taken to include cultural, the socio-economic (identifiers such as income, education, employment and social status), and some people like to include the spiritual. The social sciences – and their neighbours in the humanities – encompass an array of disciplines with different foci, favoured problems and intellectual traditions. They have different scales, for instance with psychology concentrating on individuals and their thinking and behaviour, and sociology and anthropology concentrating on various societal scales from small groups to nations. Power and political relationships are central in sociology and political science, may or may not feature in anthropological or arts studies, but are apt to be neglected in psychology other than as a factor in small-group processes. By way of paradigms, positivism – still necessarily dominant in the biophysical sciences and economics although accompanied by systems analysis and complexity theory - has long given way to constructivism and postmodernism and their variants in many social sciences. It still has a role, particularly in underpinning quantitative methodologies.

This provides a diversity of potential contribution to public-interest problems requiring a variety of insights and strategies, but underlines the risk of over-generalisation about the 'social'. It highlights the demands placed on a few social scientists recruited to interdisciplinary research organisations (including CSIRO, Kington and Littleboy's base) to contribute to the examination of a wide set of issues which are likely to reach well beyond any single individual's disciplinary comfort zones. It suggests the communication demands of working in teams across major differences in discipline, particularly where questions of preference for and trust in quantitative or qualitative data and their collection processes arise. The parent of all our sets of disciplines, philosophy, periodically raises the intellectual 'bar' on fundamental matters and stimulates intellectual development, but can no longer provide sufficient common language or intellectual framework for the immediate challenges of research and development on world and local questions.

Frameworks

The Kington and Littleboy paper adopts a concise conceptual framework to explore the role of social processes in integrative research, in terms of the use of social processes as *tools* in integrative research, and the existence of social processes that act as *constraints* on the delivery of integrative research outcomes. While both dimensions can refer either to processes occurring within a research team, or to external linkages such as the engagement of stakeholders, the paper concentrates largely on what happens within research teams. Brown's response offers the converse.

While this framework works well for the paper, I would like to stretch our thinking about integration a little by sharing two other recent frameworks for considering integrative research. The Department of Natural Resources and Mines, Queensland (Dwyer 2003), recently conducted a study for the enhancement of its own integrative research. This considered integration in terms of:

- Integrating scientific (biophysical, economic and social) outputs into policy
- Supporting community needs with science
- Research
- Communicating science, and
- Gathering of local knowledge to be integrated with scientific knowledge to inform local and regional issues.

This framework places the integration of science (the 'research' point above) within a cluster of activities using science: integrating the disciplines into new interdisciplinary science; integrating local with scientific knowledge; integrating science with management – whether for policy or community and regional needs – and recognising the essential lubricant of communication. When we choose to integrate our sciences to meet particular needs and purposes – which as Kington and Littleboy point out does not mean for all purposes since many issues remain amenable to single-disciplinary solutions – we should also try to integrate the science with its users and uses. The more this can be accomplished, the more likely it is to contribute to the issues or policies for which it is intended.

This DNRM framework obliges us to consider some variations in the contributions required of the social sciences. The first point, about *integrating scientific outputs into policy*, suggests needs for policy analysis, planning, for understanding the social, economic and other contexts to which the policy is directed (requiring some sociological, anthropological or economic analysis perhaps, and some political analysis could be wise). Indeed, the point should be considered a two-way process, not of integrating the science – assumed to be produced first - into policy, so much as a shared process of creating scientifically-informed options which combine well with the contexts in which they are to work. The second point, about *supporting community needs with science*, suggests an ethical and practical issue of directing research activity towards public needs. At a surface level, this suggests a need for consultation, stakeholder analysis, and accountability, but the social sciences can identify further concerns. Many social scientists would be quick to point out the power relations inherent here. Just who constitutes 'the community' and which segments of it are really likely to solicit and benefit from the research?

The third point, concerning *research* itself, is the one most familiar to many of those who debate integration, and the subject of Kington and Littleboy's paper. Just how does one create synergy between the people and their disciplines brought together to cooperate on a problem, what are the intellectual and personal communication factors involved, and what processes does such a team engage in? As they recognise, the success of an interdisciplinary team can be as much about personal engagement and successful leadership as about planned combination of their disciplines.

The fourth point, *communicating science*, at face value suggests application of an interdisciplinary subset of social science processes and knowledge, already integrated and under continual development by communications and extension theorists and practitioners. Many of these practitioners, however, would hold that this is best achieved by subscribing also to the fifth point, about *integration of local knowledge with scientific knowledge*, since communication should be two-way and as far as possible consistent with the recipient party's existing understandings. The fifth point offers more, however. It reminds us that science is not the sole source of knowledge, and that there may be equally valuable knowledge available for consideration and perhaps combined use. A key example is the traditional ecological knowledge and medical knowledge of Indigenous peoples internationally, which is couched in very different paradigms to scientific knowledge and indeed integrated with religion in many societies. This knowledge is frequently holistic and integrated; ecological, and based on longstanding observation handed down through oral traditions.

Many Australian Indigenous peoples recognise complex patterns in the environment including sophisticated biological indicators. Fiona Walsh's (1990) work with the Martu in the Western Desert demonstrates the complexity of this knowledge, which includes land classification, and species responses to climatic events which may occur infrequently. As those working with other cultures are well aware, working cross-culturally across these knowledge sets requires ethnographic approaches, trust and a high

sensitivity to the intellectual property rights of the culture concerned, and increasingly legal awareness as these rights become recognised in international law. We also need to be respectful of and open to the contributions of local observational knowledge in our own subcultures, such as the knowledge of landholders who know their areas well. Where scientific knowledge aims to find general rules, landholders aim to know how their own area works. Landholders thus frequently select and integrate knowledge at a highly localised scale, and some can become disillusioned with scientists who may not have immediate answers as to what will work for their particular region or property.

The other as yet unpublished framework which has appealed to me recently is produced by Lorrae van Kerkhoff (2002) as part of her PhD on integrated environmental research. In a chapter which captures examples which will be familiar to many of those engaged in integrative research, she lists a set of models of integration. The *container* model assumes that one can put a number of scientists, or their disciplines, together and synergies will occur, at least better than if one hadn't put them together. Containers can be physical spaces, or organisations such as Co-operative Research Centres (CRCs). Kington and Littleboy's paper describes well why this is not enough. A *purchaser-provider* model considers research as business: the research is seen as integrative across science and public boundaries when it responds to a client's need. It is also often multi-disciplinary because of the nature of the problems addressed.

The *jigsaw* model portrays integration as a matter of coverage of topics or questions – it assumes that if one has all the parts of information needed, one has a whole. Some pieces may be established knowledge, some can be provided by a set of projects, and gaps will remain to be filled because the existing science is not yet capable of addressing them. This is an excellent image for an assumption that fragments of science can dovetail – our emerging interdisciplinary experience suggests this is far from neat, if possible at all. To give just one example, relevant knowledge may exist, but at different and unmatchable scales. *Silos*, illustrated with a drawing of wheat silos, aims more actively at combining different types of knowledge. The information is not merely put together, as in the jigsaw, but 'mixed, reformulated or repackaged'. Modelling is given as an example. Interestingly, van Kerkhoff points out that there are significant losses of knowledge in the inevitable structural constraints and selectivity inherent in such an approach - more integration is not necessarily better! The *value-adding* approach is similar to the silos model, but has a multi-stage process of combining information. Lastly, van Kerkhoff refers to *extension*, as the field concerned with relationships between research groups and their end users. This matches with the communication and integration with local knowledge points in the Department of Natural Resources and Mines (2003) framework above.

Van Kerkhoff concludes that these conceptualisations are inadequate, and instead proposes a four dimensional approach which considers science as pure thought (one-dimensional), a disengaged, rational process; science as a social institution (two-dimensional) with group processes allowing cumulative knowledge; the entry of non-science players (a third dimension, strengthening research by allowing it to 'move beyond the confines of science' through extension and transfer of technology); and the

fourth dimension of time. Through time, research and influence, action and boundaries can shift. Kington and Littleboy's paper is particularly enlightening on the second dimension, of science constructed through social processes. The DNRM framework corresponds particularly well with van Kerkhoff's third dimension, of moving beyond the confines of science.

It is interesting to reflect on social science experience with each of van Kerkhoff's types of model. *Container* is one of the earliest models we have experienced. Depending on the organisation and casting of the problems to be addressed, it remains common for social scientists and indeed economists to be or feel outnumbered, and intellectually marginalised. It is difficult for these fields to integrate with the biophysical sciences through sheer proximity, since their paradigms and methods can be incommensurate. Gender and age differences can also contribute, since women are more common in the social sciences, and social scientists are among the most recently recruited to those established environmental science organisations that are extending from biophysical to more broadly interdisciplinary research. Further, the container model is not particularly focused: what are the participants supposed to integrate about?

Van Kerkhoff's *purchaser-provider* model, which can arise from consultancies or partnership projects associated with DNRM's *integrating scientific outputs into policy* could give greater scope and freedom of movement to the social sciences, if the task includes considerable social science or policy. It can be quite challenging if the question appears reasonable enough, but is not easily answered from existing or readily-created new knowledge. A recent example of this is a task to conduct a social impact scoping study towards the Murray Darling Basin Commission's Living Murray Project (Hassall and Associates, Ross and Maher 2003). We were required to scope the potential social impacts of returning three levels of environmental flow water to the rivers, in nine major river catchments feeding the River Murray, across four jurisdictions, all in a matter of months and on a tight budget. The projected biophysical response to these three scenarios was imprecise, and the required economic information, from concurrent studies, not yet available. There was very little social 'baseline' data on the areas affected, other than census data. The social science approach we developed was able to sketch potential impacts, with some regional variation, but to differentiate potential social impacts at the different scenarios for levels of water return with any reliability would have been impossible since the social sciences cannot be so precise especially with limited data.

The *jigsaw* model appears influenced by reductionist thinking, that our world is ultimately knowable given enough effort and improvement to our science. Even among the biophysical sciences, it overlooks the problem of scale, that knowledge may exist for one scale in some parts of the jigsaw, and other scales in other parts, but these may be unmatchable. A piece of biophysical information, say the numbers of an endangered species or the best practice to save their habitat when viewed in purely biophysical terms, may or may not have closely matching social or economic jigsaw parts. There may be contradictions, for instance something clearly warranted in biophysical or economic terms may be highly controversial or impractical when viewed in social terms. 'So what' questions may arise: demographic information makes a useful jigsaw piece given its

availability in secondary data, but what does it mean when one has to consider its implications for planning, social impact assessment or catchment management? How would one combine jigsaw pieces from positivist and constructivist science? I imagine this occurring through healthy debate rather than neatly fitting pieces.

The *silo* model is more deliberately integrative. Current examples based on modelling favour quantitative approaches, although approaches involving qualitative, conceptual modelling could be conceived. The amount of social information that lends itself to quantification is limited, and 'so what' questions arise. One intellectually ambitious attempt to integrate social, economic and biophysical information through a combined quantitative and qualitative model is the Integrated Water Resources Assessment and Management (IWRAM) approach developed by Integrated Catchment Assessment and Management (ICAM), a centre at the Australian National University (Scoccimarro et al. 1999; and see http://icam.anu.edu.au/html/water_management.html) with Thai partners through the Australian Centre for International Agricultural Research. Using an integrative backbone of a river network with 'nodes' at each village, it was possible to model the behaviour of a catchment and its inhabitants. Runoff, streamflow and erosion varied according to rainfall, slope and forest cover; villages removed amounts of irrigation water for farming at each node leaving less to progress down the river, and the different combinations of ethnic and socio-economic groups in the villages used land and water according to different cultural and economic goals, with varying socio-economic distributional effects. The qualitative issue of cultural groups' farming systems was a particularly important contribution to this approach. Nevertheless, as van Kerkhoff observes, such tight approaches necessarily de-select important information while using other information more efficiently than looser models.

The *value-adding* approach is a sequential variant of the silo. A risk here, familiar to many social scientists, is that the social science is often left to last. There is a longstanding tendency for biophysical scientists or policy organisations to wish to get that science established well before adding social and economic dimensions. There may be an assumption that the social science is easier, less expensive, and takes less time. Unfortunately the latter also need long periods of development - especially if there is little or no relevant background information - and is also subject to high degrees of uncertainty because contexts are subject to rapid social and economic change, and people are apt to change their views even faster.

Lastly, van Kerkhoff's *extension* model provides a strong role for those of the social sciences concerned with thinking, knowledge, behaviour, social processes and communication. Nevertheless there can be paradigmatic tensions between contemporary extension practitioners who favour inclusive participatory methodologies, and some biophysical scientists and policy makers who may expect an older, sequential approach under which they develop the knowledge, uninterrupted, and then send it out for adoption. Any 'barriers to adoption' are then easily viewed as the fault of the recipients, not of the science or its local applicability.

Further considerations

While Kington and Littleboy focus on social *processes* in integrative research, I believe there are serious considerations surrounding the contribution of the social sciences to interdisciplinary (and hence to integrative) research. Is the triple bottom line uneven? The social scientists who are involved in environmental research – and the economists – still tend in many organisations to be in short supply compared to the biophysical sciences. While this need not be a constraint if only a proportion of these biophysical scientists seek to engage in integrative research, the demand on key people suggests it is hard to find enough social scientists to participate in the growing number of interdisciplinary endeavours. This is excellent news for our social science and interdisciplinary graduates, and suggests an important higher education role. Further, as Kington and Littleboy also observe, many of those now conducting social research come originally from other disciplines. This is both a strength and a weakness – many have foundations in other fields such as agricultural science or ecology, providing an excellent bridge with biophysical science, but unless they have undertaken extra study may have had less opportunity to develop and maintain theoretical and methodological depth in the social sciences. The field of extension has proved very fruitful in linking between the biophysical sciences, in a focused way which uses selected bodies of theory from several social science disciplines, and selected methodologies, particularly participatory action research.

Further, there are breadth and depth challenges among the social sciences: the questions that arise concerning sustainability cannot be pigeonholed into say sociological, psychological, anthropological, human geography or political science questions. We need to become informed across our neighbour disciplines, to blend among social scales from the individual to whole societies, and to recognise key theoretical and practical issues such as power relations and political influences. We also need to be policy literate and well informed on community interests. Social scientists have advantages however – our approaches can apply in different geographical situations, given familiarisation with the people and characteristics of the context. We are not constrained to being marine scientists, or forest ones (though many of our number specialise in rural sociology). We can, and do, specialise in certain cultures however, and certainly specialise at particular scales (eg community, region) and in particular bodies of theory.

Another issue faced by social scientists, economists and biophysical scientists in their interdisciplinary interaction is respect – for different types of data (qualitative and quantitative, precise and fuzzy) and for very different paradigms. Some social scientists are trained in positivism as well as constructivist and other paradigms, but fewer biophysical scientists are aware of or comfortable within the social science paradigms – though this is improving. There are shared or potentially shared paradigms, such as systems analysis (once popular in anthropology in the form of structural-functionalism), and complexity theory. Statistical methods provide a common ground for some, indeed it is interesting to see some recent influence of social science multi-dimensional scaling methods within ecology. There are also some efforts to develop common scientific languages. One becoming popular in community development and with government

agencies, adopting the discourses of economics, is the 'five capitals' (Bebbington 1998, Campbell et al. 2001). This has provided welcome recognition for the importance of social cohesion (cast in this intellectual context as 'social capital') while reducing the environment to notions of 'natural capital' and 'physical' or 'manufactured capital' (including infrastructure).

Another promising direction for integrative research is the development of interdisciplinary specialisations, such as impact assessment, planning, resource economics and ecological economics. This is how some disciplines originally started: for instance both psychology and sociology were formerly branches of philosophy. Such fields allow researchers and practitioners to sustain interaction around common themes and to build new bodies of knowledge and experience drawing on parent disciplines and generally responding to a public, practical need. Their journals and conferences provide a forum for communication and shared endeavour.

Conclusions

Like the other respondents Booth and Brown, I argue that we need to unpack our expectations both of integration, and of the social contributions to integrative science and practice. There are many potential directions for integration, both inherent to research and linking it to its users. There is no single social science: there are many different social sciences and humanities, each offering different strengths and insights, but also limitations when used alone. Most disciplines also have internal debates, such as between postmodernists and positivists.

So what should we do? Integration approaches, and team selection, will require a 'horses for courses' outlook. I suggest we first analyse each problem and its context, then select approach and team accordingly. Integrative approaches will not always be necessary or the most appropriate. Since much research on current problems is called for on short notice, we need background research on social contexts, such as ethnographies and community studies. These provide vital qualitative background, which can be combined with demographic and other statistical data, for policy and problem-oriented studies when the needs arise.

Social scientists engaging in integrative research or practice need to respect and value equally those of our colleagues who have hybridised their fields between a biophysical or economic, and a social science; and those who have retained (or newly arrived with) greater depth in a social science but may have less initial familiarity with the disciplines or geographical contexts they are about to collaborate within. We need to invest in human capacity: in the learning of individuals and the availability of staff with integrative skills and experience. In the academic system, this entails recognising and rewarding this type of research as strongly as disciplinary research. We need to invest in the building of interdisciplinary and integrative knowledge, including frameworks (intellectual tools for understanding), and communication mechanisms such as this Forum. As my title, the DNRM framework (Dwyer 2003) and Brown (2004) and Booth (2004) suggest, we need to consider the social dimensions of integrative research in two key ways: integrating

across the sciences within a research process, and integrating with both the knowledges and the needs of the public science serves.

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