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Adopting Orphans: Uncertainty and Other Neglected Aspects of Complex Problems

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INTRODUCTION

The driving force for initiating the production of this book was my interest in improving the ability of researchers to contribute to tackling complex social, environmental and technical issues. Such issues cannot be easily delimited. Instead they highlight connections. For example, tackling an environmental issue like human-induced global climate change involves altering industrial, agricultural and personal practices, which are connected in a web. Considerations include economic growth and prosperity, employment, energy supplies, food security, transport, population growth and so on. Similarly, tackling an issue like illicit drugs involves dealing with the social problems that facilitate the illicit drugs trade, the personal and community dysfunctions that make using such drugs attractive, and the benefits associated with drug use.

Interconnected systems of problems such as these highlight two things. The first is the importance of pulling together relevant knowledge from academic disciplines and practice.[1] The second is the impossibility of knowing everything that is necessary to deal with all the problems. Thus tackling complex issues requires effectively dealing with both what we know and what we do not know.

The importance of bringing discipline- and practice-based knowledge together is increasingly acknowledged, for example through recognition of the importance of multi-, inter- and trans-disciplinary[2] research. Furthermore, as we highlight in Chapter 1, there is also increasing appreciation of the necessity to deal effectively with uncertainty. Translating what we know and do not know into decision-making and action is an additional dimension to tackling complex

issues. Both integration and implementation are therefore critical. Yet there has been a paucity of organized development of concepts and methods that are useful for a) bringing together and acting on knowledge from different disciplines and practice areas, b) understanding and managing the areas of uncertainty, or c) investigating and applying what we know and what we do not know in combination.

Despite the absence of large-scale, well-accepted, organized systematic approaches, these issues have stimulated research efforts on a project basis. Indeed the first task is to collate the many advances in concepts and methods that are scattered throughout the research world. These have been particularly evident in academic areas which have achieved significant growth since the 1970s such as environmental sciences, public health and business studies. They have also received a fillip from moves to commercialize academic research. Military and, more recently, security research is an additional important contributor. Finally, important research streams seeking to empower communities have provided additional concepts and methods.

There are numerous illustrations to draw on. Environmental researchers have developed a range of modelling techniques, as well as concepts like the ecological footprint and ecosystem services, to enable the pooling of knowledge from different disciplines and practice areas. Public health and clinical researchers have paid considerable attention to how research findings can be translated into better patient care, building up, for example, the Cochrane collaboration (n.d.), which synthesizes and publicizes the best research findings. Military and other security research has made breakthroughs in ways of bringing together expert evaluations to assist decision-makers plan for likely futures through the Delphi technique and scenario development. The deliberative democracy movement has established ways to help the general public inform themselves and come to united judgements about complex issues through citizens' juries and consensus conferences. There is considerable experience in turning basic research into profitable commodities from partnerships between industry and research in numerous scientific fields, ranging from gene technology to lasers. Systems ideas have been developed for and applied to business to enhance responsiveness to economic opportunities and social needs.

My interest is in capturing this array of integrative and implementation concepts and methods in one place and in making them easily accessible to those dealing with complex issues. The idea is to synthesize them into a solid core that promotes cross-fertilization, allowing those working on complex issues in or across different areas such as the environment, public health, security and business to have access to the full gamut of concepts and methods, rather than only those developed in their area. This core also provides the foundation for building new theories and techniques. I propose that the way to do this within an academic setting is to develop a new discipline or specialization – Integration and Implementation Sciences (I2S; see Bammer, 2005).

I2S complements, rather than replaces, traditional disciplinary and practice perspectives. As described above, I2S focuses on concepts and methods to bring together knowledge from different disciplines and practice areas regarding both what is known and what is not known about a complex issue in order to support effective decision-making and action. Thus a key feature of I2S is to facilitate the development of more sophisticated understandings of ignorance and uncertainty and to provide an academic 'home' where this can be done. No existing discipline or practice area has the mandate for pulling together multi-disciplinary and multi-sectoral approaches to uncertainty, and there is currently no academic area where the production of a book such as this one is a legitimate and valued activity. In addition to uncertainty, I2S has identified other largely neglected orphan areas which are essential for understanding and dealing with complex issues and seeks to bring them into the mainstream research enterprise.

One of the challenges for I2S is that the ability of the research community to deal with what is known is much more advanced than the ability to contend with what is unknown. The illustrative developments described earlier focus on what we know rather than on uncertainty. Therefore, even though the basis of I2S is that knowledge and uncertainty are equally emphasized when dealing with complex issues, in practice this is currently not achievable. One of the core tasks of I2S is therefore to raise the profile of uncertainty when dealing with complex issues and to improve the concepts and methods for understanding and managing them.

The purpose of this chapter is to sketch out what this new discipline looks like and how it promotes the further development of approaches to uncertainty, which combine discipline- and practice-based knowledge and assist decision-makers and society at large in dealing more effectively with the complex issues that challenge us.

The rest of this chapter outlines the foundations of I2S – the core concepts and central methods – and how these are relevant to improving the ability to tackle complex issues. A major issue is that, unlike in other disciplines where there is an agreed way to think and write about how the work is conducted, there are no standardized processes for describing integration and implementation. A framework for consistent descriptions is suggested.

INTEGRATION AND IMPLEMENTATION SCIENCES – CORE CONCEPTS

I2S is underpinned by five core cross-cutting concepts, none of which currently has a well-established academic home. All have footholds in a range of different areas of research, but none of these areas allow the full development of the concept for tackling complex issues. The first core concept, described above, is emphasizing that what we do not know is as important as what we do know, so

that more sophisticated approaches to uncertainty are needed. The others are systems-based thinking, problem framing and boundary setting, values, and principles of effective collaboration (Bammer, 2007a). Each of these four concepts is briefly outlined in the following subsections.

Systems-based thinking

At the heart of I2S is systems-based thinking. This provides an orientation to looking at the whole issue and its relationship to its parts. To put it simply, everything is interconnected. Systems-based thinking emphasizes that issues have many dimensions, including an extensive array of factors, with both linear and nonlinear connections and interdependencies and a range of relevant political, cultural, disciplinary and sectoral perspectives. Because of the extensive interconnections, changes made in one area often have consequences elsewhere, and these may occur in unexpected ways. A systems approach also helps us realize that there are vast areas which may be relevant to the issue of interest where nothing is known or where available knowledge is uncertain. A systems-based approach therefore orients us to the importance of both knowledge and uncertainty. I2S draws on an extensive body of knowledge encompassed by systems thinking and complexity science. The I2S focus is on identifying key principles which are widely applicable (see, for example, Resources for Developing Unifying Concepts and Toolboxes for Systems Thinking and Practice, 2006).

Problem framing and boundary setting

Although a systems view is important, no research project or programme can cover everything, so the way any particular issue or problem is tackled has to be delimited. This is done through both the way the problem is defined or framed and where the boundaries around the problem are set. Frames and boundaries will determine what is included, excluded and marginalized in the research.

While problem framing and boundary setting are generally only considered in relation to what we know, they are also relevant for what we do not know. For example, boundaries also determine the uncertainties that will be ignored or banished.

In terms of problem framing, the way problems are defined and the language used to describe them can play a powerful role in setting the basis for research integration and implementation. For example, referring to people who inject illicit drugs as 'junkies', 'cool nonconformists', or 'sons and daughters who have lost their way' all have different connotations leading to different ways they are responded to. Similarly, research on drug prevention could be defined or framed as 'an examination of individual factors involved in initiating illicit drug use' or alternatively as 'an examination of popular culture and its influence on illicit drug use'. Both are about understanding why young people use illicit drugs as a first step towards more effective prevention – but one approach frames it as

a problem of individuals, whereas the other treats it as a societal problem, especially one of how societal expectations are communicated through television, music, the internet, films and so on.

The way a problem is framed already implicitly sets some boundaries around it. The boundaries specify what will be attended to, what will be ignored and what will be marginalized (Midgley, 2000). An important aspect of this for research integration and implementation is determining which disciplines and which non-academic or practice perspectives will be included in the project and which dimensions of uncertainty will be incorporated. For example, until relatively recently, research on natural resource management, such as determining how water supplies will be allocated, only involved science-based disciplines, such as hydrology and ecology. Today, on the other hand, it is common for such research to also include not only social science disciplines, but also representatives of groups affected by the decisions, such as farmers, and those involved in making them, such as policymakers. However, the research is still likely to only consider very limited aspects of uncertainty, such as those which can be dealt with through sensitivity analysis, ignoring other dimensions such as distortions or taboos. Thus, while the boundaries of the research in terms of what we know have been greatly expanded, this is generally not the case in terms of dealing with uncertainties. Furthermore, boundaries are not just about inclusion and exclusion. Highly relevant aspects, both of what we know and what we do not know, may only be given peripheral treatment and therefore marginalized.

Problem framing and boundary setting are inevitable, and from an I2S perspective it is essential that they are well thought through and managed. Furthermore, I2S requires systematic approaches to framing problems and setting boundaries which include both knowledge and uncertainty, allowing researchers to be more aware of the processes and their consequences for the research. While research integration and implementation can rely on a relatively good idea of what different disciplines and practice areas can bring to the understanding of what is known about an issue, the different perspectives they offer on uncertainty are much less clear. This book, and particularly Chapters 24 and 26, starts to systematize different disciplinary and practice approaches to uncertainty.

Values

The way the problem is framed and the boundaries are set is closely aligned with the values underpinning the research. Even though all research is located in a values framework, this is often implicit and researchers may be unaware of how values shape their work. Furthermore, research which brings together the perspectives of different disciplines and practice groups often has to find ways of managing different values. Again values are relevant both to how we think about what we know and to how we think about what we do not know, and again more is known about values in relation to knowledge than in relation to

uncertainty. We start to unpick values (or morals) in relation to uncertainty in Chapter 25, building on Smithson's work presented in Chapter 2 and in Smithson (1989).

In terms of how values relate to how we deal with what we know, one way in which differences in values are highlighted is through epistemology. For example, positivism sees research as value free, with values having no place except when choosing a topic; interpretive social science considers values to be an integral part of social life, with no group's values being seen as wrong, only different; and critical social science maintains that all research has a value position and that some positions are right while others are wrong (Neuman, 2003).

Another manifestation of values is in the orientation of research to having an impact on real world problems. For example, there are different ways of considering the harms which might arise from new actions based on the research findings. One way is to judge the harms caused by the new actions in light of what would have happened if no actions had been taken. Even though the new actions may lead to harms, if these are less than the harms that occurred originally, the actions can be justified. This is consistent with a utilitarian approach. Another way to judge harms is to assess whether the new actions cause new harms without being concerned about allowing existing harms to happen. In this case, if the new actions were to cause significant harms, even if these were less than the harms which would occur without the actions, the actions would be hard to justify. This is consistent with a deontological approach (Ostini et al, 1993).

More generally, a task for I2S is to make values explicit and to find ways to accommodate or at least manage differences in values. Rather than avoiding these differences, I2S recognizes that they are critical to a rich understanding of complex issues and to effectively dealing with them.

Principles of collaboration

A systems-based approach involves bringing a range of perspectives and skills to bear on the issue of interest and therefore involves collaboration with the appropriate people from both disciplines and practice. Collaboration is essential for pulling together both what is known and what is not known about a problem.

The collaborations which underpin I2S, and indeed collaborations more generally, are all about harnessing difference. The value of developing a partnership is that the collaborator brings an alternative perspective or skill or some other attribute that contributes something relevant to addressing the issue either in improving understanding about it (which can include understanding about what is not known) or in implementing that understanding in decisions and action.

However the differences between research partners cannot be limited to those which advance understanding of or effective action on the problem.

Differences in ideas, interests and personality will also provide potential sources of unproductive conflict. The critical element of collaboration is to recognize that differences between research partners fall into two categories: differences that are key to and underpin the partnership, which must be effectively harnessed, and differences that are incidental to the collaboration and that may undermine the achievement of its goals, which must be effectively managed (Bammer, 2007b).

In terms of synthesizing the diverse relevant contributions, the focus is on what the integration and implementation is aiming to achieve, being clear about what the different partners are contributing and what is being integrated and implemented, deciding on the most effective methods and who will undertake them, taking into account institutional and other aspects of context which affect the integration and implementation, and considering how the impact will be assessed (Bammer, 2007b).

In terms of dealing with differences in personality, interests, ideas, working style and other attributes which can lead to unproductive conflict, the task for I2S is not to eliminate disagreements and competition, which can provide a vital stimulus to creativity, but to minimize the tensions and disputes which prevent people from working together constructively. There are two strategies which may be useful here. One is to foster reciprocity; this involves partners treating each other with trust and respect. The second is to build on the broad sweep of knowledge about personality differences, conflict resolution, building trust and so on which has been gained in business, community development and other areas. Some simple techniques can be surprisingly effective. Personality assessments (such as the Myers Briggs typology; see Myers and Myers, 1993), commonly used in team building, often result in conflict melting away, as participants realize that the annoying behaviours of others are not intended to be provocative but simply reflect a different psychological make-up and orientation to the world. The main problem is that this knowledge is not compiled in any single place or tailored as a resource for those managing research collaboration and integration (Bammer, 2007b).

Integration and Implementation Sciences – Methods

The previous section outlined the core concepts underpinning I2S which are essential for tackling complex issues. In this section I briefly describe five strategies for carrying out integration and implementation, each of which encompasses a range of methods –dialogue-based, model-based, product-based, vision-based and common metric-based respectively. Some of these methods stem from systems thinking and complexity science, while others have been developed to meet the needs of particular research areas.

The majority of these methods focus on what is known, and there is much to be done to stimulate development of methods which focus on uncertainty. There are, however, noteworthy beginnings, some of which are noted in the following subsections.

Dialogue-based methods

Dialogue is the most common strategy for achieving integration and implementation of discipline and practice perspectives and is an essential component of the other strategies, as well as being an approach in its own right. Franco (2006, p814) draws on the key references in the field to provide a useful definition: 'the goal of dialogue is to jointly create meaning and shared understanding between participants'. From an I2S perspective, a key question is 'jointly create meaning and shared understanding' *about what*? The 'about what' question is answered by the particular aspects of research integration and implementation under consideration. Thus some dialogue methods are well suited to creating meaning and shared understanding about the judgements people have on how best to move forward on a problem. Others can provide mutual insights into the different interests involved in the problem, and still others into the different visions for how the problem might ideally be solved. To date, five categories of dialogue methods have been identified: methods for integrating judgements, visions, interests and values and methods that are useful for integrating more than one of these elements (Bammer and the Goolabri Group, 2007; McDonald et al, 2007). Dialogue methods for integrating judgements are one important integrative method that takes uncertainty into account, as judgements are relied on when facts alone cannot provide the answer.

Model-based methods

The second primary group of methods for integration and implementation are model-based. Models are a key way for representing systems and for providing aids to thinking about complex issues. The primary tasks of modelling are description, explanation, prediction, imputation, integration and evaluation (for more detail see Bammer, 2007c). When modelling is used as an integrative tool, the emphasis is on the process of developing the model and its utility in helping decision-makers. The model is therefore a device which provides a focal point for discussion and action between people representing different disciplinary perspectives and different types of practical experience relevant to the issue under consideration. It provides a way of organizing different pieces of information.

Different models provide different organizing strategies. Thus a system dynamics model concentrates on feedback and demonstrates how vicious and virtuous cycles are, sometimes unwittingly, established. An agent-based model focuses on the different actors involved (the agents) and the key determinants of

their behaviours ('rules' for their actions). Among other things, an agent-based model seeks to understand if there are simple rules or behavioural determinants which can explain even quite complex behaviours. As well as providing a rationale and a focus for interaction, models can provide an effective interface between researchers and decision-makers, supporting the latter's determinations and resultant actions. In particular, decision-makers can find it very useful to vary the parameters in a model to, in effect, try out different decision options and get a feel for possible consequences.

Models are where most advances have been made in dealing with uncertainty relevant to integration and implementation. They can provide methods for representing and investigating the propagation of uncertainties throughout complex systems or into future scenarios. Methods are currently available for modelling not only probabilistic and statistical uncertainty, but also vagueness and imprecision. Models also can explore the consequences of decision-makers' beliefs about their own or others' uncertainties.

Product- and vision-based methods

Like model-based strategies for integration and implementation, product-based and vision-based strategies use the product or vision as a device around which to build the interaction between people representing different disciplinary perspectives and different types of practical experience relevant to the issue under consideration.

An example of a large-scale product-based integration and implementation comes from building the atomic bomb in the 1940s. The atomic bomb project brought together basic science (such as achievement of controlled fission), the solution of a vast range of technical problems (such as developing an implosion trigger device), engineering and manufacturing prowess (as in generating adequate amounts of fissionable material), and military and political judgement in terms of its use (Rhodes, 1986).

The World Commission on Dams, which was active between 1998 and 2000, provides an example of vision-based integration and implementation. The vision was to achieve 'development effectiveness', where 'decision-making on water and energy management will align itself with the emerging global commitment to sustainable human development and on the equitable distribution of costs and benefits' (World Commission on Dams, 2000, pxxxiii). The World Commission on Dams had wide-ranging considerations in terms of issues, evidence, countries and participants, including diverse technical, social, environmental, financial and economic evidence from case studies, country studies, a survey, technical reports, submissions and fora. It eschewed a 'balance sheet' approach to assessing costs and benefits in favour of multi-criteria analysis. A guiding set of values based on United Nations declarations and principles about human rights, social development and the environment, and economic cooperation underpinned the approach.

Common metrics-based methods

The idea behind the common metric is to convert all the discipline and practice perspectives on an issue to the same measure, which allows integration through simple arithmetic. The most widely used common metric is monetary value – such as the dollar. Much can be learnt from the discipline of economics about the conversion of a range of aspects of a complex issue to a dollar value, such as putting a value on life or fresh water. Economics also provides a range of methods for integration using a common metric, such as cost–benefit analysis. An important application of these ideas has been in ecosystem services, which involves putting a monetary value on the 'services' (for example clean air, aesthetics and recreation) which the ecosystem provides (see, for example, Cork and Proctor, 2005).

The underpinning principle has also been used to develop other common metrics, such as ecological and carbon footprints and, in public health, the disability- or quality-adjusted life-year. For example, the ecological footprint is based on 'how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes under prevailing technology' (Global Footprint Network, n.d.). The disability-adjusted life–year, or DALY, is a measure of years of 'healthy' life lost by being in a state of poor health or disability (World Health Organization, n.d.).

When it comes to uncertainty, the prime example of a common metric is probability theory. This is especially true of Bayesian subjective probability frameworks, because they purport that all uncertainties in beliefs can (and should) be rendered as probabilities. The past three decades have seen spirited debates between Bayesians and advocates of alternative formal uncertainty frameworks (such as fuzzy logic or belief functions) over whether there really is a single common metric for dealing formally with uncertainty (Smithson, personal communication, July 2007).

Although new common metrics can be difficult to develop, good ones are conceptually straightforward and easy to use, making them a powerful integrative tool.

INTEGRATION AND IMPLEMENTATION SCIENCES – FRAMEWORK

I argue that one reason why our understanding of integration and implementation is not further advanced is that there is no unified way of thinking and writing about them. I propose that a new level of specificity could be introduced by addressing the following six questions:

1 Integration and implementation **for what and for whom**?
In other words, what are the aims of the integration and implementation and who is intended to benefit?
2 Integration and implementation **of what**?
This addresses the diverse perspectives that are being synthesized and then applied and the actors involved.
3 What is the **context** in which the integration and implementation is occurring?
This involves the political or other action context which influences priorities in terms of the framing of the issue and the people seen to be key actors, as well as the focus of action resulting from the integration.
4 Integration and implementation **by whom**?
Even though integration and implementation often requires partnerships, the process of synthesis and application does not need to be collaborative. It can be undertaken by an individual (often the leader), a subgroup or the whole group.
5 **How** is the integration and implementation undertaken?
This takes us back to the methods outlined in the previous section.
6 What are the **measures of success**?
Success is often not reported in integrative and implementation studies and there are no standard procedures to evaluate it. The questions described above, however, provide the substrate for evaluating success. First, how well were the integration and implementation aims met? Were influential new insights produced? Did effective action result? Second, some process issues can also be evaluated. Were all the necessary elements included in the integration and implementation? Were effective integrative and implementation methods used? (Bammer, 2006)

The explicitness of these questions can help us face up to what we do not know about integrative and implementation methods, as well as allowing processes to be better understood, compared and evaluated.

Applying the Integrative Framework to this Book

This book, like the symposium which preceded it, focuses on the integration of discipline and practice knowledge rather than the application or implementation of that knowledge. I apply the I2S questions on integration to this 'uncertainty project' by way of illustrating the I2S descriptive framework, as well as clarifying what the uncertainty project is trying to achieve and how. Addressing the framework questions also highlights areas of weakness. A brief synopsis is provided here. For more detail see Bammer and the Goolabri Group (2007).

Integration for what and for whom?

The aim of this book is to provide more sophisticated and useful concepts and tools for understanding and dealing with uncertainty. In the short term the targets are researchers and practitioners with an interest in improving their ability to manage uncertainty within their own work. We also aim to provide legitimacy for thinking about uncertainty in a cross-disciplinary and cross-sectoral manner. Our ultimate objective is to promote the development of more sophisticated methods for managing uncertainty. Specifically, we aim to enhance considerations of uncertainty when complex issues or problems are addressed and, in the long term, to provide one or more frameworks that will make this process of considering and making decisions based on multiple perspectives on uncertainty more effective.

Integration of what?

'Integration of what' addresses the different elements that are being integrated. In our case, the 'what' consisted of different perspectives on uncertainty, each represented by a different person. We realized we could not practically include every important angle on uncertainty, but we did aim for maximum diversity among the invited participants. The project brought together 20 different discipline-, practice- and problem-based perspectives on uncertainty. Another important ingredient was Michael Smithson's expertise in thinking about ignorance and uncertainty and the paradigms used to deal with them (see his seminal 1989 book *Ignorance and Uncertainty: Emerging Paradigms*); that research was used as the foundation for further integration.

What is the context in which the integration is occurring?

There are four contextual factors relevant here. First is the current state of thinking and knowledge about uncertainty. In his 1989 book, Smithson argued that the current re-emergence of thinking and research about uncertainty is the greatest creative effort since 1660, when probability theory emerged. He also notes a corresponding difference in responses to uncertainty. Earlier efforts aimed to eliminate or absorb uncertainty, whereas the focus now is on coping with and managing it. The second contextual factor is my development of Integration and Implementation Sciences, in which understanding and managing uncertainty plays a central role, as described earlier. The third factor is the contexts of the individual participants – why they agreed to take part in this exercise. This was not explored, but is also relevant. Finally, funding was available. The main source was untied funding from the Colonial Foundation Trust, through the Drug Policy Modelling Project (now Program; see Ritter et al, 2007), which was provided to explore the feasibility of a range of new approaches to tackling the illicit drugs problem in Australia. This allowed us to try out some relatively radical ideas, such as convening the symposium which led to the production of this book.

Integration by whom?

For this book, there are three sets of integrators. One is the individual reader – you – who will sift the offerings for the insights most relevant to your interests. A second is the book authors, who as symposium participants were asked to reflect individually on at least two of the other papers for insights they provided for their own approaches. The third is integration led by Michael Smithson and myself, which tied the chapters and the symposium discussion together and to the current body of knowledge about uncertainty (see Chapters 24–26).

How was the integration undertaken?

Five strategies for undertaking integration and implementation have been outlined earlier. We used dialogue-based and product-based methods. The product is this book and the main dialogue occurred at the symposium which first brought the authors together. At the symposium we also attempted to use a conceptual model, which Smithson had developed, as an integrative tool. However a number of participants baulked at this approach, leading us to abandon it.

What are the measures of success?

Evaluating the success of the integration requires assessment of both process and outcomes. However, the benchmarks for either dimension are not clear.

In terms of outcomes, there are four primary measures of success for the book. The first is whether readers gain new insights. Certainly all the symposium participants reported that their understanding had been increased and some had developed a new approach to their field (see Bammer and the Goolabri Group, 2007). A few also worked together to produce new collaborative knowledge (see Chapter 1). This is the second indicator of success. The third is the new insights produced in terms of the overall framework for uncertainty, discussed in Chapters 24–26. Certainly Smithson and I argue that that these papers move our appreciation of this area forward, but that has still to be tested by peer review of the book. The final measure is whether this book provides the foundation for further work, as we envision.

In terms of process, the approach we took largely worked. While we were not able to include all relevant perspectives (and indeed that was not an aim), bringing together a highly diverse group of people generated excitement, enthusiasm and new knowledge. At the symposium, Michael Smithson pointed out:

> *[In 25 years researching this field] I have never seen a collection that has the breadth for one thing, in terms of the variety of disciplines covered, but more importantly that has the breadth in terms of the concepts and the variety of different takes on uncertainty that was covered. I think we have something unique here … I think it's extremely rare to get an assembly of people with the*

variety of perspectives we've got who can or will listen to each other. … [W]e really have something genuinely new here and we have a great opportunity here.

CONCLUSIONS

The basis for this chapter is that tackling complex issues requires attention to be paid to integrative and implementation concepts and methods that do not currently have an established place in academic work. Chief amongst these is the ability to deal with uncertainty more effectively. The thesis underlying this book is that bringing together knowledge about and approaches to uncertainty from a range of disciplines and practice areas will provide a richer appreciation of uncertainty and enhance approaches to complex issues. The chapter has briefly described the importance of uncertainty being considered on a par with certainty as a core concept of a proposed new discipline – Integration and Implementation Sciences. Other core concepts, methods and a descriptive framework have been presented, along with their relevance to both better appreciating uncertainty and to tackling complex issues. Integration and Implementation Sciences aims to accelerate the development of fresh productive thinking. Improving our ability to deal with uncertainty is a major task for the new discipline, and enhancing our ability to integrate different disciplinary and practice views of uncertainty is central to this.

NOTES

1 Knowledge from practice means knowledge about the problems and ways of tackling them from government policymakers, business, organized professions, affected communities and so on. I also refer to this as knowledge from different sectors.
2 Curiously, while these research endeavours often include practice/based knowledge, as well as knowledge from academic disciplines, the labelling of such research as multi-, inter- or trans-*disciplinary* persists.

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