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COPING WITH DEEP UNCERTAINTY

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Deep uncertainty occurs when little is known about the phenomena under scrutiny and when experience for dealing with them is lacking. Six strategies for making decisions under deep uncertainty are presented: (i) delaying to gather more information; (ii) targeting critical uncertainties and determining if there are clearly preferable options for proceeding, (iii) thinking laterally, (iv) invoking the precautionary principle, (v) using an adaptive management approach and/or (vi) building a resilient society.

Integration Insights is a series of digests of concepts, techniques or real-world examples of integration in research.

INTRODUCTION

Deep uncertainty occurs in situations where there is a high level of ignorance about the phenomena posing potential threats to human societies, where there is poor scientific understanding, and where there is extensive reliance on modeling and subjective judgements in lieu of estimates based upon experience with actual events and outcomes. Managing deep uncertainty can be an essential element in effective responses to real world problems, which require integration of areas of ignorance and uncertainty, as well as synthesis of discipline and practice knowledge. Six strategies for making decisions under deep uncertainty are discussed. They are not mutually exclusive. They are:

1. delay to gather more information and conduct more studies in the hope of reducing uncertainty across a spectrum of risk,
2. interrelate risk and uncertainty to target critical uncertainties for priority further analysis and compare technology and development options to determine whether clearly preferable options exist for proceeding,
3. enlarge the knowledge base for decisions through greater lateral thinking and perspective,
4. invoke the precautionary principle,
5. use an adaptive management approach, and
6. build a resilient society.

DELAY TO GATHER MORE INFORMATION

For many problems, delay is a sensible option. “Value of information” methods now seek to weigh the value of seeking more information and analysis against the costs of further delay. Not all decision elements are typically included in such assessment, but relevant analysis for many decisions to proceed or to delay further can be had. But for deep uncertainty problems, science is intrinsically limited.

TARGET CRITICAL UNCERTAINTIES AND IDENTIFY PREFERABLE OPTIONS

This involves interrelating risk and uncertainty to target critical uncertainties for priority further analysis and comparing technology and development options to determine whether clearly preferable options exist for proceeding. Which uncertainties, it needs to be asked, are critical for decisions to be made and to what extent can they be reduced by further research and assessment? Without such a priority determination, uncertainty is a limitless track of unending work, where new uncertainties appear as old ones are put to bed.

LATERAL THINKING

Vertical thinking is customary in risk analysis, where research for the source of the risk and means of risk mitigation thinking is important. Two types of lateral thinking are also possible. The first involves placing a particular problem or risk into a broader category of similar problems to assess where complementarities exist and relevant risk experience can be tapped. Many people have noted that the thousands of chemicals facing potential regulation cannot be managed one by one. The need clearly exists to define 'like' clusters of problems or hazards to determine both whether they can be managed as a group and where hazards or problems rank within the group and thus indicate priority. This broadening also needs to examine the embedding of problems within other policy domains, such as agriculture, energy or transportation, where policy structures support development. Another example is finding appropriate locations for various facilities, which has emerged as a common problem in many societies. Whether nuclear plants, wind energy farms, or hazardous waste sites, common problems in assessment and engaging the public exist across facilities. So learning from other relevant societal experience is essential.

The second type of lateral thinking involves the need for explicit risk/benefit comparisons among the options available to the decision-maker. If some options are decisively better than others considering the range of risk that may exist (even when large uncertainties are taken into account), then delay is not a sensible option. This is not to suggest that efforts to understand and reduce (where possible) existing uncertainties should not continue. Of course, they should. But if the development is deemed essential to decision goals, if benefits clearly are judged to exceed costs, and if a concert of political support exists or can be built, then development can proceed while efforts to build the knowledge base continue.

THE PRECAUTIONARY PRINCIPLE

The precautionary principle emerged from the Rio Declaration on Environment and Development of 1992, holding that 'where there are threats of serious or irreversible damage, the lack of full scientific understanding shall not be used as a reason for postponing cost-effective measures to prevent environmental deterioration' (Whiteside, 2006, pviii). The principle leaves much to determine in its application, as European experience has shown, but clearly it is germane to many situations of high uncertainty where serious or irreversible risks are involved. What is 'serious' or 'irreversible' must be determined, of course, but a decision in favour of precaution can escape the burden of endless studies aimed at determining whether risk is involved and whether it is sufficient to justify societal intervention. So a choice in favour of precaution may be made on ethical grounds, while scientific work continues to reduce or clarify the nature of uncertainties and risks.

ADAPTIVE MANAGEMENT

Most environmental protection efforts have traditionally proceeded in 'command and control' fashion, drawing upon military models of how decision objectives may be accomplished. In such an approach, it is assumed that risks and uncertainties can be defined with sufficient accuracy and the future can be anticipated sufficiently well that sound decisions can move forth, usually to achieve quantitative standards. Detailed guidelines and procedures typically are an intrinsic part of this approach. So in emergency response regulations, for example, detailed guidance is provided aimed at an 'engineered' societal response – when warning of an event should occur, the form it should take, when evacuation should occur, routes to be taken, etc.

Adaptive management proceeds in a fundamentally different way. It assumes that uncertainties cannot all be reduced and that the future to a significant degree is unknowable or only partly knowable. Surprises must be expected. Learning through experience and from evolving knowledge is essential. Societal efforts to control hazards are seen as experiments through which learning may occur. When uncertainties abound, there is little reason to believe that we will get things right on first try. The approach is to proceed with humility. Given that the required knowledge base is evolutionary and will grow over time, adaptive management attempts to maximize effective use of increasing knowledge and learning from the application of intervention systems.

Adaptive management is, like sustainability, becoming a favourite slogan. Contrary to its popularity, however, it is not suitable for all risk and uncertainty situations. While elements of nuclear accident management have a strong record of monitoring experience and learning from mishaps and accident precursors, this does not mean that we should be prepared to undergo catastrophic accidents from nuclear plants while we put in place an evolutionary regulatory system. By contrast, climate change is a challenge in which basic societal and economic institutions are deeply involved, potential impacts are as yet highly uncertain in spatial and temporal distribution, optimal mixes of mitigation and adaptation systems are unclear, and value issues are profound and highly contentious. Adaptive management is clearly more suitable for such a problem. It is a clear case where 'one size does not fit all'.

Moreover, adaptive management requires institutions that function very differently from the well-honed 'command-and-control' world of environmental protection. These institutional prerequisites include such far-reaching issues as:

- highly flexible management structures, capable of recreating themselves in short time frames;
- horizontal interaction as well as vertical authority, information flow, and reporting;
- high permeability of institutional boundaries to external environments, stakeholders, and clients;
- candid and open acknowledgement of uncertainties, gaps in knowledge, and errors in past decisions;
- multiple centres of learning within the institutions;
- effective monitoring systems to test projections and estimates against actual experience;
- capabilities that embrace the concept of socio-technical and socio-ecological systems and the broad capabilities they require for assessment and decision making; and
- ongoing active involvement of major stakeholders at all levels of the institution and all phases of the decision process.

Existing management institutions, whether in the public or private sector, typically do not score well on these attributes and accordingly have constraints on their abilities to learn. However institutional assets for learning and adaptive capacity come with other problems. Open acknowledgement of high uncertainty or past errors can well erode public confidence and credibility. Mid-course corrections in management strategy can raise questions about the competence of managers. Openness to stakeholders may erode the role of high-quality internal expertise. Problems abound and knowledge of how to address them is weak.

BUILD A RESILIENT SOCIETY

Even more fundamental than the above prescriptions, a longer term, systems-approach is possible to begin the effort to reconstruct society, building the institutions, structure of economy, and social capital needed for a society resilient to a wide array of threats and shocks. A resilient society, as Walker and Salt (2006) have recently argued, is one predicated on the understanding that it is constantly in the midst of dynamic changes. This continuing process of change challenges institutions and policy makers to construct a course for society in which the society, economy, and ecosystems constantly work to create adaptive functional systems that provide people with valued goods and services across scales and over time. It is a course that seeks continuously to create new options as old ones close (Walker and Salt, 2006, p140). It is a new paradigm for guiding society and the economy, and their relationship with nature, to goals of sustainability and resilience and away from preoccupation with short-term profits and gains. Sustainability efforts in Europe are taking initial steps toward this new paradigm but as yet this vision remains on the horizon of all advanced industrial societies.

CONCLUSION

The various options for coping with deep uncertainty identified above are not mutually exclusive, of course. Even the use of standard risk assessment and command-and-control regulation typically employ some elements of precaution and adaptations to evolving knowledge or new experiences. On the other hand, there are important choices among the archetypes of these different approaches. Heavy reliance on the precautionary principle, as Whiteside (2006) points out, moves significantly away from an approach of risk balancing with benefits, in which the burden of proof is strongly on the advocates of precaution. In cases of deep uncertainty, all approaches can benefit from more integrative systems thinking, involving greater use of lateral thinking and analogue cases.

The greater the uncertainty, the greater the need for social trust. This has been known since Luhmann (1979) articulated this relationship. If it is clear that many unknowns permeate a particular environmental or risk problem, then confidence that the analyst and decision maker are deeply committed to protecting those at risk and care about their well-being is essential. If conditions of low trust prevail, they pose major challenges to decision making. These are difficult enough if the problems are familiar and uncertainties are low. In situations of deep uncertainty, however, social trust becomes an essential resource. The combination of deep uncertainty and high social distrust is often a recipe for conflict and stalemate. It is also known that despite well-intentioned efforts by planners and decision makers, trust once lost is extremely difficult to rebuild and often cannot be gained within the time frames that decisions require (Slovic, 1993).

With the increasing complexity of the coupling among society, economy, technology, and nature, deep uncertainty problems are likely to be a major part of the policy and political landscape. They will almost certainly continue among the more difficult policy and decisions that societies face, particularly if global environmental change and sustainability issues continue to be more prominent on national and international agendas, and in public values. While we have strategies and tools for moving forward, recognition is needed that progress is a question of long-term transformations, and the urgency to begin these changes and paradigm shifts is growing rapidly.

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