Credibly Constructing Risk Comparisons

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Abstract

This paper briefly recounts the experience of the New Jersey Comparative Risk Project in order to illustrate the role played by insights from the science and technology studies literature in the project's design. It shows that a project's adequacy and legitimacy can be enhanced by treating the potential contributions of experts, officials, stakeholders, and the public respectfully, and by building in much interaction among these groups. It also reveals a costly tradeoff between heightened interactions and participant fatigue.

1. Introduction

Scientists—including social scientists—believe that efforts to describe and explain should precede efforts to prescribe and act. Thus the field of science and technology studies (STS) has devoted much effort to diagnosing problems associated with science-in-policy [1]. Contributors to this field have spent somewhat less time developing new mechanisms for entraining expert knowledge. Yet there is now a substantial body of evidence to rely upon, so that some innovators are incorporating STS insights into practice. Needed now are scholarly efforts to learn from these practical experiments [2].

2. New Jersey Comparative Risk Project

This paper reflects on one recent experiment. The author was a participant-observer in the New Jersey Comparative Risk Project (NJCRP), a recently completed, multi-year investigation of the state's environmental problems from a strategic planning perspective [3]. The project evaluated 75 different environmental threats in terms of their relative impacts on human health, ecological quality, and socioeconomic status in the state of New Jersey. The project involved highly choreographed interactions among a steering committee of prominent citizens, technical work groups composed of scientific experts, and members of the general public.

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Instead of negatively declaiming the existence of boundary work, capture, and other problems, this paper shows how knowledge of such problems can be applied positively, as an aid to the project design process. The paper documents the value of STS concepts in the design of the NJCRP, while also reporting on problems not well anticipated in the literature.

3. Comparing risks

The archetypal technical risk comparison involves expected value calculations in a risk "ladder" format: the average annual probability of death from asbestos exposure at school is orders of magnitude less than that of smoking, for example [4]. Yet many threats have multidimensional impacts, affecting not just human health, but also ecosystems and socioeconomic status. Plus the risks may be uncertain, variable, acute or chronic, voluntary or involuntary. Many of these dimensions warrant consideration when developing public policies towards environmental threats, implying that public risk comparisons should strive for more richness than a simple risk ladder can deliver. Unfortunately, multidimensional comparisons can be very complex, and aggregation into an overall risk ranking becomes a significant technical and procedural challenge.

4 Constructing credible comparisons

Risk comparisons could be self-consciously designed to perform the task of socially constructing practical, policy-relevant knowledge. Projects could pursue both substantive and procedural rationality, numinous and civil legitimacy [5]. While the general public and a steering committee would nominally supply "values" and technical work groups would nominally supply "facts," many close interactions among them could ensure a more integrated process of knowledge construction. Technical experts would need to develop special decision support tools to facilitate these interactions.

5. Designing the NJCRP

The designers of the NJCRP pursued just such a strategy for achieving credibility. They acknowledged the need for authoritative, scientifically adequate analysis by carving out distinct tasks for specific types of experts. There were separate technical work groups for toxicologists and epidemiologists, ecologists and biologists, and social scientists. This separation allowed experts to assemble disciplinary knowledge efficiently and to conduct peer review effectively.

Yet the designers of the NJCRP had read the STS-influenced 1996 update to the 1983 "red book" on how to conduct risk assessment in government [6, 7]. They took to heart the newer book's advice to create a highly interactive process that integrated the expert ("factual") and public ("values") components.

Those planning the NJCRP placed the non-expert steering committee over the expert technical work groups in the project organizational hierarchy. This stratagem was designed to prevent the technical experts from running away with the project.

The designers of the NJCRP also accepted the argument that distinct managerial, pluralistic, and communitarian discourses about environmental problems might fail to intersect, leading to conflict and controversy [8]. Therefore, the NJCRP included explicit roles for experts, public officials, professional stakeholders, and members of the general public, and it attempted to integrate their contributions.

6. Conducting the NJCRP

The project began in 1998 and is expected to be finished in mid-2002. The amount of work was much greater than anticipated, it took far longer than planned; and the project had to survive a gubernatorial transition in early 2002.

The lead agency for this study was the New Jersey Department of Environmental Protection (NJDEP). A three-person team consisting of an agency manager, an agency scientist, and an outside academic managed the project. The steering committee included about twenty prominent citizens—of whom about one half actively participated throughout the project. The three technical work groups included about sixty experts plus an equal number of occasional advisors, content contributors, and peer reviewers. A special feature of the project was the involvement of several dozen graduate students, most for class credit but a few for pay, in providing draft materials for use by the socioeconomic and ecological technical work groups. The public participation efforts reached hundreds of people through focus groups and surveys. A newsletter kept many additional people informed about the project.

The cost of the project was approximately $250,000 plus a roughly equivalent contribution of off-budget expert labor. Funding came from a U.S. Environmental Protection Agency grant and from the operating budget of the Division of Science, Research, and Technology at NJDEP.

During this long project there was attrition from the steering committee by the death of one member, by some environmentalists who worried about being co-opted, and by a few other stakeholders for whom it held little more than peripheral interest. The core group left at the end of the process was loyal but fatigued.

The technical work groups also suffered from attrition and participant fatigue. This was due in large part to the fact that most participants were volunteers who already had full time responsibilities within NJDEP or elsewhere. When handed a very broadly scoped set of analytical tasks by the steering committee, these experts were overwhelmed. It took them more than two years to finish a set of analyses that the project designers had expected would consume no more than a few months. In the end, consultants were brought in to finish the technical work.

More realistic budget planning at the outset of the project might have allowed the work to be completed more quickly by dedicated staff or consultants. However, such realism might also have prevented the project from ever getting started because the true magnitude of the resources required would then have been visible. The project managers preferred to adopt the "NASA" approach to funding this project by underestimating costs at the beginning, and then scrounging for resources later.

As of this writing, the final report for the project has yet to be publicly released, pending its acceptance by the new NJDEP commissioner and governor.

7. Substantive findings

Two classes of environmental threats rose to the top of the list at the conclusion of the project. One was primarily a human health problem: indoor air pollution. The other was primarily an ecological and socioeconomic problem: land use change.

Traditional pollutants such as lead, ozone, nitrogen oxides, particulates, and sulfur oxides captured the middle of the list. Also in the middle were exotic plant and animal invaders.

At the bottom of the list were threats that were well controlled, such as bacterial contaminants in drinking water, as well as threats that simply did not affect New Jersey very much, such as hantavirus.

8. Communicating the results

The technical experts produced thousands of pages of analysis in their responses to the steering committee's request for human health, ecological, and socioeconomic impact information for each of some 75 different environmental threats. Aggregating and reducing this information was an enormous and delicate task.

The steering committee chose not to develop a single overall ranking of environmental threats. They found the analytical assumptions necessary to construct an integrated ranking based on rating-and-weighting principles to be too unrealistic. Instead they opted for a more transparent sorting technique that identified which environmental threats received "high" scores across all three impact categories of human health, ecosystems, and socioeconomics. No threat did so. Instead, threats exhibited either high human health or ecological impacts, but never both.

The steering committee, with much assistance from the project team, reported a small number of coherent, substantive findings instead of a ranked list of environmental threats. By telling an environmental story rather than delivering a Letterman-esque Top Ten list, the steering committee aided their policymaking audience by delivering succinct recommendations.

One-page summaries for each of the 75 environmental threats provided an intermediate level of detail for interested parties who wanted less than thousands of pages but more than ten pages of analysis. A website ensured that all three levels of reporting were widely accessible.

9. Uncertainty

The comprehensive comparative analysis of environmental threats was an ambitious undertaking. In many cases, the knowledge was inadequate to link cause and effect, threat and impact, conclusively together. The knowledge gaps led one participant to say that the NJCRP should be renamed the New Jersey Comparative Ignorance Project. Ignorance was not the only type of knowledge gap, however. Incertitude and ambiguity also played roles [9].

Project participants employed an innovative, multi-pronged strategy for dealing with their inevitable knowledge gaps. First, the designers of the project encouraged analysts to employ expert judgement (subject to peer review) rather than allow uncertainty to paralyze them. Second, the project's designers required the author of each impact assessment to specify the level of confidence they had in their findings. Third, each impact assessment included a section characterizing relevant knowledge gaps. Fourth, the project team performed sensitivity analyses testing the stability of the comparative risk rankings given uncertainty. Included in this effort was an innovative use of Monte Carlo simulation to investigate whether environmental threat scores differed significantly from one another. Fifth, the final report openly discussed knowledge gaps, subjectivity in analysis, and other factors limiting the adequacy of the results.

The overall thrust of the strategy for dealing with knowledge gaps was to achieve a rigorous humility, to deliver a constructive policy message without overstating the authors' confidence in their findings [5].

10. Conclusions

The NJCRP delivered a useful and powerful policy message in its substantive findings. Even prior to its official release, the project helped elevate land use issues and indoor air quality issues in importance within NJDEP and other agencies.

It is fair to ask whether the time and expense of the NJCRP was necessary—did it merely restate the obvious? In the case of land use, there was already a wide consensus that this was a problem in New Jersey (although there was little consensus on solutions to the problem). The NJCRP added modestly to the documentation of the problem, providing data that could improve the quality of the policy debate. The value added to the land use debate was then quite limited. However, the NJCRP did much more to raise awareness that indoor air quality deserved attention from policymakers. This issue had fallen between the cracks, being central to neither the state's environmental agency nor its public health agency. Indoor air quality stands to receive renewed scrutiny from both agencies in the near future. More broadly, the NJCRP provided the first systematic crosscutting analysis of the state's environmental problems, and this represents a resource that should be helpful to both NJDEP and its stakeholders for a variety of purposes.

By incorporating insights from the STS literature into the design of this project, the NJCRP enhanced its adequacy and legitimacy. The emphasis on intensive interactions among experts, officials, stakeholders, and the public improved the quality of the analysis and the acceptability of the policy message. However, the interactions carried a price in lengthening the process and inducing stakeholder fatigue.

The notion of "too much" interaction and participation rarely appears in the STS literature. But urban planners and others with an interest in process questions [5, 9, 10, 11] are now characterizing interaction and participation as variables to be optimized rather than maximized. The experience of the NJCRP supports that position. As a result of the long, intensive process, the NJCRP experienced attrition of its volunteer base and a

serious threat to its survival due to a gubernatorial transition.

11. Acknowledgements

I thank the New Jersey Department of Environmental Protection and the U.S. Environmental Protection Agency for funding this project and involving me in it. Dozens of my students, colleagues, and professional acquaintances volunteered time to the project. The views expressed here are my own and they do not necessarily represent the views of the sponsoring agencies or the project participants.

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