RISK PERCEPTION AND RISK MANAGEMENT: A REVIEW

Part 2: Lessons for Risk Management

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Abstract: While experts confine the term risk to a combination of magnitude and probability of adverse effects, lay persons associate with risk a variety of criteria, such as voluntariness, possibility of personal control, familiarity, and others. To improve our knowledge about the risk perception process is crucial for improving risk management and risk communication. Responsive and rational approaches to risk management should recognize the results of risk perception studies in two ways: First, management has to address the concerns of the affected public and find policy options that reflect these concerns; second, risk reduction or mitigation should be tailored towards the goal of meeting not only the risk minimization objective, but also the implicit criteria of risk characteristics that matter to the public. If these criteria are in conflict with each other, tradeoffs have to be made and justified through legitimate instruments of conflict resolution. Risk perception studies can help to identify public concerns and shape the arena for conflict resolution. In addition, risk perception studies offer valuable insights for designing and implementing risk communication programs.

INTRODUCTION

The first part of this article focused on the mechanisms of intuitive representation and evaluation of risks. The incorporation of risk perception into the decision making process can be frustrating and counterproductive, if the biases and problems of intuitive perceptions are ignored or downplayed. In particular, risk managers have to be aware of the following problems revealed by the reviewed psychometric and attitudinal studies:

· Inaccurate perception of the meaning of probabilities

· Different meaning of risks depending on social context and on one's social or cultural group membership

· Discrepancy between the professional concept of risk as the product of magnitude and probability and the public view of risk as a multidimensional construct, consisting of qualitative risk characteristics and perceived fairness

· Incorporation of qualitative risk and benefit factors in risk perception in addition to expected losses over time

· Thirst and desire for scientific certainty and deterministic estimates of safety in public perception

· Fear of unfamiliar, low probability-high consequence risk sources

· Strong preoccupation with risk related factors such as equity, volun-

tariness, and societal ability to manage and control risk sources

These problems relate to obvious biases in drawing inferences from incomplete information. These biases cannot and should not be used for normative decision making. However, many elements of public perception can play a valuable role in risk management. While experts confine the term risk to a combination of magnitude and probability of adverse effects, laypersons associate with risk a variety of criteria, such as voluntariness, possibility of personal control, familiarity, and others. The better our knowledge about the risk perception processes, the more we are able to improve our risk management skills (Watson 1986; Krewski et al. 1987).

Risk managers are faced with a serious dilemma: On one hand they are obliged to minimize risks in terms of lifes lost, on the other hand they have to be sensitive to the perceptions of people and to be responsive to public concerns. In most risk areas, both goals are often in conflict with each other. The technology option or policy that would minimize the average number of potential victims (as calculated in probabilistic risk assessments) is often the least preferred option by an attentive public. Selecting such a risk minimization strategy evokes often public protest and opposition; adhering to the public preference, however, implies frequently to tolerate a higher risk level than necessary. How can this conflict be resolved?

INCORPORATION OF RISK PERCEPTION INTO MANAGEMENT STRATEGIES

The response to this dilemma requires first a thorough reflection on what public perceptions mean for making rational decisions. The view that the public perception is distorted and biased and that experts should define the "real" risks is overly simplistic and naive (Fischhoff et al. 1986; Otway and von Winterfeldt 1982). Experts are also subject to heuristic biases, such as overconfidence, and can only rely on the available data for making their risk assessments. Calculated risks often suggest an accuracy of the results that is not supported by the underlying data base. Uncertainties are often ignored and many estimates rely on subjective probabilities of experts (Renn 1985). Such assessments are necessary and legitimate inputs for making prudent decisions (since nothing better is available), but they should not serve as the only criteria for evaluating the acceptability or tolerability of a risk (Krewski et al. 1987). It is not necessarily irrational to base one's policy on a concept of risk that is different from the concept suggested by the expert community. To put extra weight on risks with high uncertainties, to avoid risks that have high catastrophic potential in spite of the minute probability for such a catastrophe materializing, to adopt a more cautious strategy to cope with unfamiliar risks, and to assure a sufficient level of institutional control and monitoring before a risky technology is implemented are all valid and reasonable tools to assist risk management decisions. At the same

time, however, risk managers have to be aware that these legitimate elements of public risk perceptions are accompanied by a variety of heuristic biases, which should not be adopted as rational principles for making risk decisions.

Professional risk assessments and public perceptions of risk have both merits and limitations for designing risk management. The results of probabilistic risk assessments (PRAs) represent the best of expert knowledge with respect to expected performance and malfunctions of a technology and with regard to the corresponding impacts for public health and environment. Public perceptions cannot match the accuracy or methodological vigor of such professional assessment. However, the public perception incorporates a larger variety of dimensions and concerns, such as society's ability to cope with a rare, but catastrophic event, which are either ignored or "averaged out" in professional risk estimates (Lynn 1986; Watson 1983).

FUNCTIONS OF RISK PERCEPTION

What are the legitimate functions of risk perception in designing and implementing risk management policies? Risk perception can serve risk management in three distinctive ways:

1) Those factors, which people who have to bear risks consider to be violations of their values and interests, must be regarded as important determinants of any management approach to balance risks and benefits of a proposed decision (Slovic et al. 1979; Renn 1985; Borcherding et al. 1986). Public health or environmental deterioration may not be the only dimensions that are of concern to the affected population. Long-term effects on pollutant concentration in soil or water, the shift of reputation or image of a community, the potential transformation of a landscape, the social repercussions of a risk-causing technology on community life, and the threat of loosing or changing the cultural identity of a community may all be concerns of citizens that are often overlooked or ignored by experts or regulators. Many risk debates or public hearings on a risk related topic suffer from the inability of risk managers to acknowledge these secondary concerns. Citizens are often forced to phrase their objections in terms of technical risk arguments which do not adequately express the nature of their concerns. Such debates usually end with frustrations for all involved parties since the real issues are never discussed (Ruckelshaus 1982). Risk perception studies can help to uncover these underlying concerns and assist the risk manager in setting the agenda for the meetings with the public.

2) The basic dimensions of qualitative risk factors are important aspects for designing and modifying technologies and for creating acceptable risk control strategies. The major shortcoming of professional risk assessments is the degree of abstraction from the situation and the timing of exposure. Public perception of risk focuses on the circumstances of risk and includes aspects such as equity, catastrophic potential, dread, and possibility of per-

sonal or institutional control. These aspects play an important role for individuals and groups and determine the degree of comfort or discomfort with a specific technical solution or activity (Otway and von Winterfeldt 1982). Beyond the consideration of public acceptance, however, it appears prudent from a normative point of view to design or re-design technologies in a way that these qualitative risk characteristics are reflected in the technological structure and/or the organization of its functioning in society. Risks with low catastrophic potential, risks that entail a "forgiving" technology, risks that lead to a more equitable distribution, and risks that provide sufficient opportunities for protective actions in the case of an emergency have first of all the advantage of facing less public opposition. They also help improve risk management by restricting the scope for "unpleasant" surprises, by placing the burden of technological risk on the shoulders of a large segment of society, and by providing effective emergency planning prior to implementing the technology (Perrow 1984).

To take these qualitative aspects seriously may, however, conflict with the risk minimization objective. Large-scale technologies pose often less risks to individuals than a variety of small-scale technologies that would provide identical services (Inhaber 1979). In these instances, tradeoffs have to be made between two or more conflicting values. It depends on the decision making structure and the political mandate of a risk management institution how these conflicts are resolved and what weights are assigned to these

different dimensions. It is important to keep in mind that risk perception studies can help to identify the qualitative characteristics and to indicate the strength of concern people have in evaluating the risk in question. They may also reveal inaccuracies about or misconceptions of the severity of consequences associated with the risk under consideration. Consequently, peoples perceptions may be excellent guidelines for identifying the scope of risk management actions, but should be supplemented by more accurate expert judgments to determine the actual dose-response relationship on each identified dimension or concern (Renn 1985).

3) Risk perception studies are also essential in designing risk communication programs (Covello et al. 1986). Communicating to the public about risks and risk management is contingent on the knowledge of the concerns and perceptions of different groups and individuals. Without perception studies, the communication program may address issues that are either not contested or irrelevant for public opinion. The effectiveness of communication, however, rests not only on the knowledge of what matters to the targeted audience, but also on the willingness of the risk manager to incorporate the revealed concerns of affected public groups into the design of risk management policies (Lynn 1986). In this respect, the two points mentioned above are prerequisites for designing effective, two-way risk communication programs (Kasperson 1987). Often communication is regarded as a panacea for shifting public opinion. Communi-

cation programs based on this presumption are prone to fail. Communication is defined as a two-way learning experience: if risk managers are unwilling or unable to adjust their viewpoints, the public will refuse to adopt or even consider what the managers have to say. If, however, representatives of the public gain the impression that risk managers are incorporating the concerns of public groups into their decision making, they are more likely to accept information that helps them to correct their own distorted views and to overcome certain biases in assessing the risk.

RISK PERCEPTION AND RISK COMMUNICATION

In which way can risk perception studies help to design effective risk communication programs? First of all, risk communication must address the qualitative characteristics of risk. It is not sufficient to confine the communication process to the discussion of probabilities and consequences. Communication should include such aspects as the voluntariness of exposure, the possibility of personal control, the different management options to monitor, mitigate or control risk consequences, and other relevant characteristics (Covello et al. 1986; Keeney and von Winterfeldt 1986).

Secondly, risk communicators should explain the functional equivalents of voluntariness and personal control for collective decision making (for example siting of hazardous facilities), risk regulation and emergency management. Many studies have re-

vealed the central importance of control options in perceiving risks (Gould et al. 1988; Vlek and Stallen 1981). Control can be exercised by institutions rather than individuals, but such a delegation of control depends on a trusting relationship between the risk management institution and the affected public. Potential elements of a trust-building communication program should include three crucial elements: (i) the assurance of an open and rational decision making process, (ii) proof that the operating and regulating institutions are independent and impartial, and (iii) sufficient evidence that the regulatory agencies are capable to monitor routine emissions or safety standards and willing to intervene in the production process if the risks turn out to be more severe than expected (Renn and Levine 1988). People have demonstrated their willingness to accept involuntary risks if they had confidence in the licensing and regulatory agencies. If this confidence is lost or challenged, risk rejection or avoidance is the likely response by the public.

Thirdly, the result of a communication program is always uncertain regardless how welldesigned such a program may be. The processing of information by the media, the competition of information from different sources, the co-existence of personal, professional, and institutional selection of information, and interaction among different target audiences create enough complexity and uncertainty that the final effect of the communication process can hardly be measured at all (Renn 1988). For this reason, guidelines for effective risk management can rely only

partially on empirical evidence. Studies on risk perception can, however, provide helpful clues for designing communication programs that assist people in making prudent judgments about risks they face.

CONCLUSIONS

The artificially constructed contrast between an allegedly rational assessment by professionals and an allegedly irrational perception by laypersons has not only disguised the limitations and values of both approaches, but has also put considerable constraints on an effective and acceptable risk management approach. The professional calculation of risk should be an important and essential component of the decision making process with respect to risk acceptance and risk management. This demand, however, is hardly disputed by any public group (Renn 1985). Nobody wants to substitute scientific knowledge with intuition. To make professional assessments, however, the sole criteria for judging the "acceptability" or "desirability" of a technology or a risk management policy, contradicts the mandate of decision makers to design public policies in the public interest and in accordance with socially shared values (Lynn 1986; Perrow 1984).

Risk management can incorporate the results of risk perception studies in three ways: First, management can address the concerns of the affected public and find policy options that reflect these concerns; secondly, risk reduction or mitigation should be tailored towards the goal of meeting not only the risk minimization objective, but also the implicit criteria of the qualitative risk characteristics. If these criteria are in conflict with each other, tradeoffs have to be made. The process of making tradeoffs is inevitable for stochastic risks and can only be justified through legitimate instruments of conflict resolution. Risk perception studies can help to shape the arena for facilitating the process of assigning tradeoffs and to identify the values and concerns of all parties involved.

Thirdly, risk perception studies can help to design successful risk communication programs. Risk communication relies on a two-way exchange of arguments and the willingness of both sides to learn new arguments and adjust their position accordingly. Risk perception studies can help to determine the beliefs of the various parties involved and to address these beliefs in the information package. Finally, the results of perception studies offer valuable clues for improving the credibility of an institution. If institutions have lost their credibility, people will not believe the content of their message and may not even listen. To be more credible implies to be sensitive to public concerns and to organize communication as a two way process: from and to the target audience. Most communicators are aware of this, but have not yet succeeded to implement an effective and open dialogue with representatives of the public.

Risk managers are therefore well advised to encourage risk perception studies and to develop a decision making process in which risk percep-

tion variables are routinely included in the analysis of impacts and consequences of different policy options. The example of nuclear energy has demonstrated that ignoring public perception and using PR-methods to sell this product to the public have failed in almost every country of the world. Taking risk perception seriously does not only pay off in terms of public acceptance, it is also mandatory for making rational decisions in a democratic society.

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