RISK PERCEPTION, COMMUNICATION AND DECISION- MAKING PROCESS

Vladimir NINKOVIĆ[1], Ladislav NOVAK[2], Želimir KEŠETOVIĆ[3]

SUMMARY:

This article intends to give brief outline of psychological, sociological and cultural theories of risk. More detail will be given on risk perception paradigm and the phenomenon of risk amplification, as well as their practical implication in the process of risk decision-making and communication as the basis for qualitative risk management.

INTRODUCTION

Until recently the tendency within risk management was to present risk as something quantifiable, measurable and calculable which can be presented in various units. Such tendency is understandable given the fact that the most "experts" in the field of risk assessment and risk management have their professional background in technological and natural sciences.

For them risk is the equation of **probability** of event occuring multiplied with **impact** of event occuring. Also, older debates in psychology treated risk as a real and objective entity, amenable to quantitative analysis. However, not all risks and hazards can be efficiently assessed with quantitative paradigm. Modern risks coming from new technologies are generally characterized by complexity, uncertainty and ambiguity. In such cases relying only on experts' opinions and quantitative calculations may prove insufficient, given that about such issues different experts often have different opinion which can cause dissent among stakeholders and the general public. Such cases present the field where the qualitative research techniques should be applied. Qualitative risk assessment tries to take into account, in the first place, human perception of risks and hazards and social and cultural settings in which risk perception takes place.

MODERN SETTINGS AND NEW CHALLENGES

In the (post)modern world, the principle of social responsibility, concept of democratic governance and growing body of legislative documents encourage the public to take active part in the risk assessment and risk management processes. According to the words of Ulrich Beck, the reason for such practice is that the contemporary society is the "Risk Society" and the world of manufactured uncertainty, the society where in the first place we become more and more aware of the technological and scientific risks and hazards we are surrounded with and, in the second place, the society where such risks are rapidly increasing.

The logic underlying modern industrial societies is changing from one based on the distribution of "good" aspects, in the form of material products, to one based on the distribution of "bad" aspects, in the form of risks and unintended consequences. Anthony Giddens speaks of "risk culture", which can be seen as a new imperative for modern society; we live in a society which is no longer turned towards the past, but towards the future, in which individuals have acquired considerable autonomy and are encouraged to take their lives in their own hands - we must constantly think ahead and remain alert to both risks and

[1]Vladimir Ninković, professor of Spanish and English, master student of Faculty of Security Studies University of Belgrade, e-mail: vladimirninkovic@yahoo.co.uk

[2] Ladislav Novak, Ing. PhD., Fakulta špeciálneho inžinierstva, Katedra manažmentu, Žilinská univerzita v Žiline, ul. 1 mája 32, 010 26 Žilina, e-mail: Ladislav.Novak@fsi.uniza.sk

[3] Želimir Kešetović, PhD, assistant professor, Faculty of Security Studies University of Belgrade, Gospodara Vučića 50, 11000 Belgrade, Serbia, e-mail: kzelimir@yahoo.com

opportunities. In such society it is no wonder that the psychology and perception of risk come into focus of the research.

In the transformation from modernity to late modernity the judgments made by professionals are being constantly exposed to scrutiny.[4] Professionals are more open to questioning from clients, can be exposed to charges of incompetence, and are required to justify their actions and present the service user with possible alternatives for action. Users of professional services are now faced with a proliferation of knowledge from various sources (popular science books and magazines, newspapers, TV, Internet), which can conflict with what are they being told by professionals and "experts".[5]

New hazards recognized in modern living have changed in kind, regardless of whether any particular type of risk has increased or decreased. In addition, new knowledge about hazards and risks has led people to think about them in new ways. For some modern risks, adjectives "uncertain" and "ambiguous" are even more convenient. Exactly these problems of complexity, uncertainty and ambiguity are three major challenges in risk analysis, perception and communication. Even the terms themselves are not easy to define and characterize. Seth Lloyd writes that he once gave a presentation which set out 32 definitions of complexity[6]. One of the most comprehensive texts on this topic published in continental Europe: "OECD Guidance document on risk communication for chemical risk management" gives the following definitions and explanations of these terms.

Complexity refers to the difficulty of identifying and quantifying causal links between a multitude of potential candidates and specific adverse effects. In such cases sophisticated scientific investigations are necessary since the dose-effect relationship is neither obvious nor directly observable. Under these conditions, scientific models of risk assessment (including hazard identification, exposure characterization, risk characterization and risk quantification) are the most appropriate instruments to gain a better picture of the relative risks associated with these complex causal chains. To communicate complexity, scientific expertise and technical skills are needed. Resolving conflicts of complexity requires deliberation among experts. The more complex, the more multi-disciplinary, and the more uncertain a phenomenon appears to be, the more necessary a communicative exchange of arguments among experts occurs.

If complexity cannot be resolved by scientific methods, uncertainty increases. Probabilities represent only an approximation to predict uncertain events. Even simple relationships, however, may be associated with high uncertainty if either the knowledge base is missing or the effect is stochastic by its own nature. If uncertainty plays a large role, in particular indeterminacy or lack of knowledge, the public becomes concerned about the possible impacts of the risk. If risks are associated with high uncertainty, scientific input is only the first step of a more complex evaluation procedure.

Coping with uncertainties requires the inclusion of stakeholders and public interest groups, if there are different views, perceptions about the adequate level of protection. The objective of this discourse is to find the right balance between too little and too much protection. There is no scientific answer to this question and even economic balancing procedures are of limited value, since the stakes are uncertain.

Ambiguity denotes the variability of (legitimate) interpretations based on identical observations or data assessments. Most of the scientific disputes in the fields of risk analysis and management do not refer to differences in methodology, measurements or dose-response functions, but to the question of what all this means for human health and environmental protection. Hazard data is hardly disputed; most experts debate whether a specific hazard poses a serious threat to the environment or to human health.[7]

While scientific positivistic research is required to identify and estimate risk, it is no longer sufficient. There still remains considerable work to be done in understanding how individuals perceive identifiable risks. The definition and estimation of risk is often removed from the lay individual. In order to democratize procedures for the management of risk assessment, research and management

---

4 GIDDENS, A: The Consequences of Modernity, Polity Press, 1990.

5 DENNEY, D: Risk and Society, Sage Publications, London, 2005, p.74.

6 LLOYD, S.: *Programming the Universe*, Knopf, London 2006.

7 OECD Guidance document on Risk Communication for Chemical Risk Management: OECD Environment, Health and Safety Publications Series on Risk Management, No. 16, Paris, 2002, pp.52-54.

must be defined within interdisciplinary terms. This will require separation of fact from opinion or what we know about risks and what we might feel about them. Rosa attempts to construct a framework which allows risk judgments to be made with respect to prevailing cultural understanding. She also describes several levels of "risk judgment", which incorporate problem solving strategies.[8]

1. Grounded realism. Risk created by accidents and emergencies. Knowledge about such outcomes is high, and specific examples are numerous. Traditional methods of risk assessment are adequate.
2. Uncertainties increase drawing on a wide range of professional consultancy. The most obvious example of this is the development of the relationship between the physician and the patient. The diagnosis of potentially life-threatening disease is an example of such a risk.
3. High decision stakes and high levels of uncertainty. The basis of knowledge claims about outcomes stakes are low, with few available concrete examples. Problems require scientific understanding but are too uncertain to be explained entirely by positivistic science. The natural sciences are ill-equipped to deal with uncertainty. Because decision-making takes place in a value-laden world, this order of risk inevitably requires that value judgments are made with respect to the nature of risk. For Rosa, post-normal science can include culturalist and phenomenological positions when defining both the nature of the risk and its possible impact.

Rosa argues that the risk assessment can incorporate a democratization of risk assessment procedures and bring the experiences of individuals affected by risk into public "post-normal" scientific debates. Such democratization presupposes a form of regulated autonomy in which mature consumers, who are able to access and assess expert advice on risk, are available.

RISK PERCEPTION AND HAZARD CONSTRUCTION

Even if the experts and professionals accept the theory that we live in the "risk society", the public is reluctant to adopt the "risk culture" in general. Laymen have their own way of dealing with risks and hazards. Either the public "overestimates" risks considered by the experts to be statistically insignificant or under control (which can lead to various types of social reactions, such as anti-nuclear demonstrations), or else they continue to "under-estimate" the risks and hazards associated with individual behavior (which, on the other hand, can complicate things for experts who are trying to develop preventive policies).

The most overestimated causes of death include all accidents, pregnancy, childbirth, abortion, flood, tornadoes, cancer, fire and homicide. Individuals also have a propensity to believe that they are personally immune from risky events. The "it won't happen to me" phenomenon applies to many individuals when they drive a motorcar or smoke a cigarette. The most under-estimated causes of death include smallpox vaccination, diabetes, lightning, stroke, tuberculosis, asthma and emphysema.[9] In both cases, perceptions of risk acquire their own strength and sometimes have consequences greater than the risks themselves.

From the perspective of social sciences, risk perception includes human beliefs, attitudes, judgments and feelings, as well as wider societal or cultural values and dispositions that people adopt towards hazards and benefits coming from them. Such view on risk perception is deliberately wide, because it takes into account that people rather evaluate hazards as something real and palpable than risk which is but an abstract concept.[10] Risk perception is above all multidimensional, because one hazard can have different meanings for different persons (depending on, say, their system of values) and in different contexts. In some circumstances, the important aspects of perception and acceptability of risk include reasoning not only about physical characteristics and consequences of a certain activity, but also about societal and organizational factors such as credibility and trustworthiness of the risk management and authorities.

What humanist sciences generally intend to assess in the risk perception research, includes human cognition and processing of the various information about hazards, as well as the „second hand" information originating from scientific communication, the

[8] Rosa, E.A. 'Meta-Theoretical Foundations for Post Normal Risk', Journal of Risk Research 1: 1998,pp.15–44.

[9] DENNEY, D.: op.cit. p.20.

[10] PIDGEON, N: Risk Perception in Risk Analysis, Perception, Management, Report of a Royal Society Study Group, London, 1992, p. 89.

communication of the „significant other" of the social surrounding, such as peers or other trustworthy figures and, of course, the media. Today's psychological practice accepts the general position that the outside information are first selected and then interpreted on the basis of the structures of the organized knowledge through which all individuals personalize the world, as well as on the basis of the system of beliefs and significations which is shared between the individuals within a certain culture, society or a social group.[11]

Although people in defining probability use various heuristic simplifications or „short-cuts", they have relative sofisticated views on certain risks, including important qualitative factors which formal techniques of risk assessment very often do not take into account.[12] Some studies showed that individuals in Western societies (both experts and lay) tend to rank the chances of dying from particular hazards very much in line with the available statistic estimates. Systematic differences between intuitive and statistical estimates can be seen only in case of the extreme values: people tend to overestimate the fatalities from very low probability events (e.g.nuclear radiation) and underestimate the very probable ones (e.g.cancer, stroke...). One of the explanations of this effect is that people use the availability heuristics, which means that, under certain circumstances, people will judge the likelihood or frequence of an event in part as a function of the ease of recall (availability) of similar instances from memory.[13] It is often said that key impact on the availability from memory are the information from the media. Sensational overreporting of relatively rare accidents such as fatal lightning strikes or airplane hijacking can increase the availability of such events. On the other hand, relatively „normal" causes of death such as car accident or a stroke, rarely become the headlines. This can lead to people overestimating the probability of rare but „sensational" events and underestimate very frequent but not so „interesting".

One of the key questions in the risk assessment is what makes the acceptable risk.[14] This complex question does not include only scientific assessments of the „facts" but also the values which society assigns to the concepts as progress, cost-benefit distribution from the technologies and consequences of their breakdowns and accidents such as death, pollution, economic crash etc. Therefore, it is clear that acceptability does not depend only on the owner but also on the user of the technological systems and products. How user constructs risk and safety is the topic of every debate about acceptability and the appearence of serious accidents can create the impression that a certain technology represents too big a hazard for society to be accepted.[15] Nuclear energy and nuclear plants are the perfect example for this, with only few but serious and global disasters which had consequences on the opinion of many people.

Hazard construction is the process whereby people identify what they regard as the key features of a complex situation and combine them into something which appears to make sense. The UK concept of Risk Assessment consists of building a hazard construct based on the following questions:
Risk: From What?
Risk: Of What?
Risk: To What?
Risk: So What?

It might be assumed that there would be quite a high degree of agreement about the answers on such simple questions. In practice, however, different groups can come up with significantly different assessments.

Having produced a hazard construct, if it is to be of any benefit it has to be utilized. Whether or not this can be done depends on the structure of society. In a very structured society, different groups may well have different hazard constructs, but only the one of the ruling group counts for anything. In a completely open society every view must be taken into account. In the real world neither extreme is generally regarded as desirable.

Given the complexity of the modern world, people must somehow rationalize their surroundings into something manageable. Psychologists agree that we do not first see then define, but that we define first and then see.[16] In effect, we see what our experience leads us to believe we should see, and our hazard constructs are based on what we expect. This may be termed a circumscribed or prescribed cognition.

[11] Ibid. P. 98.
[12] PIDGEON N, The Psychology of Risk, in D.I. Blockley, *Engineering Safety*, 1992, str.175
[13] Ibid, p. 176
[14] N. Pidgeon prefers the term "tolerated risk". N. Pidgeon, Royal Society Report, p. 92.
[15] N. Pidgeon, Royal Society Report, p. 93.
[16] WILSON, L.: The Risks Outside and the Pictures in our Heads: Connecting the News to People and Politics, in Handmer et al. New Perspectives on Uncertainty and Risk, Australian National University, Canberra, p.137.

The basic concept is that when looking at any situation, a selective simplification of reality is constructed, based on past experience. Before new hazards can be recognized, they have to become part of a person's experience, by attending a training course, or involvement in an incident.

Constructs by professional groups may selectively include only hazards which are of professional interest. Within a professional group the assessment should be consistent, but between different groups it could be vastly different.

Apart from the previous experience, two other major influences on the outcome of the hazard construction are legislation and guidance documents. The problem with legislation is that it may limit the boundaries of the construct. In terms of major accidents, the "Seveso II" directive (the EC Council Directive on Control of Major Accident Hazards involving Dangerous Substances) was adopted in December 1996.[17] It involved a major change in the content of official hazard constructs. An example was introducing the need to include possible "domino effects", widening the boundaries of the construction to include neighboring sites and activities.

Hazard constructs can be developed for various purposes, and tend to concentrate on things which the constructor would like to change. They can also be developed as an industrial management tool, where three potential uses are for: 1. Planning, 2. Accident prevention, 3.Crisis management. Each of these areas has different aspects, which may have a bearing on the hazard construction itself, and on the consequences of the imperfections in it.

AMPLIFICATION AND OUTRAGE FACTORS

Amplification could be defined as a process during which "events pertaining to hazards interact with psychological, social, institutional and cultural processes in ways that can heighten or attenuate public perceptions of risk and shape risk behavior. Behavioral patterns in turn generate secondary social or economic consequences.

[17] Seveso II Directive [96/82/EC], Official Journal of the European Communities, No L 10/13

These consequences extend far beyond direct harms to human health or the environment to include significant indirect impacts.[18] More recently, amplification has been described as referring to the discrepancy that might exist between expert and lay points of view, or, where there is amplification of impacts, to the discrepancy between expert assessments of the risk and the magnitude of the impacts that do or do not follow. Where public perceptions are such that the risk is much greater than expert assessments would suggest, we speak about intensification. Conversely, where perception/behavior suggests that the risk is much less than expert judgment would suggest we speak about attenuation.[19]

Some theorists argued that there are a number of "negative hazard attributes" which might influence people's risk perception and therefore cause intensification or attenuation. They have been summarized by Pidgeon et al in the 1992 Royal Society Report[20]:

1. Involuntary exposure to risk (radiation vs smoking)
2. Lack of personal control over outcomes (releases of toxic chemicals vs riding a motorcycle)
3. Uncertainty about probabilities or consequences of exposure (genetic engineering vs automobile accidents)
4. Lack of personal experience with the risk (leaks of chemicals vs household work)
5. Difficulty in imagining risk exposure (genetic engineering vs actuarial risk data related to traffic accidents)
6. Effects of exposure delayed in time (long latency periods between exposure and adverse health effects vs poisoning)
7. Genetic aspects of exposure (threatens future generations) (adverse genetic effects due to exposure to radiation vs skiing accidents)
8. Infrequent but catastrophic accidents (major industrial explosion vs motorcycle accidents)
9. Benefits not highly visible (waste disposal facilities vs automobile driving)
10. Benefits go to others (siting of the power transform station)

[18] RENN, O., W.J.BURNS, J.X.KASPERSON, R.E.KASPERSON & P.SLOVIC: The Social Amplification of Risk: Theoretical Foundations and Empirical Applications , Journal of Social Issues, 48(4), 1992, pp.137-160

[19] BREAKWELL, GLYNIS M. and J.BARNETT: The Impact of Social Amplification of Risk on Risk Communication, Health & Safety Executive, Contract Research Report 332/2001, HMSO, London, 2001, pp.14-15.

[20] PIDGEON, N: Risk Perception in Risk Analysis, Perception, Management, Report of a Royal Society Study Group, London, 1992.

11. Accidents caused by human failure rather than natural causes. (industrial accidents vs exposure to geological radon)

Covello and Sandman identified nine more "outrage factors" as they called them[21].

1. Victim identity – risks from activities that produce identifiable victims are less readily accepted than risks from activities that produce statistical victims (a child who falls down the well VS statistical profiles of automobile accident victims)
2. Trust – Risks from activities associated with individuals, institutions or organizations lacking in trust and credibility are judged to be greater than risks from the same activities but associated with those who are trustworthy and credible.
3. Personal stake – Risks from activities viewed by people to place them personally and directly at risk are perceived to be greater than risks from activities that appear to pose no direct or personal threat (living near a waste disposal site VS disposal of waste in remote areas)
4. Ethical/moral nature – Risks from activities believed to be ethically objectionable or morally wrong are less acceptable than risks from ethically neutral activities (foisting pollution on economically distressed community VS side effects of medication)
5. Effects on children – Risks from activities that appear to put children specifically at risk are perceived to be greater (milk contaminated with toxic substances VS workplace accidents)
6. Dread – Risks from activities that evoke fear, terror, or anxiety are perceived to be greater than risks from activities that do not arouse such feelings or emotions (AIDS VS common cold)
7. Media attention – Risks from activities that receive considerable media coverage are viewed as greater than risks from activities that receive little
8. Accident history – Risks from activities with a history of major accidents or frequent minor incidents are perceived to be greater than risks with little or no such history (leaks at waste disposal facilities VS recombinant DNA experimentation)
9. Reversibility – Risks from activities considered to have potentially irreversible adverse effects are judged to be greater

[21] COVELLO, V. & P.SANDMAN: Risk Communication: Evolution and Revolution, in A.WOLBARST (ed.) Solutions to an Environment in Peril, Johns Hopkins University Press, 2001, pp 164-178.

Covello and Sandman argue that these findings reveal that people often perceive and assess "risk" more in terms of these factors than in terms of potential for "real" harm and hazard. For the public RISK= HAZARD + OUTRAGE[22].

When it is present, outrage often takes on strong emotional overtones. It predisposes an individual to react emotionally (e.g., with fear or anger), which can in turn significantly amplify levels of worry. Outrage also tends to distort perceived hazard.

Thus, risk, is multidimensional and its quantitative size is only one of the dimensions. Since people vary in how they assess risk acceptability, they will weigh the outrage factors according to their own values, education, personal experience, and stake in the outcome. Because acceptability is a matter of values and opinions, and because values and opinions differ, discussions of risk may also be debates about values, accountability and control. Any measurement of risk would, therefore, need to be sensitive to the system of understanding in which that risk is viewed. This also suggests that apparently irrational views may actually constitute logical constructions of a perceived reality[23].

KNOWLEDGE NEEDED FOR RISK DECISIONS

Understanding the risks is not enough. We never choose between risks, we choose between options which in the same time present some hazards and some benefits, which are as crucial to the choices as the risks are. It is often argued that decision makers need four kinds of knowledge: 1. Knowledge about risks and benefits associated with a particular option, 2. About alternative options and their risks and benefits, 3. About the uncertainty of the relevant information, and 4. About the management situation.

Within the scope of the first mentioned knowledge enter questions about particular risks and their benefits: 1. What are the hazards of concern? What environment, social groups, structures or individuals might be harmed? How serious is each potential consequence? Is it reversible? What are the benefits? How many people benefit? Who benefits and in what ways? etc.The term risk control assessment may be used to describe the activity of characterizing alternative

[22] Ibid, p. 171.
[23] Ibid, p.172.

interventions to reduce or eliminate a hazard. Assessments of the risks and benefits of all available options should also address the questions about their own reliability. Decision makers need also answers to managerial questions such as these: Who is responsible for the decision? What issues have legal importance? What constrains the decision? What resources are available for implementing the decision? In sum, a well-informed choice about activities that present hazards and risks requires a wide range of knowledge. However, the decisions about risky activities and hazards are frequently made with incomplete information.

Besides that, any scientific risk estimate is likely to be based on incomplete knowledge combined with assumptions, each of which is a source of uncertainty that limits the accuracy that should be ascribed to the estimate. The problem of how best to interpret multiple uncertainties is one more source of uncertainty and disagreement about risk estimates.

ERRORS IN SCIENTIFIC AND LAY JUDGMENT

Scientists' training, which teaches them to accurately represent certain types of uncertainties, comes into conflict with the pressure to give immediate, unambiguous answers that can inform the social and personal decisions non-experts must make about risks. If the experts remain silent or equivocal, choices will be made without taking into account what they know. Once they begin to convey what they know, however, experts must inevitably make judgments about the meaning of available information and about the degree to which uncertainty makes it less reliable. But because experts rely on ordinary cognitive processes to make sense of the mass of data they have available, their judgments about the meaning and conclusiveness of available information can suffer from some of the same frailties that affect human cognition in general.

Now, it would be appropriate to mention several major errors in scientific and lay judgment.

1. *Inappropriate reliance on limited data*. Judging by words of Tversky and Kahnemann, even statistically sophisticated individuals often have poor intuitions about how many observations are necessary to support a reliable conclusion about a research hypothesis. They mostly tend to draw conclusions from small samples that are only justified with much larger samples. They may err in the both directions, overestimating or underestimating the risks and hazards.

2. *Tendency to impose order on random events*. People who are seeking explanations for events have a tendency to see meaning even when the events are random. In interpreting statistics relating the incidence of cancer to occupational exposures to particular chemicals, there is a temptation to interpret a correlation between exposure to a particular chemical and the incidence of a particular cancer as evidence of an effect.

3. *Tendency to fit ambiguous evidence into predispositions.* When faced with ambiguous or uncertain information, people have a tendency to interpret it as confirming their preexisting beliefs.

4. *Tendency to systematically omit components of risk.* In analyses of complex technological systems, analysts are often prone to overlook the ways human errors or deliberate human interventions can affect such systems; the ways different parts of the system interact etc.

5. *Overconfidence in the reliability of analyses*. For instance, civil engineers do not normally assess the likelihood that a completed dam will fail, even though about 1 in 300 does so when first filled with water.

These normal cognitive tendencies can lead expert risk analysts to premature judgment that a risk is low or high. The existence of these tendencies justifies a certain amount of skepticism on the part of decision makers, including individuals, about definitive claims made by risk analysts. Therefore, different publics and different experts are likely to see complex choices in different, sometimes contradictory ways even when the information is not at issue. Incomplete and uncertain knowledge leaves considerable room for scientific disagreement. Judgments about the same evidence can vary, and both judgments and the underlying analyses can be influenced by the values held by researches. Since scientists and the people who convert scientific information into risk messages do not all share common values, it is reasonable to expect risk messages to conflict with each other. Even in the best circumstances for communication conflicting risk messages would create confusion in the minds of nonexperts who must rely on them to inform their choices.

IMPLICATIONS OF CONFLICT FOR COMMUNICATION

Four aspects of risk conflicts have implications for risk communication.

1. Differential knowledge – One source of conflict about risk is that experts and non-experts know different things about the risks and benefits of technology. In particular, technical experts have specialized knowledge about the nature of both the hazards and their benefits that non-experts, lacking this knowledge, may dispute. Conversely, non-experts sometimes have local knowledge about exposures or the practical operation or a hazardous activity that technical experts do not share. When conflict arises mainly from differential knowledge, risk messages focused on information can improve the risk communication process. A second aspect of differential knowledge and conflict is the differences in the degree of understanding in various groups typically involved in risk issues. Information simply made available to the public through the mass media and other channels is typically taken up more readily by those with high, rather then low, socioeconomic status because the former usually have a higher level of education, enabling them to understand technical material more easily. This leads to a so-called knowledge gap.

2. Vested interests – Those who bear the risks of a technology are not always the same people who gain the benefits, and, when the risks and benefits are distributed in unequal proportion, those holding the different interests come into conflict. This kind of conflict is most clearly evident in decisions about the siting of locally unwanted facilities such as hazardous waste sites, power lines and radioactive waste depositories.

3. Value differences also underlie conflict about risk. For instance, some people may believe that a potential catastrophe should be avoided by not adopting a technology that might produce it, while others may believe that potential problems could be solved after the technology is implemented but before the problems become too serious.

4. Mistrust of expert knowledge as interest serving. Public mistrust from government and industry sources also underlies conflict about technology. Many people are aware that experts can be found who will support nearly any position in a technological debate. They realize that industry groups tend to produce only those scientific arguments that advance their goals and that environmental groups do the same.

In most risk debates some participants are concerned with narrower issues of risk analysis, some with interests, some with value questions and some with issues of trust. For this reason different participants want to send and receive different kinds of risk messages, and the risk communication process includes the full range of types of messages. The designers of risk messages need to be aware that a program of messages that addresses one source of conflict may fail to address other sources. Therefore, risk communication is difficult because risk messages often seem to operate at cross-purposes.

REFERENCES

[1] BECK, U.: Risk Society: Towards a New Modernity. New Delhi: Sage. (Translated from the German Risikogesellschaft*,* 1998

[2] BREAKWELL, GLYNIS M. and J.BARNETT: The Impact of Social Amplification of Risk on Risk Communication, Health & Safety Executive, Contract Research Report 332/2001, HMSO, London, 2001,

[3] COVELLO, V. & P.SANDMAN: Risk Communication: Evolution and Revolution, in A.WOLBARST (ed.) Solutions to an Environment in Peril, Johns Hopkins University Press, 2001

[4] DENNEY, D: Risk and Society, Sage Publications, London, 2005

[5] GIDDENS, A.: Runaway World: How Globalization is Reshaping Our Lives. London : Profile, 1999.

[6] GIDDENS, A: The Consequences of Modernity, Polity Press, 1990.

[7] LLOYD, S.: *Programming the Universe*, Knopf, London 2006.

[8] OECD Guidance document on Risk Communication for Chemical Risk Management: OECD Environment, Health and Safety Publications Series on Risk Management, No. 16, Paris, 2002

[9] PIDGEON N, The Psychology of Risk, in D.I. Blockley, *Engineering Safety*, 1992

[10] PIDGEON, N: Risk Perception in Risk Analysis, Perception, Management, Report of a Royal Society Study Group, London, 1992.

[11] RENN, O., W.J.BURNS, J.X.KASPERSON, R.E.KASPERSON & P.SLOVIC: The Social Amplification of Risk: Theoretical Foundations and Empirical Applications , Journal of Social Issues, 48(4), 1992

[12] Rosa, E.A. 'Meta-Theoretical Foundations for Post Normal Risk', Journal of Risk Research 1: 1998
[13] Seveso II Directive [96/82/EC], Official Journal of the European Communities, No L 10/13
[14] WILSON, L.: The Risks Outside and the Pictures in our Heads: Connecting the News to Peopleand. Politics, in Handmer et al. New Perspectives on Uncertainty and Risk, Australian National University, Canberra, p.13