



# Beyond Statistics and Technology - Risk Handling in a Decision-Maker's Perspective

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IIASA Working Paper



December 1991

Oestberg, G. (1991) Beyond Statistics and Technology - Risk Handling in a Decision-Maker's Perspective. IIASA Working Paper. Copyright © 1991 by the author(s). <http://pure.iiasa.ac.at/3524/>

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# Working Paper

## Beyond Statistics and Technology—Risk Handling in a Decision-Maker's Perspective

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WP-91-41  
December 1991



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The executive summary of a contemplated book (in Swedish) tentatively called "Risk, To Be Handled With Care" was written during the author's stay from April 1 - 30, 1991 at the International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria.

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# Beyond Statistics and Technology—Risk Handling in a Decision-Maker’s Perspective

*Gustaf Östberg\**

## Abstract

Studies of high-level decision-makers considering societal risks have demonstrated that their ways of actually dealing with such issues do not conform very closely to the normative pattern emerging from conventional risk analyses. The scientific concept of risk does not appear to be very useful in this context. The decision-makers are less concerned about information and knowledge than about problems related to polarized opinions among those affected by risks, surprises, mistakes, contradictions and other transscientific phenomena. Improvements of so-called decision support for high-level decision-making on societal risk need the application of perspectives other than those adopted in most conventional risk analyses. What is required are changes in attitude and mentality in order to be able to really care for the decision-makers. In the end, what really matters is values, interests and will of persons.

## Keywords:

Achievement, attention, attitude, “Bildung”, caring, constraints, contextuality, contradictions, credibility, decision-makers’ perspective, eclecticism, existentialistic, incompatibilities, inconsistencies, intelligence, intentionality, interest, irrationality, language, mentality, metaphor, mind-sets, myth, multiple rationalities, paradigms, participatory research, paradox, phenomenology, political animal, power, pragmatism, tacit knowledge, taken-for-granted, thinking, thought processes, transscience, trust, unbounded rationality, uncertainties, understanding, values, will, world picture.

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## Why another look at risk handling is needed

There was a time when risk was considered to be a relatively simple matter to deal with, using probability theory in order to assess risks as the product of probability of hazardous events and their consequences. Research—not least under the auspices of IIASA—as well as experience has shown, however, that risk cannot be dealt with properly as a statistical phenomenon solely. A number of different principles have to be engaged in any attempt to handle risk aiming at decisions, particularly on a societal level.

Even then, it appears as if the support that science might provide for such decision-making does not play the role one may expect on the ground of the scientific paradigms in question. Other perspectives seem to be predominant at the very instant a high-level decision-maker considers an issue involving a particular risk. He or she may not even be able to recognize the risk as regarded from a scientific point of view. Hence, in order to really serve the purpose of assisting societal decision-makers, scientific risk handling also has to take other perspectives than those of the respective disciplines into account.

While most specialists engaged in research and practice of various aspects of risk handling may agree in principle that their efforts need to be coordinated into a general scheme, very few are prepared in practice to accommodate their views to suit the perspective of high-level decision-makers. This is particularly true when it comes to incorporating societal and humanistic aspects into patterns established on the basis of scientific and technological models. Most scientists and technologists are reluctant to respect such disciplines as, for instance, psychology, sociology, and anthropology as equally important for the understanding of decision-making related to risk.

It is the aim of the present treatise of societal risk handling to shed light on aspects that are often neglected in considerations of the process of actually making decisions. In the vocabulary sometimes used in this context, the issue is that of transscience, i.e. the role of phenomena which cannot easily be entirely described using conventional concepts of science. The problem to be approached is how to understand such phenomena and how to take them into proper account when analyzing and describing risk scientifically.

A problem of understanding is not like a scientific question which has only one correct answer. Rather, it is a question of attitude and mentality which should preferably be dealt with by performing a process of development of “Bildung”—a German term that unfortunately cannot be translated literally into English by a single word but may be understood by the IIASA community. Therefore, the way of approaching the problem of transscientific aspects of risk handling is to make a “Bildungsreise”, which means a tour among a number of different issues related to understanding in general and of risk in particular. At first, a reader used to linear processing may find this procedure confusing but, hopefully, the scattered reflections on understanding and representing risk will form a meaningful network.

Finally in this introduction, it should be mentioned that most of the points raised are prompted by the author’s experience from work as a scientist and technologist in the materials field as well as a researcher and consultant to government agencies and ministries in Sweden on issues of safety and health related to technology and the environment. Diversions into humanistic and social sciences have been made with the guidance of experts encountered by chance, for example at meetings and conferences arranged by IIASA.

## Plural rationalities should be considered

Trust in formal rationality as a decisive criterion when dealing with risk becomes even more questionable if one considers political judgment of risk. In the polarized debate on technology, all the different parties can usually base their arguments on some kind of rational reasoning. Nevertheless, despite agreement on the logics, the final conclusions often differ in a sense that cannot be explained by analysis of the rationalities as such.

Social anthropologists have made it clear—partly on the basis of work at IIASA—that the differences of opinion about technology are not due primarily to the different political standpoints as such. The basic discrepancies are to be found in the underlying myths about nature. The judgment of technology depends on whether nature is believed to be benign, ephemeral, perverse or capricious according to the anthropological classification. In terms of socio-political system types, this corresponds to the individualist, the egalitarian, the hierarchist and the fatalist type respectively.

This explanation of the causes of different rationalities is of interest from the point of view of risk handling in general since it makes it possible to distinguish opposing views on risk also in other terms than according to apparent political differences. Furthermore, the reference to myths of nature calls attention to the role of values in forming the factual basis for the particular rationalities of the different judgments of risks. Facts are appreciated differently depending on their relation to the myth in question. Hence, different rationalities are developed which should not be compared as such, but with respect to their origins in myth. Accordingly, the handling of risks becomes the handling of myths.

## Do ends follow means or vice versa?

Schematically, risk handling is thought of as a process of solving problems by first defining a goal or an end – usually reducing or eliminating the risk in question – and then finding suitable means of achieving the goal – usually restrictions of some kind. In principle, these two steps are described as independent, separate activities. As is well known, considerations of possible means may have an influence on the assessment of desirable goals. Often this dependence of ends on means is so strong that the definition of ends becomes subordinated to the selection or development of means.

Formulated in this general way, the dilemma of ends and means appears to be trivial and not worth much discussion. From a decision-maker's point of view, however, it is important to realize that the ends – his primary concern – can be radically transformed, or even distorted, by undue considerations of means during the process of implementing a decision. In order to counteract this tendency, the definition and formulation of general goals on a high level should be made in such a way as to permit these goals to be subdivided or delegated to more concrete tasks at lower levels without being perceived as instructions about means. The decision-maker's role is simply that of any manager, namely to clarify the general idea behind the different activities of the organization in terms that make it possible for every unit to recognize its own goal in relation to the means of achieving the overall goals.



In some areas of risk handling, it is relatively easy to develop and maintain an understanding of the goals of the activities, in health care at hospitals, for instance. In activities related to health, but divorced from the actual operations on people, it has proved more difficult to induce a feeling for the ultimate goal, for instance in industries supplying equipment for health care, e.g. artificial limbs or kidneys. The consciousness of the ultimate use of the products seems to be obscured by the interest in the technology and economics of the production.

## **Do we know how decision-makers think?**

From what has been said so far, it should be quite obvious that handling of societal risks is not simply a question of acquiring and processing information and knowledge. The formal definition of risk as the product of probability and consequence is only of passing interest in making decisions on societal risks. The main problems are those associated with the ways we may deal with other than formal rationalities in the perspective of the decision-makers. In order to further clarify this point about rationality and perspective, an analogy with botany might be appropriate. According to Linné, flowers may be classified on the basis of certain characteristics of their sexual organs. This is certainly very useful from the point of view of a systematic botanist. For customers in a flower shop, who are mainly interested in the aesthetic qualities of flowers, the sexual classification is less rational. Their decision-making process follows other paths of thought than the botanist's.

The practical performance of high-level decision-makers during handling of societal risks as compared to the conventional rationality found in textbooks on risk analysis seems to bear a certain resemblance to the discrepancy between the choice of flowers in a shop and their classification according to systems rationality. Interview studies of real high-level decision-makers asked to judge authentic cases—as well as observations of politicians in action—have clearly demonstrated the volatility of rational arguments about probability and consequence under the influence of value considerations. The process of thinking during such judgment activities can be described as navigating in an archipelago of arguments. The course taken may not be predicted using only knowledge contained in the map but is largely influenced by occasional forces of different kinds: winds, currents, magnetic aberration etc.

## **Can we really talk about risk in a meaningful way?**

Descriptions of thought processes like the ones just presented can, of course, be regarded as pieces of rhetoric. In our verbal accounts we depend on the capacity of our languages, for which there is an interdependence with thoughts. Self-reference is, therefore, unavoidable in any discourse of thinking. Nevertheless, it may be justified and helpful to perform an exercise in order to assess the degree of rationality of high-level decision-making on societal risk, provided that the linguistic aspect is also taken into account. The linguistic question we have to face in the light of what has been said about so-called non-rationality is how to speak about those parts of the reality of decision-making on risk which, by definition, are not included in the rational descriptions of models. Even if we address several different rationalities based on different myths of nature, there remains the gnaw-

ing suspicion that something essential, related to the conventional risk concept, may be inaccessible to us when we only use our usual linguistically determined thinking processes.

## **Non-conventionality may pay off**

Fortunately, there are some means of verbal expressions that could be of help when risk communication becomes difficult, at least to the extent that we can become knowledgeable about the possible existence as such of the unknowable in question. These are the means that have been used as long as human verbal communication has existed, namely myth and metaphor. To the rationalist, this suggestion might appear frivolous or even frightening, since such ways of dealing with reality seem to move the issues into an area where rules other than those of formal logics apply. In fact, however, this is the essence of the power of myth and metaphor. They make it possible for the decision-makers to be creative by liberating themselves from the constraints of the accepted paradigms.

By such means it may also become easier to deal with other risk phenomena which are usually neglected because they cannot, in principle, be handled within the system, such as surprises and so-called inconceivable events. In the world of rational thinking and language, such phenomena do not belong to normality, and therefore it should not be considered respectable to deal with them according to current scientific and technological paradigms. After all, however, the risks which are of most concern in our real world are those that are classified as surprising and inconceivable. Therefore, no serious approach to handling of societal risks can be limited to risk analysis based on conventional concepts of risk as an entirely objective fact, possible to deal with satisfactorily according to a rationalistic paradigm solely.

Furthermore, extending the field of viewing risk handling to include also other than such risks that can be defined on the basis of the normal socio-technical system would make it possible to understand risk by looking at it in an opposite direction. By this we mean to consider the question of how come some systems work better with respect to risk in practice than they would in theory. The theory in question is then the conventional organizational and administrative account of the system which does not suffice to explain the reliability and safety actually achieved. A sociological approach has proved useful in elucidating the functioning of the system, highlighting other features than those otherwise considered normal.

## **Real communication on risk requires attention**

Anyone who seriously reflects on the nature of what is called risk may sooner or later develop an understanding that risk as a concept must be handled with care. Otherwise the full meaning of the word risk – whatever this is – might be lost in the process of handling a particular risk.

Thinking and speaking are important phenomena forming our ideas about risk handling. Our insights into the ways we think and the language we use determine our understanding of the nature of risk handling. There is an interrelationship between thinking and speaking which makes our terms and metaphors steer much of the conceptual structur-

ing of our thoughts. Terms like “perception” and “communication” tempt us to believe in mechanisms for dealing with risk similar to visual and audible processing of information. Likewise, the effectiveness of this processing is intellectually treated very much as a technical problem.

The mechanistic treatment of risk handling can only take more subtle aspects of thinking and speaking into consideration to a limited extent. One of these aspects is attention. It is a common experience that, in principle, attention is a very important phenomenon in communication but, in practice, nevertheless obscured or even ignored in dealing with risk. This is true not least when it comes to the international handling of global risks. Discussions and negotiations about agreements on schemes for dealing with the greenhouse effect, for instance, might sometimes give the impression of efficient communication, but the actual response in the form of actions reveals that the perception and communication have been only superficial. All too often, the handling of risk issues in this context seems to be characterized by detachment and mistrust, not permitting any attention to the real problems.

Hence it appears that attention, and related concepts such as interest, mind-set, will and trust, should be considered critical phenomena in assessments of the conditions for efficient risk handling. A better insight into the nature and role of attention, interest, mind-set and will may also enhance our understanding of our thinking and speaking of risk.

It should be recognized, however, that concern for attention and related aspects of what is called perception and communication of risk cannot be commandeered. There are certain psychological and social conditions that have to be fulfilled. Attention is a mental phenomenon appearing in the dealings of both individuals and groups subjected to rules and restrictions. The role of attention – related to interest, mind-set, will and trust – therefore depends, not only on the functioning of the decision-makers, but also on the operative organizations.

For the sake of clarity it should perhaps be added that the need for attention has to be balanced against the requirement of mental stability in order to make it possible to really handle risk. It is believed that in the past this balance has mostly been too much in favour of manageability.

## **Bureaucratic implementation may impose restrictions on decision-making**

In this review, for the sake of brevity, decision-making is referred to as a task for a single person. As every qualified reader knows, this is a simplification that may be permitted only when a decision made but not the process of arriving at it is considered. In practically all cases of interest from the point of view of risk handling several people are involved, indirectly or directly. Even people who usually do not think of themselves as partners in the process of decision-making may play a role, for instance those who are the first to identify the risk in question and call attention to it.

At the other end of the list of actors we find persons who are supposed to implement the decisions made. They often play a **key** role in an almost literal sense, since it all

depends on their ability to open the door that will lead to the intended goal. Closest to high-level decision-makers among the implementers are the members of the bureaucracy. Here this term refers not only to civil servants in governmental agencies, but also to the administrative personnel in commercial organizations.

Experience tells us that a bureaucracy is not just a machinery that carries out whatever it is asked to do by someone at the top of the hierarchy. A bureaucracy operates to some extent on its own according to certain rules and instructions which have been established in order to make it efficient and reliable. Naturally, such a system eventually develops a certain rigidity which does not easily permit other orders to be executed than those conforming to the prevailing rules. A novelty that might cause a disturbance of the efficient and reliable operation of the bureaucracy is considered to be an anomaly which has to be disregarded or transformed into something that is normal for the operation of the organization and its personnel.

Obviously, decisions on risk issues characterized by uncertainty are not easily dealt with by a bureaucracy which is used to following rules rather than developing pragmatic procedures for coping with other than precise and exact, or “hard”, orders. This restriction of the ability of the bureaucracy to handle “soft” aspects of risk issues necessarily affects the character of the decisions made. Hence, there are limits to what can be achieved in handling societal risks by decisions which have to pass a bureaucracy operating with the rigidity that is natural and desirable for other purposes.

## **A plea for caring about the decision-makers**

The panorama of risk handling depicted by the impressionistic collection of various trans-scientific features of risk presented in this review is by no means complete. For the sake of brevity, a number of equally important aspects of decision-making on risk have only been touched upon in passing, for instance ethics, comparison of different risks, “de minimis” criteria, to mention but a few. Hopefully, however, what has been highlighted might serve the purpose of setting up a background against which high-level decision-makers may appear less strange than when compared with the normative picture emerging from conventional risk analysis projections.

In order to understand the actions and standpoints with respect to risk taken by a high-level decision-maker in the conceptual environment described above, it seems to be necessary to realize what his primary ambitions are. Rather than solving a certain problem according to rationalistic criteria in the first place, his goal is to secure an achievement which may be as consistent as possible with some more general policy. Another requirement is the need for keeping control of the situation, or in other words, being able to use power if necessary.

Unlike a detached risk analyst on a lower level, a decision-maker cannot refrain from acting or expressing an opinion by simply referring to incomplete or inadequate information. He must also dare to make mistakes. This means, among other things, that a high-level decision on risk has to be presented – implicitly mostly, rather than explicitly – as an assertion about safety despite the belief on the part of the decision-maker that it may turn out to be the opposite. Many times such risk handling will have little to do with the actual risks, but deal in principle with other issues whose relationship with the risks in

question can be admitted or not by the decision-maker according to the requirements of policy and control.

The dilemma of high-level decision-making from the point of view of support from conventional risk analysis is the lack of care for the decision-maker's conditions. Too little consideration is taken of his concern for such conditions and constraints as plural rationalities and polarisation of the opinions of those affected by the decisions, the problem of mastering contradictions, the fear of surprises, "inconceivable events" and of making mistakes when forced to take actions and standpoints. An improvement of high-level decision-making with respect to such conditions cannot be made by further extension of risk analysis along the same lines as before, "more of the same". A change of perspective, attitude and mentality is needed.

## What matters in the end are values and interests

In treatises of risk handling from the point of view of the main actors in high-level decision-making about risk handling, there is one element of the actual performance that is usually not considered to the extent it deserves, namely the personalities of the people involved. The personality of a decision-maker is only occasionally called attention to, for instance when a particular decision is questioned with reference to the persons responsible for it. In most reviews of risk handling, however, the decision-maker is treated as a neutral object, something like "economic man" in economics.

This remark on the neglect of the importance of personality is not meant as a general criticism of psychological and sociological analyses of decision-making, or as a suggestion that no theory of common applicability can be established. The point aimed at – for the sake of supporting the plea made above for another perspective on decision-making about risk – is that a mere consideration of the complexity and diversity of the personalities involved has a merit in itself. It is like making a decision when buying a suit in a store: a customer's confidence in the saleswoman's suggestions is very much a function of her concern for the customer's personality, even if she has only a limited number of alternatives to offer to the customer to decide about.

What seems to be particularly important in understanding the handling of societal risks by high-level decision-makers with respect to their personalities are the values governing their judgements and thoughts about the various arguments appearing during the process. Studies made of political decision-makers in action have given clear indications that their thinking as well as the underlying subconscious processes are steered by their basic values and intentions.

To some extent this steering can be expressed in socio-anthropological terms and concepts, but there remains an individual personal element that has to be taken into account. Then it is not enough to consider only the outward appearance of the values of the decision-makers according to verbal expressions of opinions and views. One has to go beyond and behind the apparent classification according to social status, professional characteristics, etc.

Again, it is realized that a qualified general treatment of the problem of risk handling should not be permitted to develop **too far** in a direction eventually leading to something

like psycho-analysis of individuals. What is needed, however, is some regard for the role of values for all the considerations dealt with in conventional risk analysis. After all, high-level decision-makers, like most humans, are sensitive to respect for their values.

Last but not least, values determine interests, and this is what matters when it comes to making political decision-makers aware of risk problems on a global scale. It appears that lack of real interest is one of the reasons for the well-known difficulty of achieving anything else than general well-meaning statements on the part of national representatives in international bodies for global cooperation on energy and the environment.

## **Creativity by changing the outlook**

A suggestion that another look at high-level decision-making about societal risks should include considerations of values and interests does not appear to be in conflict with present views on the state of the art of risk handling. In many quarters it is realized that risk research has now entered a stage where disciplines such as cognitive sciences and sociology in general have reached the limits of their abilities of dealing with risk handling problems on the basis of conventional paradigms. A new starting point could be provided by changing the perspective into that of the decision-maker – as a person as well as an important social category, cultivating values and interests.

Actually, a change in outlook by taking a step outside the common arena like this is a common way to increase creativity. If for no other reason, an attempt to take the standpoint of values and interests may stimulate research in other areas. For IIASA, an activity on risk relating to such a novel direction, into values and interests, could prove valuable as, among other things, an important contribution to the handling of global risks in view of the need for means of achieving action on several environmental and energy problems.

## Some of the quotations appearing in the book

Soren Kierkegaard:

*There may be systems in logics  
but in existence there are no systems.*

Albert Einstein:

*Perfection of means, confusion of goals.*

Ernst Mach:

*Knowledge and error  
flow from the same source,  
only success can tell one from the other.*

Title of a bestseller in the U.S.A., 1990:

*All I really need to know I learnt at kindergarten.*

Walter Heller:

*Working in practice but not in theory.*

Paul Maslow:

*If the only tool you have is a hammer,  
you tend to treat everything as if it were a nail.*

## Examples of case studies made by the author and referred to in the book

*What is meant by  $10^{-8}$ ?*

In-depth interviews, by the author, psychologists and a statistician, of politicians and other high-level decision-makers about their judgement of a particular proposal of installing a network of liquid natural gas containers in a city.

*Plastics as a material for window frames.*

A critical examination of arguments and roles of different parties appearing in a review aiming at approving plastics for this purpose.

*The effectiveness of non-destructive examination of nuclear pressure vessels.*

In-depth interviews of specialists in order to reveal the trustworthiness of this method of ensuring safety against catastrophic failure.

*Why do only a very small fraction of those who know that their homes have a radon rating above the threshold level take action?*

A study of the role and influence of central government agencies and local municipal authorities as well as the ability of home owners to implement recommendations.

*Sick buildings.*

A review of present knowledge about indoor air pollution related to building technology with the aim of assessing its value with respect to decisions about actions to be taken in particular houses.

*How designers use computerized data banks for materials.*

A theoretical and experimental study of problem solving during design, related to materials, in order to explain why computerized materials data banks have so far been of only limited use to designers.

*"Inconceivable events" in the handling of materials in a heavy machinery industry.*

An investigation of the actual performance of the control of materials during fabrication of boiler equipment as compared to the formal quality assurance system, an example of "working in practice but not in theory".

*Administrative, organizational and managerial causes of technical failures in large systems.*

An examination of roles of and (lack of) connections between various parties and persons with responsibilities for the safety against combined chemical and mechanical failure of a major component in a nuclear power plant.