Risk and Uncertainty Management Strategies

Jan Hovden
Norwegian University of Science and Technology (NTNU)
NO 7491 Trondheim, Norway
hovden@iot.ntnu.no

Introduction

The modern awareness of risk is not about our own experiences or about the current statistical risk image of deaths, harm, and injuries. Rather, it is about an uncertain future. Fear and anxiety of threats about which we are uncertain or ignorant are a great challenge for risk management, even though the probabilities of such events occurring may be very small. The frightening thing is that we don't know and have no control. We feel like victims. Therefore, the risks are real but also in a way unreal and unintelligible. A main difference from traditional risks is that they are independent of the place where you live or work. Radiation is spread by wind, toxic materials are spread by rivers and ocean currents, IT viruses are spread by global networks, epidemics are spread by airplane travelers, and hate by fanatic groups results in terrorist attacks in New York, and Madrid.

This presentation aims contributes to the discussions at the workshop on the concepts of risk and uncertainty and related management and governance strategies in different domains of threats and hazards.

In dealing with risk and vulnerability issues, we can cite Aristotle: "It is probable that the improbable will happen" and Roman historian Pliny the elder: "Solum certum, nihil esse certi". The new technological, nuclear, chemical, ecological, biologic, and genetic risks and the political and social risks, such as terrorism, are difficult to separate and survey in time and space and to explain with the rules of causality, and it is difficult to define guilt and punishment and to compensate and to insure such risks, which represent "produced uncertainties", to quote U. Beck (1986).

Scope Figure 1 illustrates the scope and variety of the subject. The vertical axis gives the links between the global, international, national, regional, local, and individual stressors and the actors at various levels who deal with risks. A main challenge is to coordinate the information and actions between the levels and layers of risk and vulnerability management systems.

The horizontal axis shows that the field covers everything from acts of God and man-made and technologically induced disasters to deliberate, malicious acts against others and self-destructive behavior. Societal vulnerability usually refers to problems related to the survival and recovery of vital societal functions, i.e. threats to infrastructures, energy supplies, and ICT (Hovden, 2001). Many important risk activities and phenomena lie somewhere between the two extremes, e.g. unintentional and non-malicious shortcuts and law and rule violations. Individuals and companies are gambling with safety and security requirements, as most of the time nothing goes wrong.

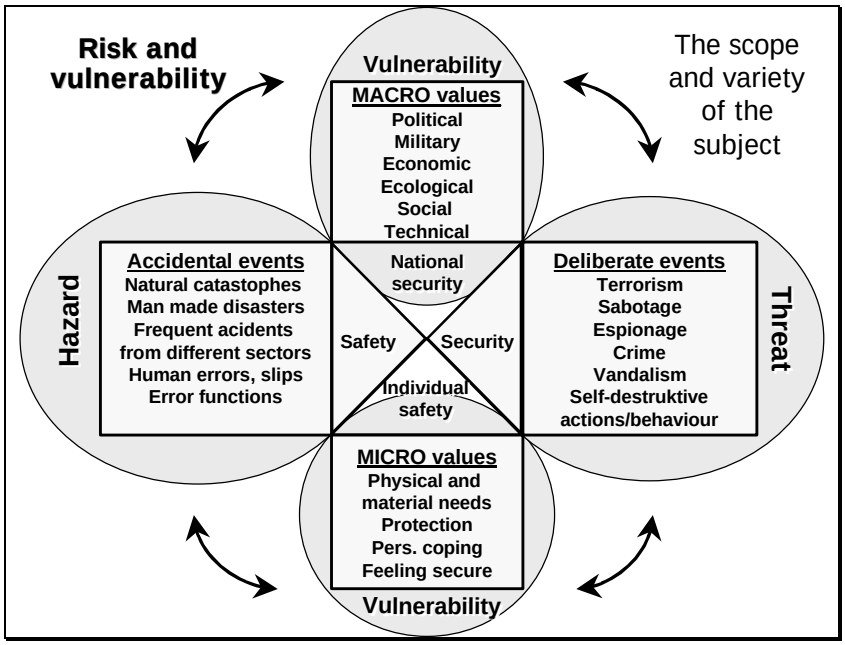

Figure 1 **The vertical macro-micro perspective on risk management combined with types of hazards, threats, and events (Hovden, 1998).**

Epistemological approaches to risk

The dichotomy above between natural-scientific objectivism and cultural relativism can be detailed and paraphrased as follows (partly based on Lupton, 1999):

- *Rationalist* – The rationalist sees risks as real world phenomena to be measured and estimated by statistics, prioritized by normative decision theory, and controlled by scientific management.
- *Realist* – The realist sees risks as objective hazards or threats that exist and can be estimated independently of social and cultural processes but that may be distorted or biased through social and cultural frameworks of interpretation.
- *Constructionist* – The constructionist sees nothing is a risk in itself. Rather, what we understand to be a risk the constructionist sees as the product of historically, socially, and politically contingent ways of seeing.
- *Middle positions* between realist and constructivist theory – Proponents of a middle position sees risk as an objective hazard or threat that is inevitably mediated through social and cultural processes and can never be known in isolation from these processes.

For an in-depth review of scientific positions and theoretical approaches in risk research, I recommend Jaeger, Renn, Rosa & Webler's book Risk, Uncertainty, and Rational Action (2001).

Different risk arenas and domains have different traditions and approaches to risk and uncertainty management. The fields of environmental risks, industrial safety,

food and product safety, transportation, defense, ICT security, and the types and approaches to crime can learn a lot from each other.

Risk and uncertainty management strategies

Ortwin Renn and his colleagues at the Center of Technology Assessment in Baden-Württemberg, Germany, have made a valuable contribution to risk management strategies. A brief review of their proposals is presented below.

Renn (2002) describes the common features and limits of the traditional method of assessing risk as follows: The traditional method relies on the relative frequencies and statistical data for expressing probabilities. The only effects considered undesirable are physical harm to humans and to ecosystems. This method thus excludes social and cultural impacts. Only rough estimates for socially induced risks, such as sabotage, terrorism, and human errors, are part of this modeling. The probability and extent of adverse effects are normally multiplied, that is, this is an expected value approach.

The proposed risk classification by the Global Change Council of the European Commission (EC) attempts to respond to the challenges of risk assessment challenges (Renn, 2002):

- Probability
- Potential for harm
- Uncertainty (variability, statistical, genuine, ignorance)
- Ubiquity
- Persistence
- Delayed effects
- Equity violations
- Potential for social mobilization.

Combining these dimensions of the EC risk concept, Klinke and Renn (2001) developed six main types of risks that determine risk management strategies. These risk types, named after characters from Greek mythology, include:

- *Damocles:* high catastrophic potential, probabilities (widely) known*Cyclops:* no reliable estimate on probabilities, high catastrophic potential at stake*Pythia:* causal connection confirmed, damage potential and probabilities unknown or indeterminable*Pandora:* causal connection unclear or challenged, high persistency and ubiquity (bio-accumulation)*Cassandra:* intolerable risk of high probability and great damage but long delay between causal stimulus and negative effect*Medusa*: perception of high risk among individuals and large potential for social mobilization without clear scientific evidence for serious harm.

When these six risk types are presented in a risk diagram (see Figure 2), we get a visual impression of the uncertainties related to the different risk types, that is, the areas covered by the actual risks. I have added the threats from terrorism to the figure.

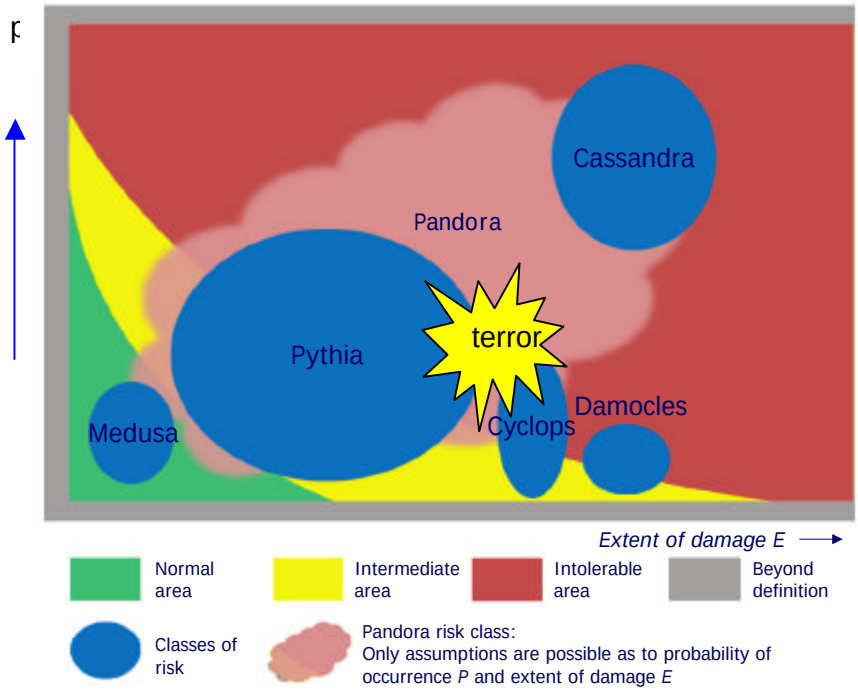

Figure 2 Risk classes. Source: WBGU, German Advisory Council on Global Change. The figure is a copy from a presentation by Renn (2002).

As most risk evaluation processes do, Figure 2 also distinguishes between three categories of risk: the normal, the intermediate, and the intolerable area. The diagram avoids the terms “acceptable”, “ALARP region”, and “unacceptable” due to possible moral implications. The terms “tolerable” and “intolerable” are ethically less emotional or sensitive. In practice in decision-making, the meaning is almost the same.

To deal with the important features for the six risk types, Klinke & Renn (2001) propose three alternative – or combined risk management – strategies:

- Risk based or risk informed management strategies (Damocles and Cyclops)
  - Sufficient knowledge of key parameters
- Precautionary or resilience based strategies (Pythia and Pandora)
  - High uncertainty or ignorance
- Discursive management strategies (Cassandra and Medusa)
  - High ambiguity

Risk-based management is characterized by an emphasis on scientific assessment, reduction of exposure and/or probabilities, risk management according to expected values on risks and benefits, and reliance on inspections, auditing, and routine controls. Examples are: industrial plants, large dams, bridges and highways, liquefied natural gas terminals, transportation (road, railway, shipping, and aviation), classic infectious diseases, and health risks.

Resilience-based management is characterized by an emphasis on trans-disciplinary research and investigations, the containment of application (in time and space), constant monitoring, redundancy and diversity in safety design, (strict) liability, and a no tolerance policy for risk control – in extreme cases, prohibition. Examples are: biotechnology, Internet sabotage, new epidemics (new

mutations), bovine spongiform encephalopathy (BSE), and extreme weather events due to global climate change.

Discourse-based management is characterized by an emphasis on reaching political consensus or agreement, the importance of procedure and transparency, the establishment of trust-generating institutions, an investment in risk communication, the involvement of stakeholders, including industry and governmental organizations, and public participation. Examples are: genetic engineering, industrial food production, biochips for human implementation, electromagnetic fields, and risks to consumers' way of life.

The main conclusion in Klinke & Renn's article is that risk management strategies need to be tailored to the main characteristics of the risk source in question. That means that in a security and crisis management regime, there should be a number of different means and strategies for dealing with the variety of risk types we face.

Concluding remarks on the government of risk and uncertainty

A comparative study of the anatomy of risk regulation regimes by Hood et al (2001) shows a substantial variety in the way hazards and threats are dealt with within countries and between countries. This supports Klinke & Renn's arguments on tailored risk management systems. However, it is difficult to conclude that one strategy is better or worse than another. It depends on the actual hazard or threat to be controlled and the specific context and political-administrative culture of each country. Nevertheless, there are some common problems and challenges.

According to a report by the Norwegian Commission on a vulnerable society (NOU 2000:24) – a comparative review on how countries like Sweden, the Netherlands, Germany, Switzerland, Britain, and the US have organized their safety, security, and crisis and emergency organizations – the concrete principles and ways of organizing these institutions and services differ considerably, i.e. the regulatory "jungles" are different. None of these countries could demonstrate a system superior to the others. Behind each system design there are traditions, political cultures, and contingencies specific to each country. However, what the countries have as common challenges are a lack of transparency, coordination, and unambiguous lines of responsibility.

A common trend in Europe and the US for the last 10-15 years is the dominance of a risk-cost-benefit analysis culture (risk-based approach) in more and more societal domains, i.e. the EU's New Method, ALARP principles, and functional requirements. Deregulations and globalization seem to require more and more complex and sophisticated risk regulations and governance. A paradox? The answer to the challenges of the risk society (Beck, 1986) is a risk regulatory state, an audit society, and a tremendous increase in standards and soft laws.

As mentioned in the introduction, the modern risk awareness is not about our own experiences or the current statistical risk picture of damage, deaths, and injuries. Rather, it is about an uncertain future. Societal security and crisis management institutions cannot solve these uncertainties, but by dealing with the hazards and threats in a constructive way, trust can be achieved and maintained. That makes it more comfortable to live with uncertainties.

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