January 18 2005: Thematic Panel Cluster 2 on:
Risk identification, Assessment, Monitoring, and Early Warning

Risk and Early Warning

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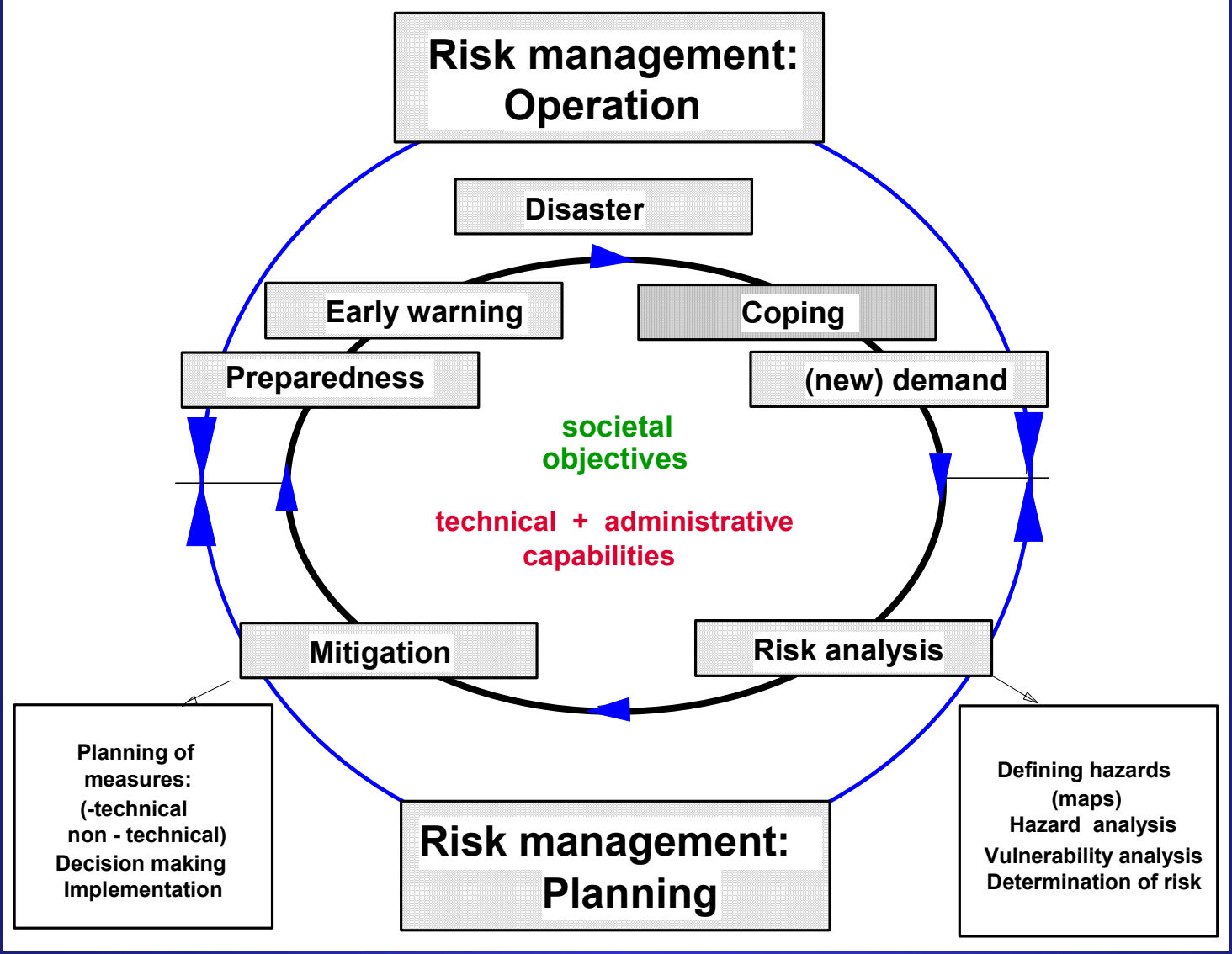
Risk management is a cyclical process with many different stages, implemented by different professionals



Interaction of risk management and early warning:

$$Ri = \sum n \cdot ex(u) \cdot K \cdot P(u)$$

n = number of elements at risk
ex = exposure to event u
K = maximum consequences
P(u) = probability of occurrence of u

The purpose of risk management is to reduce the risk to an acceptable level. To be protected against the acceptable extreme event, and to be prepared if the protection system fails.

We can influence the number of elements at risk
We can influence the exposure

There are many different players for the four stages:

Planning:	= planning engineers, decision makers, people at risk
Implementation:	=design engineers, construction engineers
Normal operation:	= operators
Emergency and rescue:	= local decision makers fire brigades, NGOs, medical doctors, rescue engineers

Each with his own data requirements, models, tools and methods

Early warning is one task in this cycle:

of planning stage: design and testing

of operation stage: testing and maintenance

We distinguish the following types of risk:

Perceived risk: usually only intuitively assessed, time dependent, often based on the largest event on record, or the last big event.
Not (or little) influenced by Early Warning

Insurance risk: the replacement value of a structure
Not (or little) influenced by Early Warning

Design risk: the expected value of the consequence if a structure fails, such as the replacement cost of building destroyed by an earthquakeof a dam or a dike. Design quantity used by engineers. If extended to a large protection system:

For a protection system, this is the same as the

Residual risk: the expected value of the consequence if a structure of a protection system fails, such as failure of a dam or a dike.

$$Ri = \sum n \cdot ex(u) \cdot K \cdot P(u)$$

The residual risk is a quantity consisting of three parts, each to be considered separately:

economic consequences (expected damage to buildings and infrastructure)

social consequences (expected number of fatalities, traumata, health impairment)

ecological consequences (expected irreversible damage to environment, effect on pollution)

$$\mathbf{Ri} = \sum \mathbf{n} \cdot \mathbf{ex(u)} \cdot \mathbf{K} \cdot \mathbf{P(u)}$$

Econonomic risk:

movable goods affected by early warning:

reduction of vulnerability ex(u)·K

Needed are:

data for assessing economic consequences: monetary local information

$$Ri = \sum n \cdot ex(u) \cdot K \cdot P(u)$$

Sociological risk:

Early warning results in: reduction of number n

reduction of vulnerability $ex(u) \cdot K$

Needed are:

data for assessing social vulnerability: quantifyable indicators needed: number of fatalities, others

How to combine these indicators into meaningful indices?

Some scientific issues on early warning:

Early warning comprises the four aspects: forecasting, forecasting communication, decision making and warning, and people response.

Demand on social science is to improve the warning and warning response by the people:

- appropriate to the level of understanding: children, illiterate people
- appropriate to the technology available,
- appropriate to the hazard environment in which people live

This requires planning early warning systems as combination of top down und bottom up projects. Learn from local experience.

$$Ri = \sum n \cdot ex(u) \cdot K \cdot P(u)$$

Environmental risk

Early Warning can influence the consequences:

protection against contamination

Problem: how to evaluate this factor: there is a need to consider pollution protection in a cost benefit analysis

Demand on natural science is to improve forecasting aspects and communication methods:

1. it is self evident that better „state of the art“ forecasting and warning technologies need be developed

however, not so evident is a general requirement

2. to identify uncertainty bands,
and
3. to set up criteria for what is a „good forecast“,

4. Needed are forecasting methods commensurate with the risk, i.e. with the expected damages.

5. Climate change research is important, but one should not confuse climate change research with research for forecastings.

6. However, it may be useful to have seasonal forecasts (El Nino).

Answers needed are:

Is there a connection of frequency of extreme events and seasonal variability?

Conclusion:

Risk management is a very comprehensive task involving many different players. These need to be coordinated.

Early warning is an important part of risk management.

However, its value should be assessed in terms of its effect on the whole process of risk management. An efficient system reduces all three types of risk:

- economic risk,
- social risk,
- and ecological risk

Scientists are challenged to provide the needed data and methods for obtaining efficient systems by:

- improving technology
- improved communication.

Thank you!

Each component of the risk management cycle has its own problems and needs to be determined

- project specific
- specific to a region

Note that engineers are to be consulted who must assess not only the technical needs for a protection system, but also for an emergency system, in case an extreme event happens which may cause a system failure:

- provision of access routes (lifelines, highways, bridges)
- provision of safe drinking water (deep wells, as proposed by the German BGR,)

Much of the discussion focuses on Early Warning Systems as a consequence of recent disasters (flood on the Elbe river, 2002, large Tsunami disaster 2004). However, it is likely that these disasters are rare events: therefore one has to consider how to make Early Warning Centers cost effective.

There are three possibilities:

1. cover large areas, with many different locations.
   Examples: Rhine for floods, Hurricane Centers,
   proposed Tsunami Center for the Indian Ocean

2. cover many different types of hazards: floods, storms, for a region

3. let the forecast and warning be done by an agency which ordinarily has other tasks: train managers for disaster management.
   Example: Fire chief of cities, city engineers