Valutazione del rischio chimico

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Valutazione del rischio: definizioni

La Valutazione del Rischio è stata definita in modi diversi da molti autori che hanno affrontato la materia (Rowe, 1977; NRC, 1983; OTA, 1993; US EPA, 1984; Bowles et al., 1987; Asante-Duah, 1990); **in termini tecnici** il *Risk Assessment* viene definito come "processo sistematico per la stima di tutti i fattori di rischio significativi che intervengono in uno scenario di esposizione causato dalla presenza di pericoli".

In termini più intuitivi *la Valutazione del Rischio è la stima delle conseguenze sulla salute umana di un evento potenzialmente dannoso, in termini di probabilità che le stesse conseguenze si verifichino.*

Siti contaminati: Caratterizzazione, Bonifica e Analisi di Rischio. Laura D'Aprile (2009)
www.isprambiente.gov.it/contentfiles/00001800/1835-1960-m1-u1.pdf

Che cos'è il rischio?

- ***DEFINIZIONE ADOTTATA NELLE PROCEDURE DI SICUREZZA INDUSTRIALE*:**

$$R = P \times D = P \times Fp \times Fe$$

R: rischio associato ad un dato evento

P: probabilità di accadimento

D: danno provocato dall'evento

Fp: fattore di pericolosità (entità del possibile danno - morte, lesioni, intossicazione)

Fe: fattore di contatto (funzione della durata di esposizione)

- ***DEFINIZIONE ADOTTATA NEL CASO DI SITI CONTAMINATI:***

$$R = E \times T$$

P = probabilità accadimento del danno conclamata (P = 1)

Fp = T [mg/kg d]$^{-1}$ (Tossicità dell'inquinante)

Fe = E [mg/kg d] (Portata effettiva di Esposizione)

Inger Lise Johansen «***Foundations of risk assessment»***
Trondheim, 2010 https://brage.bibsys.no/xmlui/handle/11250/240682

…

2.4.1 The traditional engineering approach

A conventional definition in engineering contexts is fronted by Wilson and Crouch (1982, p.9): *Risk = Probability⊗Severity*

2.4.2 The international standard

The most recent international standard on risk management, ISO31000 (2009, p.1), defines risk as: *Risk is the effect of uncertainty on objectives*.

2.4.3 Consequence-orientation according to Klinke and Renn

Klinke and Renn (2002, p.1071) defines risk as: *The possibility that human actions or events lead to consequences that harmaspects of things that human beings value*.

2.4.4 Event-orientation: Rosa vs. Aven and Renn

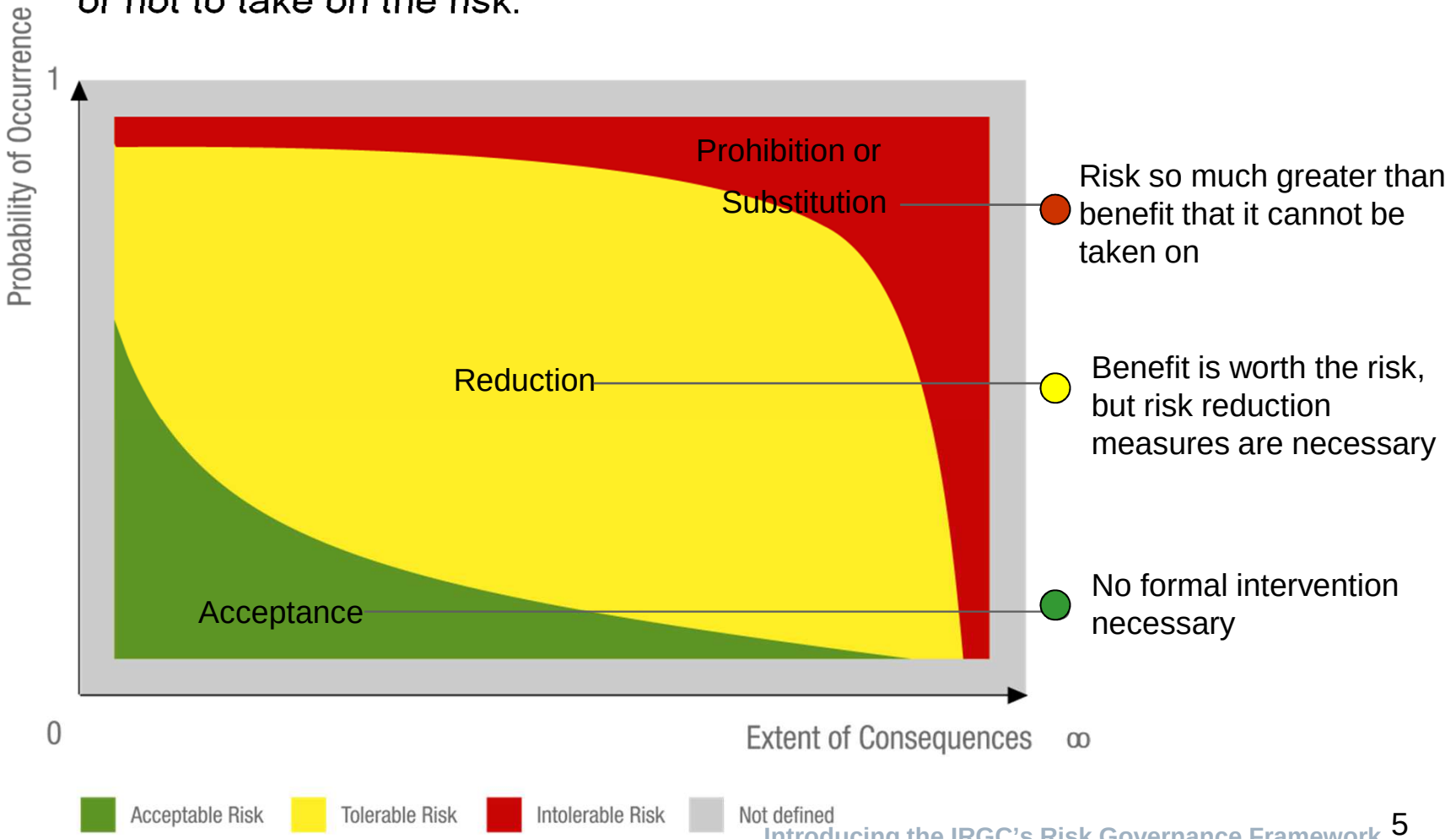
Rosa (1998, p.28): Risk is a *situation or event where something of human value (including human themselves) has been put at stake and where the outcome is uncertain.*

2.4.5 The quantitative definition of Kaplan and Garrick

Consulting the reference tracker SCOPUS, one of the most cited definitions of risk is the quantitative-, or triplet definition of Kaplan and Garrick (1981, p. 13). Risk is defined as the *answer to three questions: 1. What can happen? (i.e. what can go wrong?) 2. How likely is it that it will happen? 3. If it does happen, what are the consequences*?

EVALUATION - IS THE RISK ACCEPTABLE, TOLERABLE OR INTOLERABLE / UNACCEPTABLE (TRAFFIC LIGHT MODEL)

Based on **both the evidence from the risk appraisal and evaluation of broader value-based choices and the trade-offs involved**, decide whether *or not to take on the risk.*



A new concept of risk, called ***systemic risks*** (OECD 2003; RENN et al. 2006), denotes the embeddedness of any risk to human health and the environment in a larger context of social, financial and economic risks and opportunities.

A holistic and systemic concept of risks cannot reduce the scope of risk assessment to the two classic components: extent of damage and probability of occurrence

incertitude: overall indicator for different uncertainty components;
ubiquity defines the geographic dispersion of potential damages (intragenerational justice);
persistency defines the temporal extension of potential damages (intergenerational justice);
reversibility describes the possibility to restore the situation to the state before the damage occurred (possible restoration are e.g. reforestation and cleaning of water);
delay effect characterises a long time of latency between the initial event and the actual impact of damage. The time of latency could be of physical, chemical or biological nature;
violation of equity describes the discrepancy between those who grasp the benefits and those who bear the risks; and
potential of mobilisation is understood as violation of individual, social or cultural interests and values generating social conflicts and psychological reactions by individuals or groups who feel inflicted by the risk consequences. They could also result from perceived inequities in the distribution of risks and benefits. [7]

RISK CLASS	PROBABILITY	MAGNITUDE	OTHER CRITERIA	TYPICAL EXAMPLES
Damocles	low	high	not decisive	nuclear energy, dams, large-scale chemical facilities
Cyclops	uncertain	high	not decisive	nuclear early warning systems, earthquakes, volcanic eruptions, AIDS
Pythia	uncertain	uncertain	not decisive	greenhouse effect, BSE, genetic engineering
Pandora	uncertain	uncertain	high persistency	POPs, endocrine disruptors
Cassandra	high	high	high delay	anthropogenic climate change, destabilization of terrestric ecosystems
Medusa	low	low	high mobilization	electromagnetic fields

Table 1: Overview of the risk classes, their criteria and typical representatives

http://www.qualitative-research.net/index.php/fqs/rt/printerFriendly/64/131

Rischi diversi

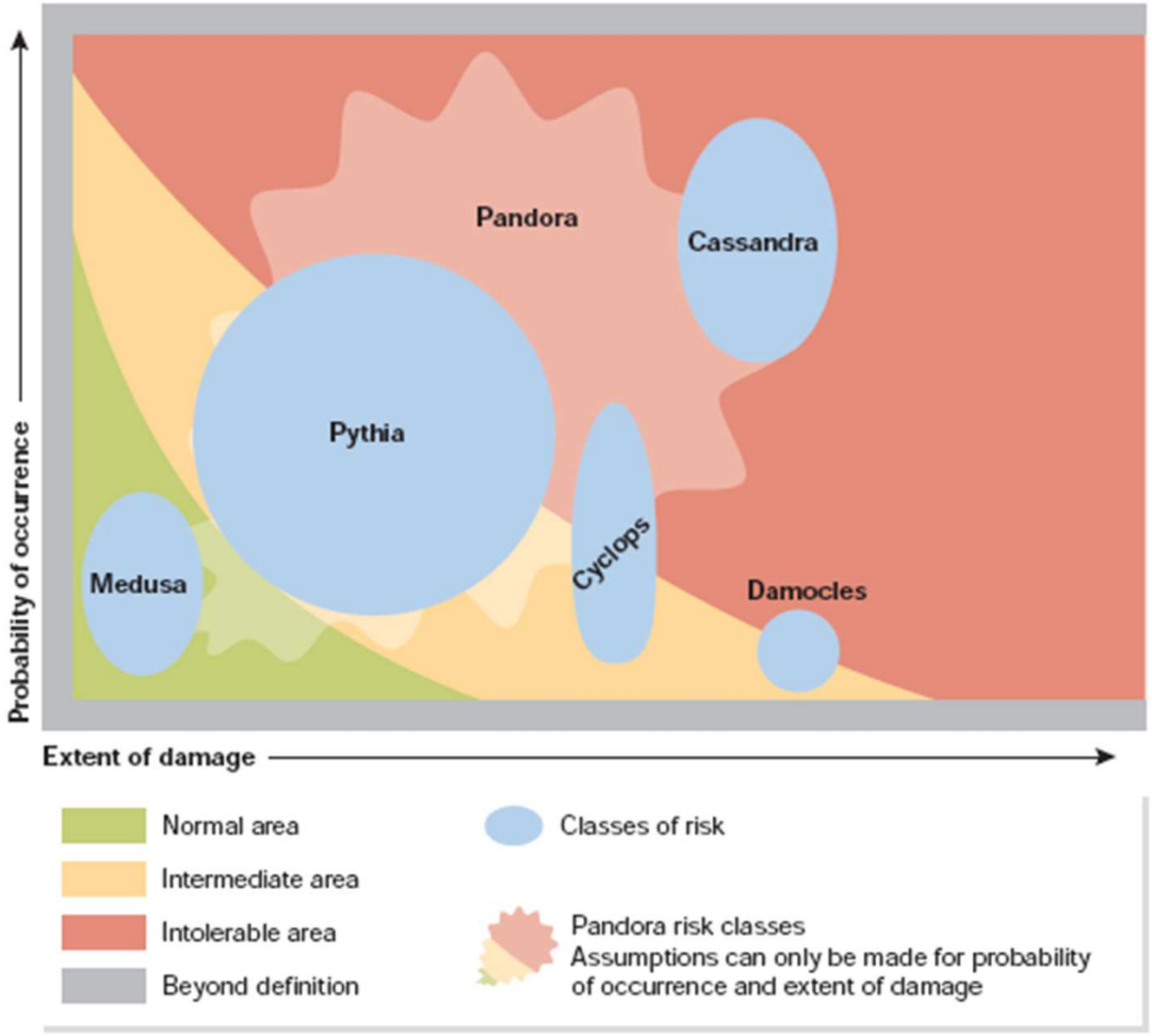


Fig 1 | Risk classes (WBGU, 2000)

Management	Risk class	Extent of damage	Probability of occurrence	Strategies for action
Science-based	*Damocles*	• high	• low	• Reducing disaster potential • Ascertaining probability • Increasing resilience • Preventing surprises • Emergency management
	Cyclops	• high	• uncertain	
Precautionary	*Pythia*	• uncertain	• uncertain	• Implementing precautionary principle • Developing substitutes • Improving knowledge • Reduction and containment • Emergency management
	Pandora	• uncertain	• uncertain	
Discursive	*Cassandra*	• high	• high	• Consciousness-building • Confidence-building • Public participation • Risk communication • Contingency management
	Medusa	• low	• low	

http://www.qualitative-research.net/index.php/fqs/article/view/64/131

http://www.wbgu.de/fileadmin/user_upload/wbgu.de/_migrated/content_uploads/Fig_D8-1.pdf

ANALISI DI RISCHIO
Valutazione del rischio e gestione del rischio

Valutazione del r.
(tecnica e scienza)

Gestione del r.
(economia e politica)

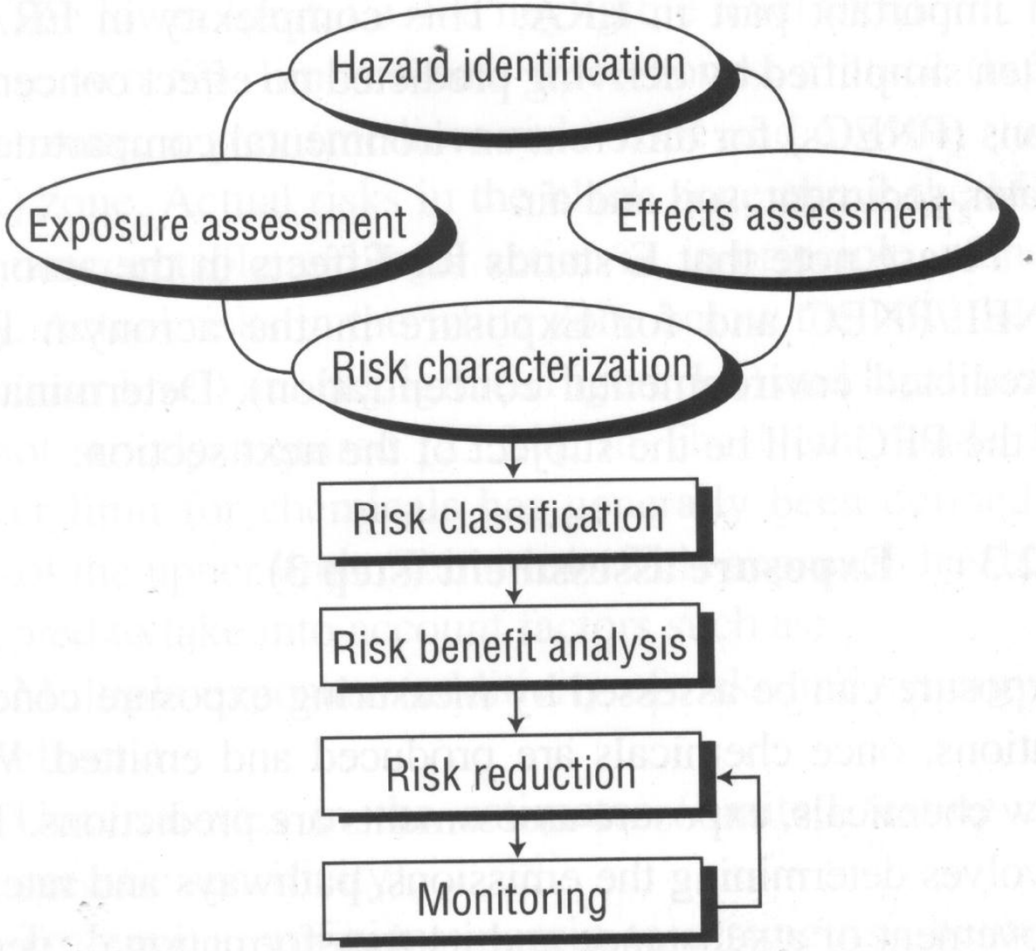


Figure 1.3. Steps in the risk management process.

RISK CLASSIFICATION:

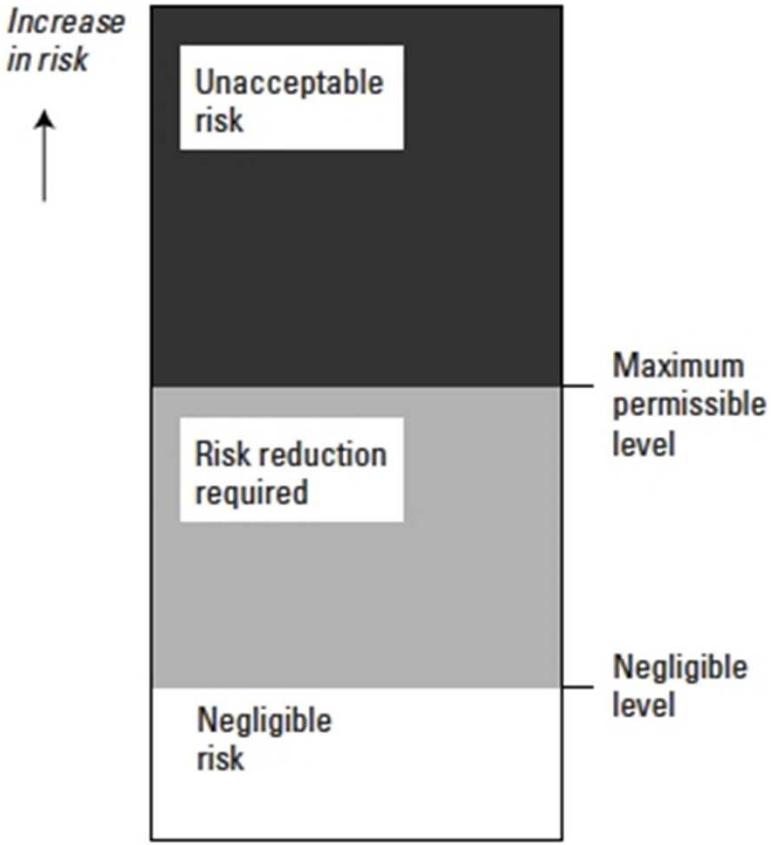


Figure 1.5. Risk limits and risk reduction.

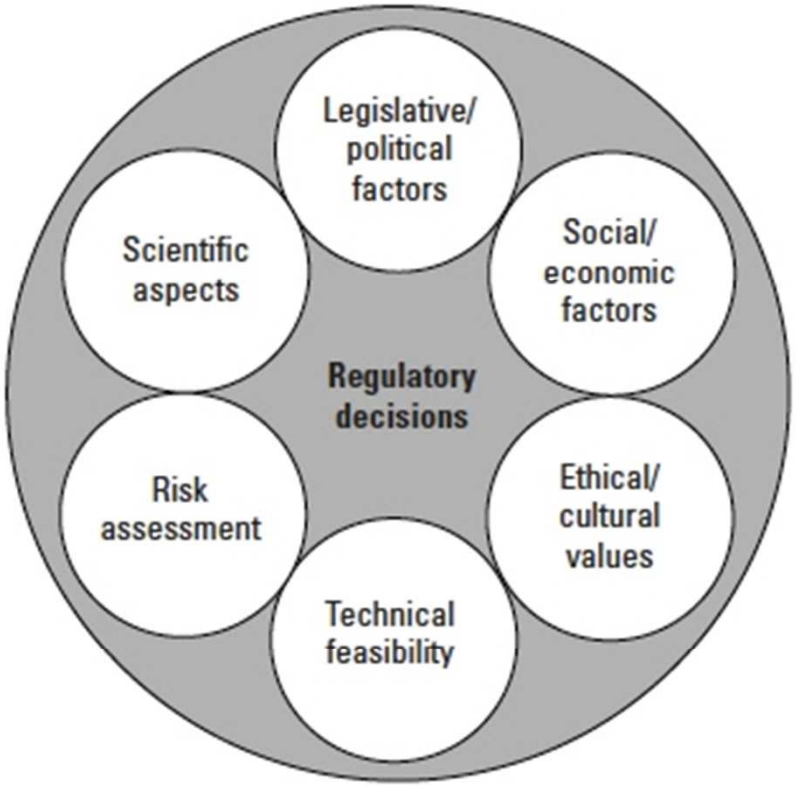


Figure 1.6. Elements in risk management. Modified from the U.S. Congress, Office of Technology Assessment [27].

RISK CLASSIFICATION: CHARACTERISATION AND EVALUATION

What are the broader, value-based questions to consider?

- **Characterization:**
  - What are the **societal and economic** benefits and risks?
  - Are there impacts on **individual or social quality of life**?
  - Are there **ethical issues** to consider?
  - Is there a **possibility of substitution**?

- **Evaluation:**
  - What are possible options for **risk compensation or reduction**?
  - How can we assign **trade-offs** between different risk categories and between risks and benefits (or opportunities)?
  - What are the **societal values and norms** for making judgements about tolerability and acceptability?
  - Do any stakeholders have commitments or other reasons for **desiring a particular outcome** of the risk governance process?

ES:


Electric shore power in the Port
of Trieste: the feasibility study

Un altro aspetto rilevante, condizionante la disponibilità di risorse e il supporto dei decisori:

LA COMUNICAZIONE DEL RISCHIO

Che è il flusso di informazioni tra valutatori, decisori, attori della filiera produttiva, consumatori finali e cittadini

Objectives of Risk Communication

- ***Enlightenment:*** Making people able to understand risks and become "*risk-literate*"
- ***Behavioral changes:*** Making people aware of potential risks and help them to *take protective actions*
- ***Trust building:*** Assisting risk management agencies to *generate and sustain trust*
- ***Conflict resolution:*** Assisting risk managers to involve major stakeholders and affected parties to take part in the risk management process

Relevance of Risk Communication

- *Health and Safety* are top concerns of people in industrial countries
- People demand more information and transparency on decisions that affect their welfare
- Trust in traditional decision makers is low and replaced by demand of participation
- Risk communication is legally demanded in many countries

Important Contextual Aspects

- ***Types of audiences:***
  - Peripheral versus central
  - Cultural subgroups: entrepreneurial, egalitarian, bureaucratic, individualistic
- ***Sociopolitical climate and style***
  - Adversarial, consensual, corporatist and fiduciary
- ***Levels of risk debates***
  - simple routine, complex, uncertain but uncontested risks, uncertain and ambiguous risks

Valutazione del rischio chimico (attività scientifico - tecnica)

Valutare il rischio significa valutare

Emissioni/rilasci di *chemicals*

Esposizione di gruppi di individui

Effetti dei *chemicals (Hazard assessment)*

Serve conoscere:

Tecnologie chimiche
Chimica
Scienze computazionali
Biochimica
Ecotossicologia

È “Trippa per gatti” per ricercatori e professionisti

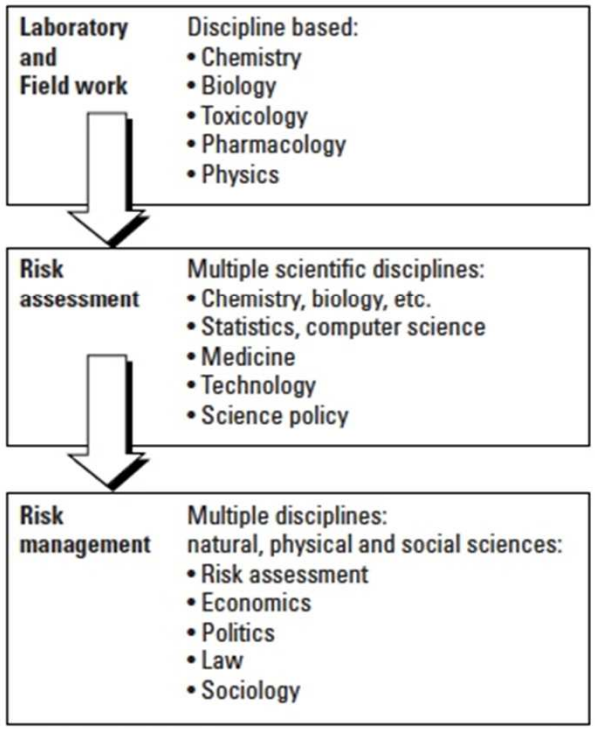


Figure 1.12. Disciplines involved in the risk management process. Modified from Patton [15].

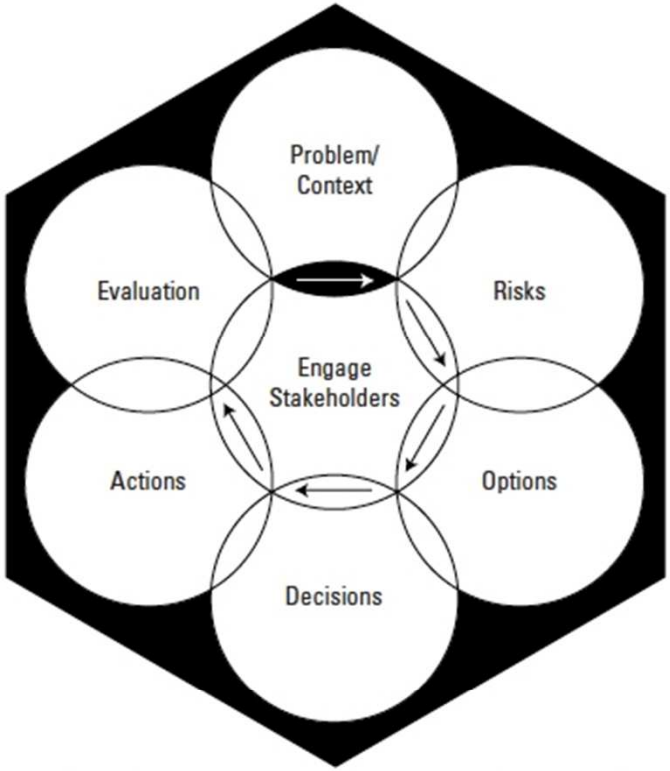


Figure 1.10. Framework for risk management according to the US Presidential/Congressional Commission [41].

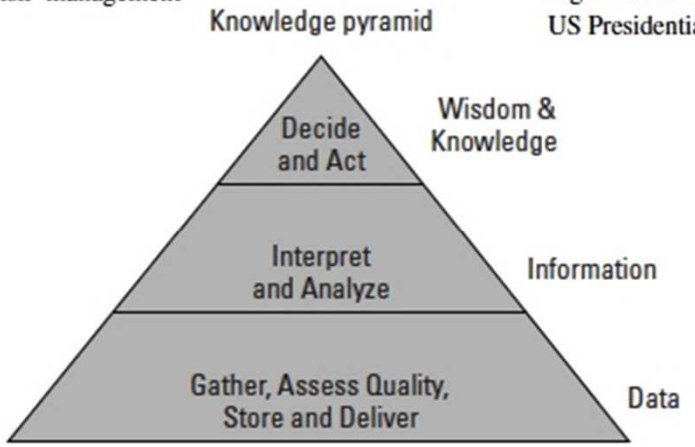


Figure 1.15. The knowledge pyramid. Modified from [91].

Valutazione del rischio chimico

Processo chimico

(Emissioni)

(Dispersione
Trasferimenti di fase
trasformazioni ambientali)

Esposizione / PEC

Valutazione del rischio

Valutazione degli **effetti** dell'esposizione
a sostanze singole e a miscele /
NOAEC /tossicologia