

Mål og mening med risikoanalyser

Noen refleksjoner

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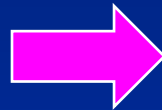
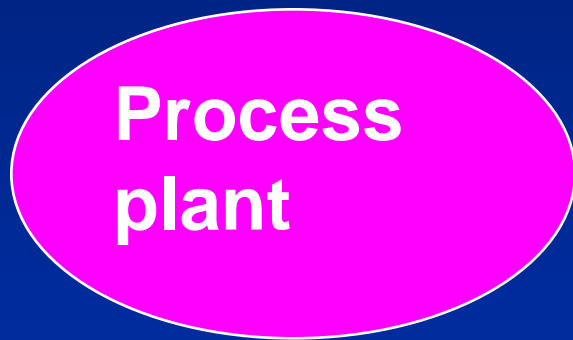
P



K

Third party risk

Neighbours



Hydrocarbon
releases,
explosions

LNG plant Stavanger, Norway



Risk analysis

→ What is acceptable risk



- ----- $p_0 = 1 \times 10^{-4}$





• ----- $p_0 = 1 \cdot 10^{-4}$



P

Is the risk acceptable ?



- ----- $p_0 = 1 \cdot 10^{-4}$



P

What is the «true» probability/risk?



P_{true}

- ----- $p_0 = 1 \cdot 10^{-4}$



P

- If you believe in a true risk this approach fails as accurate risk estimation cannot be assured

If we drop the idea of a «true» probability/risk



- ----- $p_0 = 1 \cdot 10^{-4}$

P



- We need to see beyond the number P

John offers you a game: throwing a die

- "1,2,3,4,5": 6
- "6": -24

What is your risk?

Risk

(C,P):

- 6 5/6
- -24 1/6

Is based on an important
assumption – the die is fair

“Background knowledge”

Assumption 1: ...

Assumption 2: ...

Assumption 3: ...

Assumption 4: ...

...

Assumption 50: The platform jacket structure will withstand a ship collision energy of 14 MJ

Assumption 51: There will be no hot work on the platform

Assumption 52: The work permit system is adhered to

Assumption 53: The reliability of the blowdown system is p

Assumption 54: There will be N crane lifts per year

...

Assumption 100: ...

...

Model: A very crude gas dispersion model is applied

- Assumptions
- Data
- Models
- Expert opinions

**K: knowledge that P
is based on**

Analyst's P



• $P(A|K)$

**Uncertainties are concealed in K
Not sufficient to look at P**

Probability

Relative frequency
Interpretation

P_f

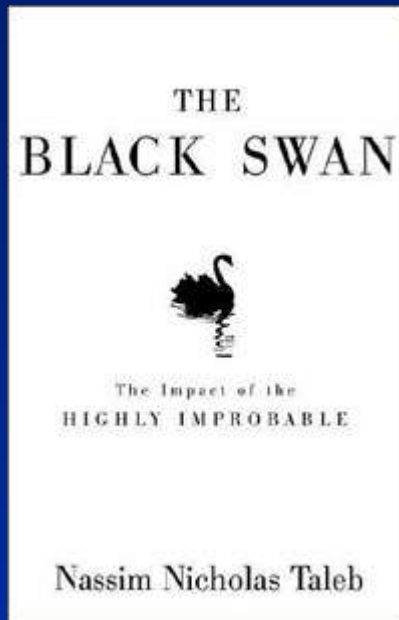
Jugdmental/
knowledge-based
probabilities P

The perfect storms and black swans metaphors



“Perfect storms”: to describe stochastic uncertainty (variation) and phenomena that are well-understood

- Accurate predictions can be made
- Design criteria for wave loads for offshore installations
- Health and traffic applications



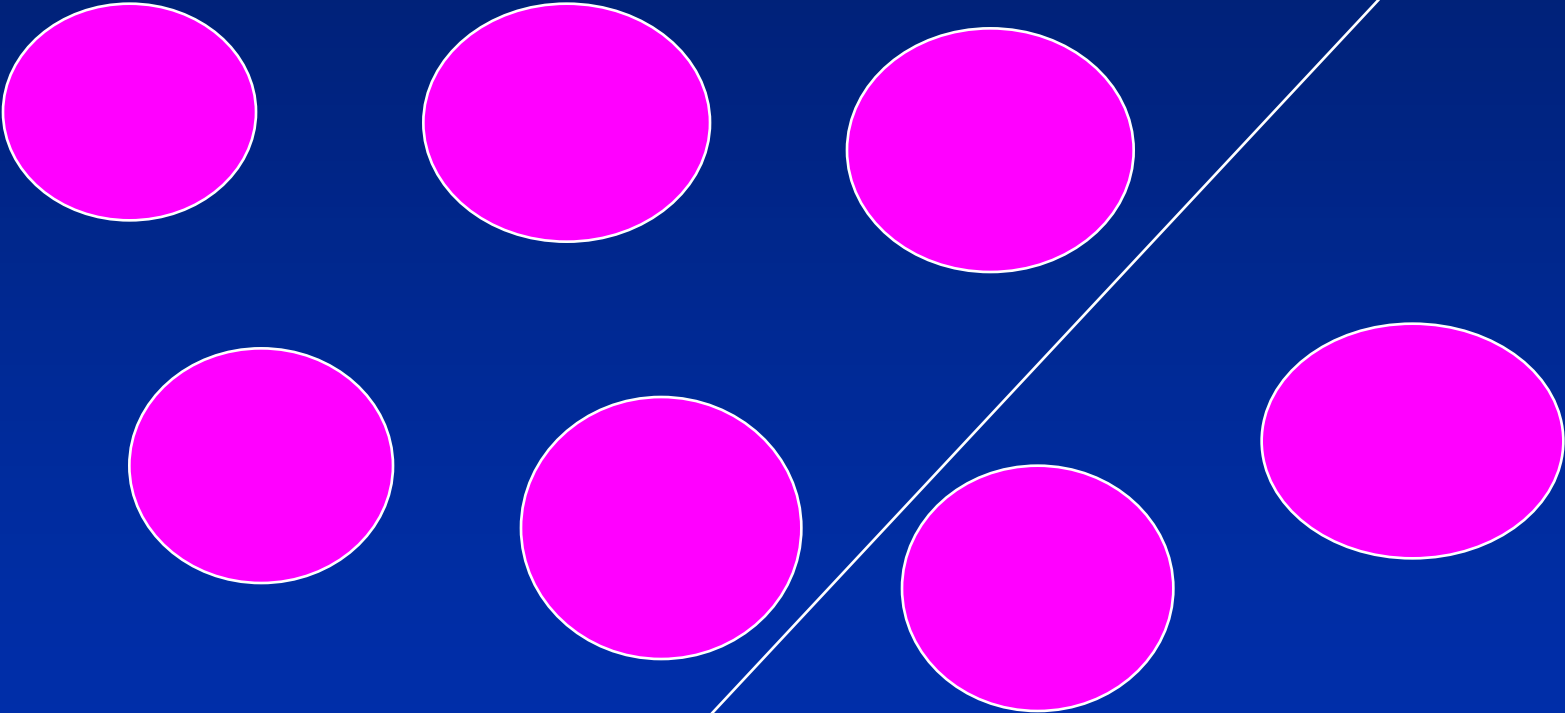
- **Mediocristan (perfect storms)**
(Normalistan)
- **Extremistan (black swans)**



Nassim N. Taleb

Threats

Known
unknowns



Unknown
unknowns
("black swans")

- Risk assessment should not only produce probability numbers
- Also need to describe the knowledge and lack of knowledge
- Focus on black swans, ...

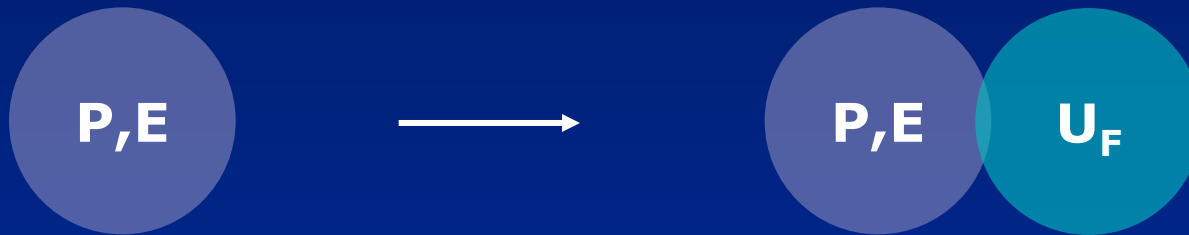
Uncertainty factors (assumptions)

- How important are they?
 - sensitivity
 - uncertainties

Uncertainty factor importance

Degree of sensitivity	Significant	9	3	2,3
	Moderate	8	6	1,5
	Minor	7		
		Minor	Moderate	Significant
	Degree of uncertainty			

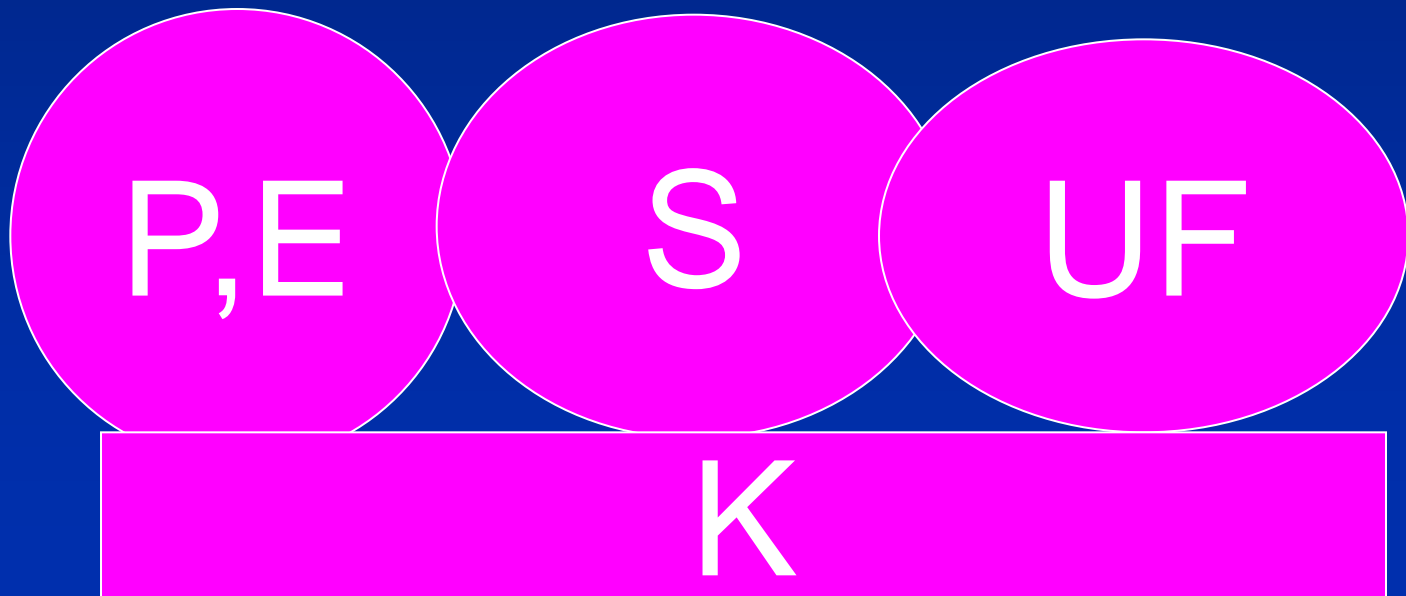
The adjusted approach



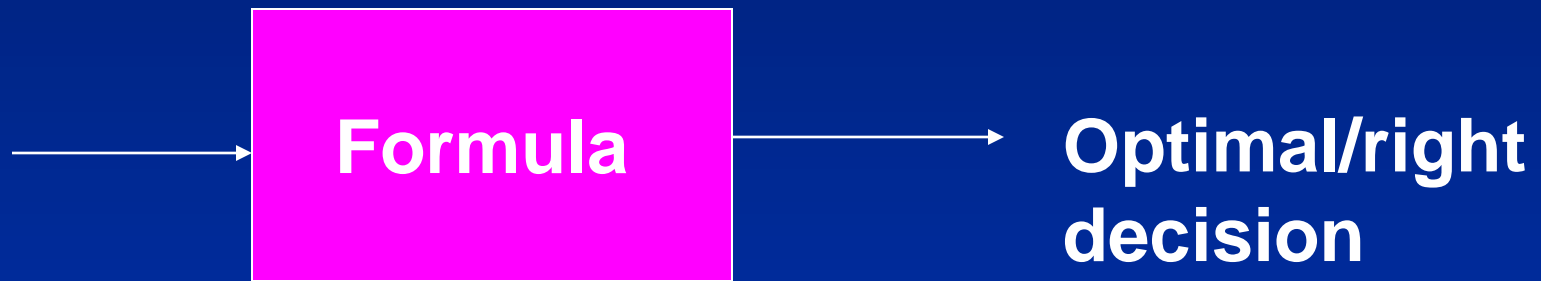
P **Probabilities**
E **Expected values**

U_F **Uncertainty factor
assessment**

Risk description



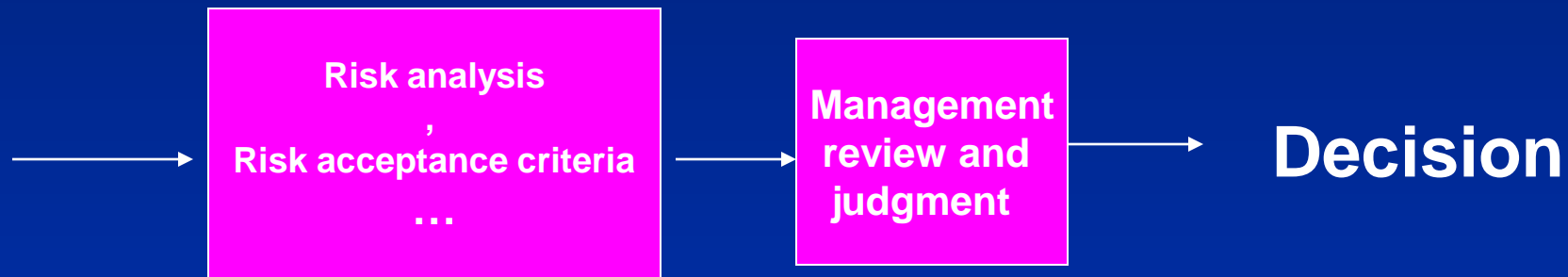
**This approach
cannot be justified**



Risk-based decision making

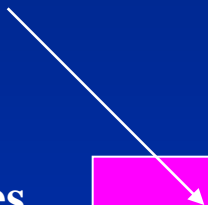
Analysis

Management



**Risk-informed decision
making**

Limitations



Uncertainties

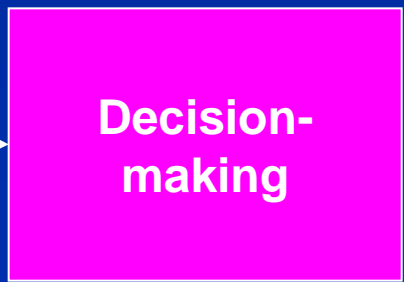


**Risk Assessment
P**

Informing



**Decision-
making**



**Other
concerns**

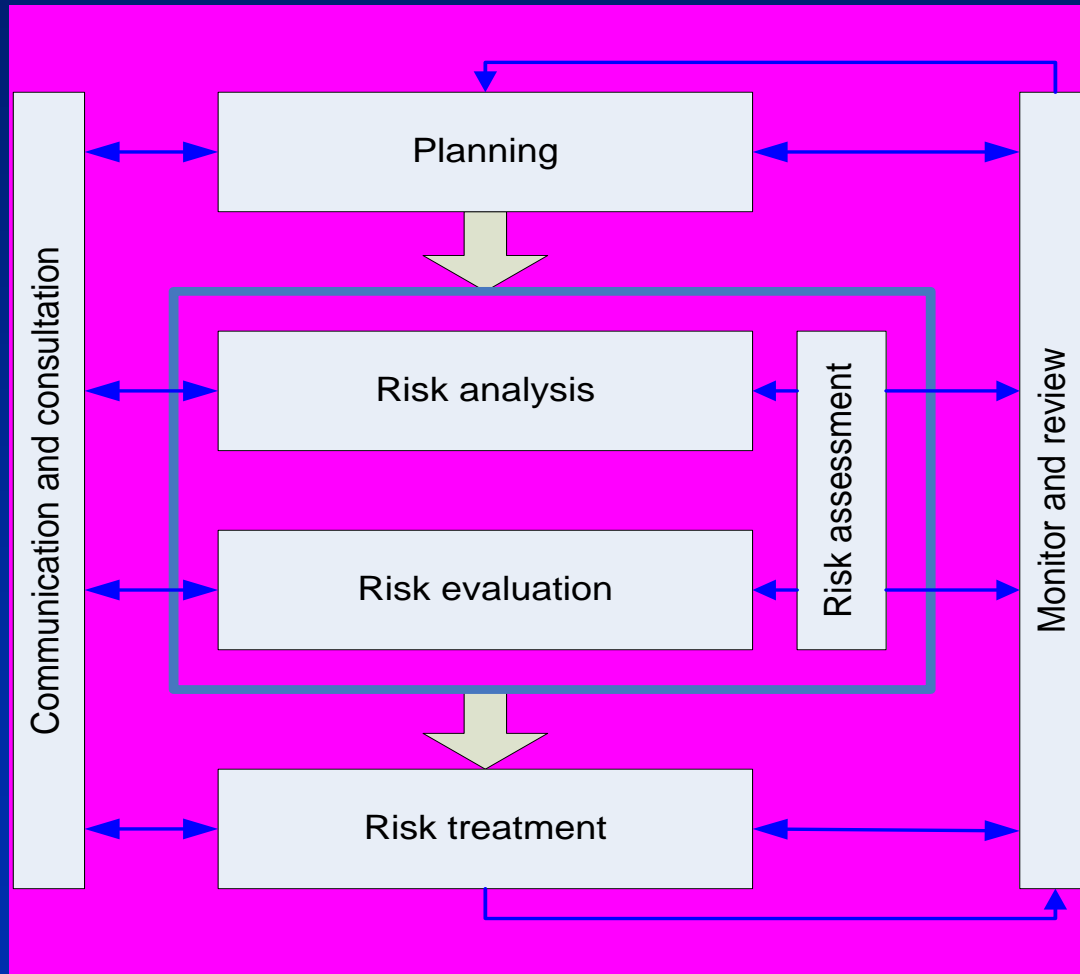


- Conservative estimation

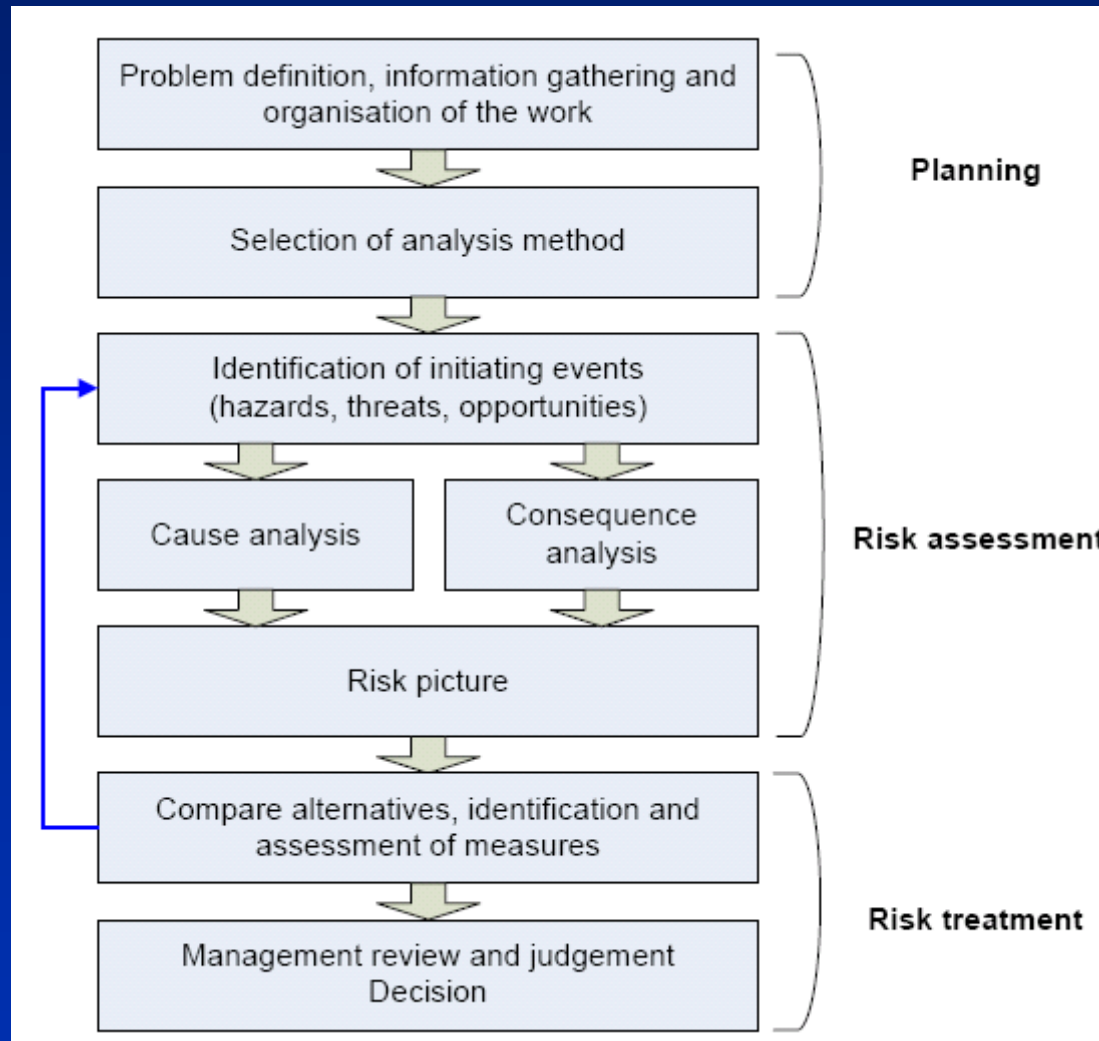
Risk assessment

- Source identification
- Cause analysis
- Consequence analysis
- Risk description
- Risk evaluation

Risk analysis process



The risk analysis process



Risk analysis

- Understanding (phenomena, events, causes, consequences, variation, ...)
- Describing risk

Describing risk

- Probability and statistics
- Risk descriptions (PLL, FAR, IR, risk matrices, F-N curves, etc).
- + K ...

P



K



Aven, T. (2012) The risk concept. Historical and recent development trends Reliability Engineering and System Safety, 99, 33–44 .

Uncertainty factors

Degree of uncertainty / Strength of background knowledge

Significant uncertainty

One or more of the following conditions are met:

- The phenomena involved are not well understood; models are non-existent or known/believed to give poor predictions.
- The assumptions made represent strong simplifications.
- Data are not available, or are unreliable.
- There is lack of agreement/consensus among experts.

Minor uncertainty

All of the following conditions are met:

- The phenomena involved are well understood; the models used are known to give predictions with the required accuracy.
- The assumptions made are seen as very reasonable.
- Much reliable data are available.
- There is broad agreement among experts.

Moderate uncertainty

Conditions between those characterising significant and minor uncertainty, e.g.:

- The phenomena involved are well understood, but the models used are considered simple/crude.
- Some reliable data are available.

Uncertainty factors

Sensitivity

Significant sensitivity

Relatively small changes in base case values needed to alter conclusions (e.g. exceedance of risk reference values).

Moderate sensitivity

Relatively large changes in base case values needed to alter conclusions.

Minor sensitivity

Unrealistically large changes in base case values needed to alter conclusions.