

# DIE ROLLE VON INGENIEUREN IN DER „BRAVE NEW WOLRD“ DER TECHNOLOGIEN

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## **Die Rolle von Ingenieuren in der „brave new world“ der neuen Technologien: 1914-2014-...**

## **Role of engineers in the „brave new world“ of new technologies: 1914-2014-...**

Oct. 15, 2014

**A. Jovanovic**

Steinbeis Advanced Risk Technologies

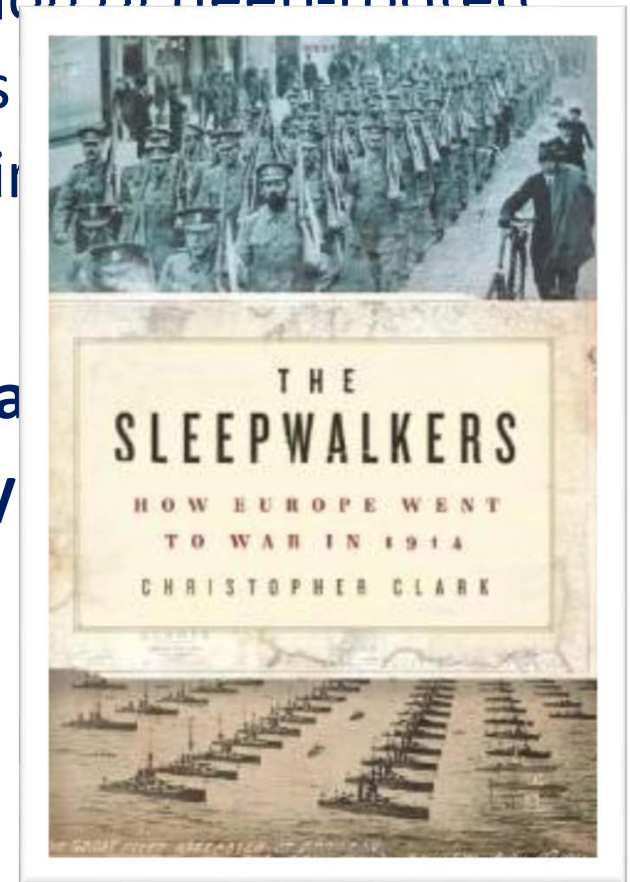


# 1914: The sleepwalkers – die Schlafwandler

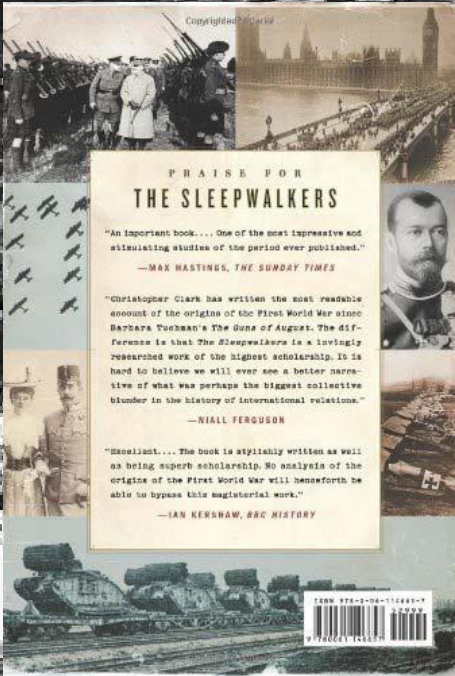
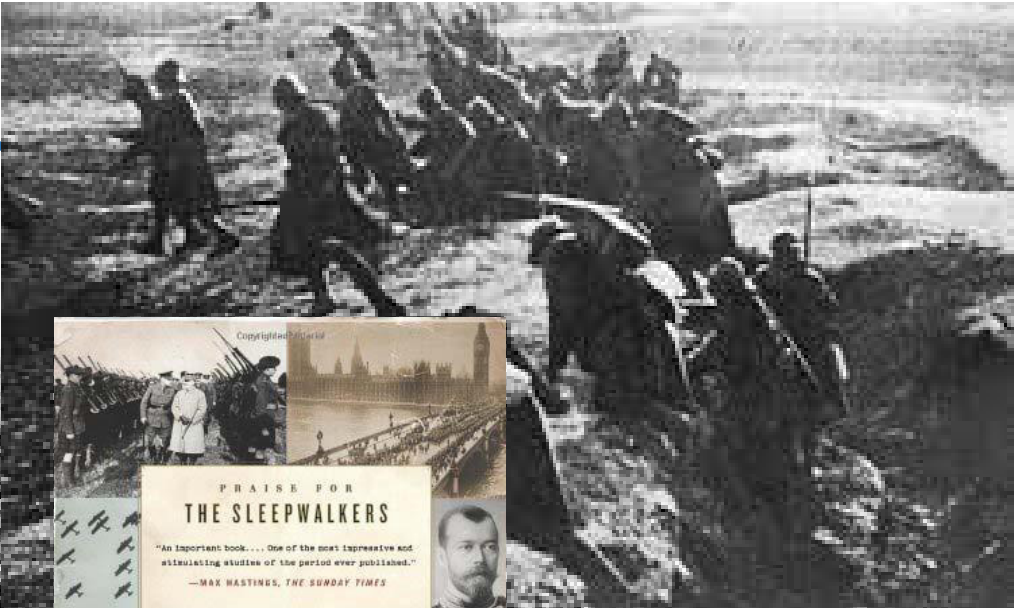
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The participants were conditioned to keep walking along a precipitous escarpment, sure of their own moral compass, but unknowingly impelled by a complex interaction of deep-rooted cultures, patriotism and paranoia, sediments of memory, ambition and intrigue. They were, in

**“sleepwalkers, watchful but unseeing, had yet blind to the reality of the horror they bring into the world.”**



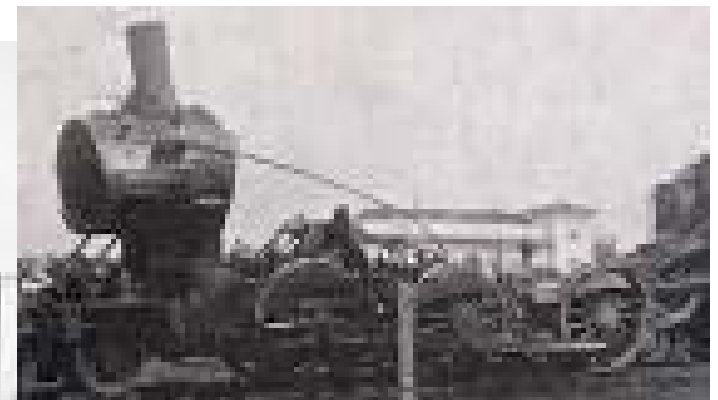
# The result



# Engineers? The sleepwalkers – die Schlafwandler?

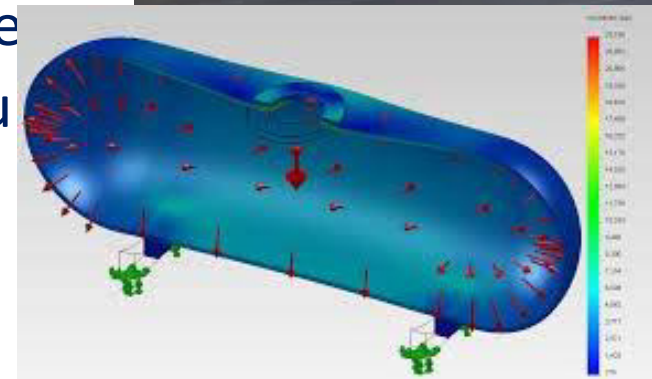
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Vor genau 100 Jahren, im Jahre 2014/15, erschien die erste Edition von den berühmten ASME-Standards – „ASME Boiler Code - Rules for the Construction of Stationary Boilers and for the Allowable Working Pressures“. Die Standards waren die Antwort von *Ingenieuren* in Massachusetts auf das, was in als „public outcry“, heftige Reaktion der *Gesellschaft*, auf einer **Serie von Explosionen in den Jahren 1905 und 1906**, bekannt ist.



# No!

**Antwort:** Infolge dessen, hat der *Staat* Massach Gesetz im Jahr 1907 verabschiedet und der ASM (Society of Mechanical Engineers) hat, dann, im (Boiler Code Committee) gegründet. Seitdem sind **Standards** und darin angesprochene *Technolog* weiterentwickelt und sind noch heute eine Druckgerätesicherheit weltweit (Anwendung fast 100,000 Kopien offiziell benutzt).



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**Engineering related risk –  
accompanies engineering  
from its very beginning**

*... what has changed?*



1895

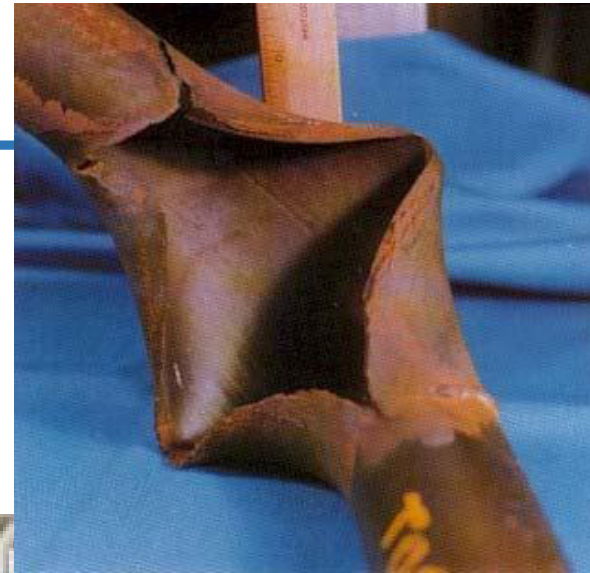


1998





# Engineering related risk – accompanies engineering from its very beginning



*... examples follow!*

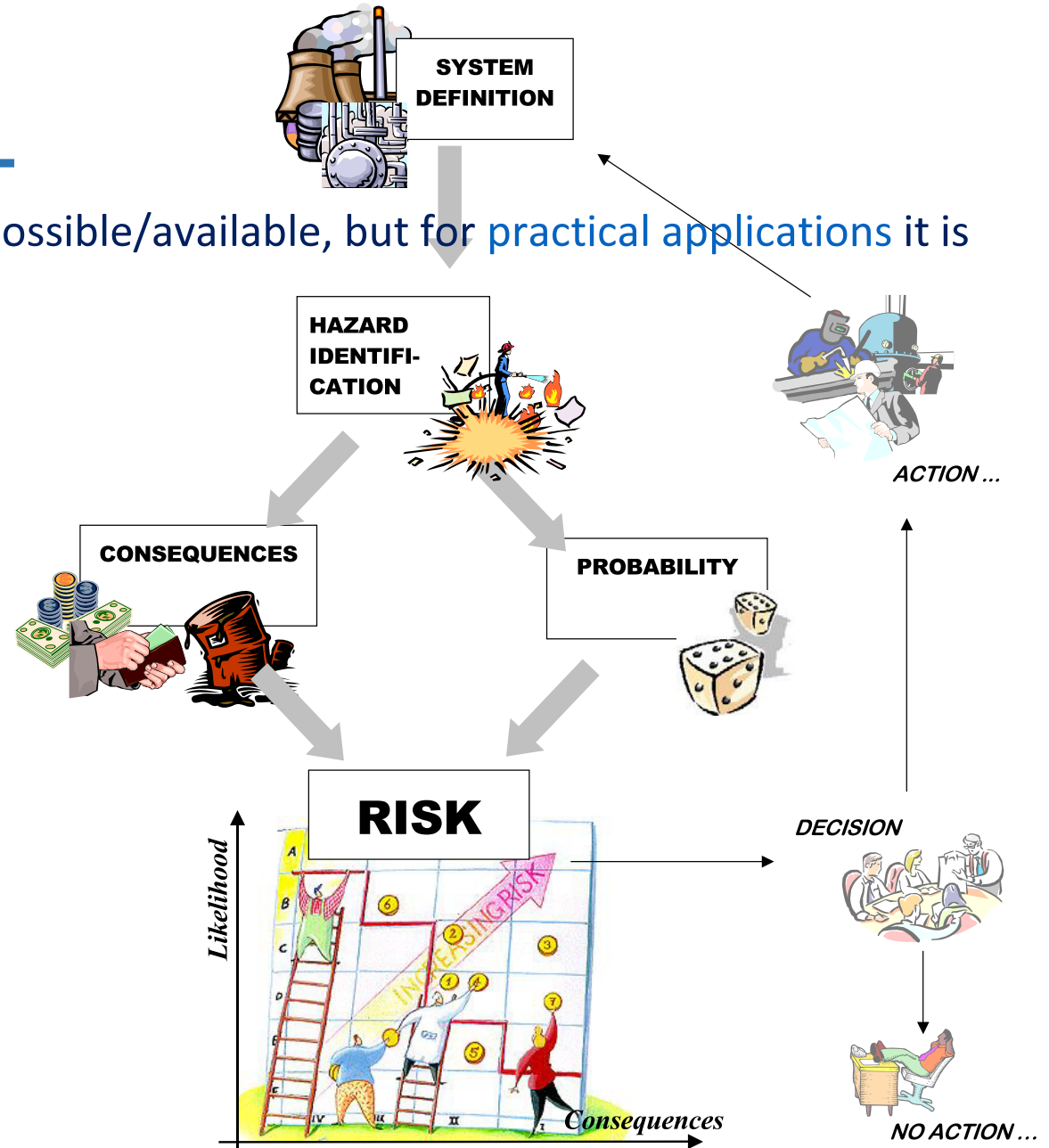
# RISK – Think in scenarios

Many different definitions are possible/available, but for practical applications it is commonly accepted that

$$\text{RISK} = \text{probability} \times \text{consequences}$$

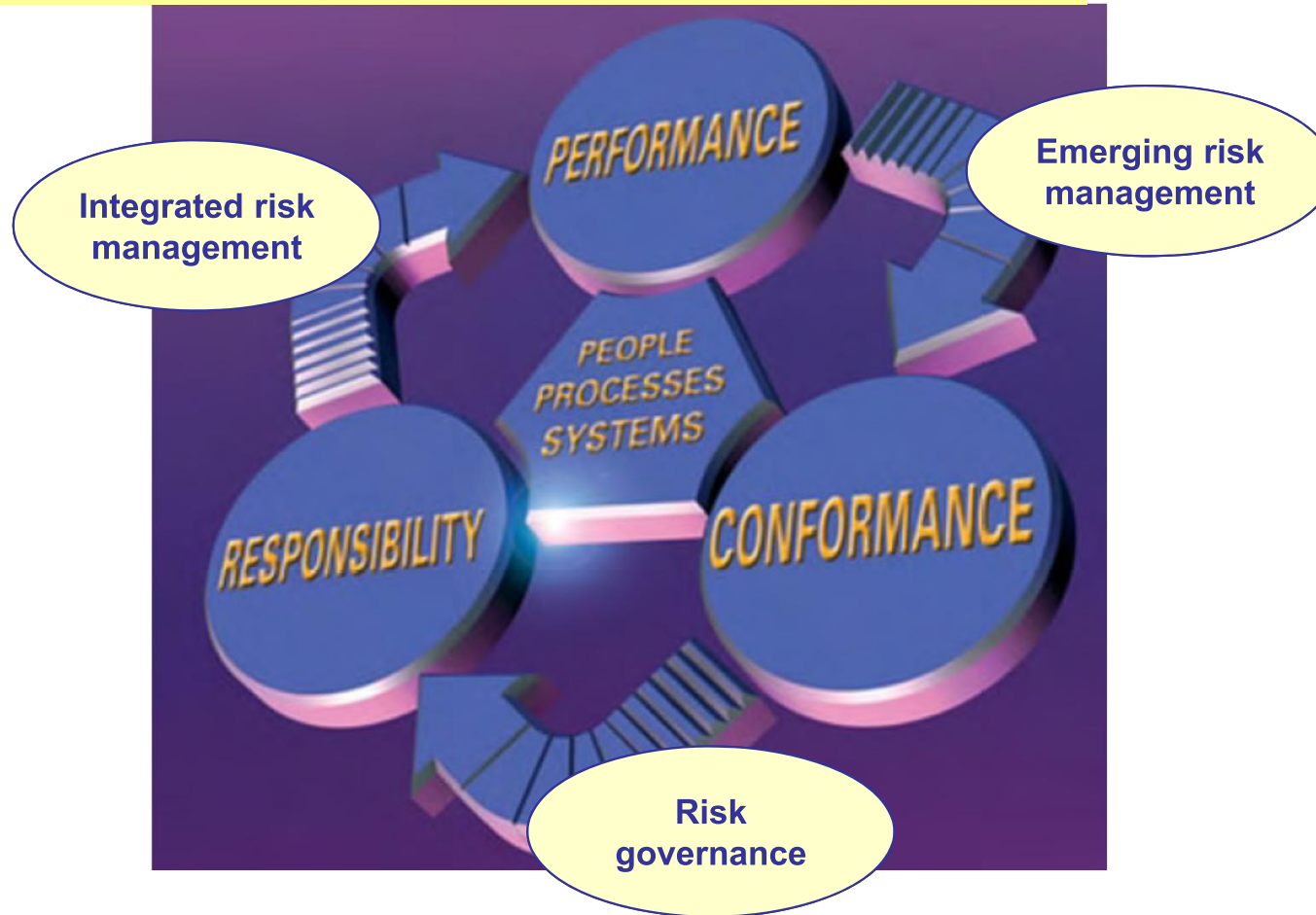
to do it practically one must:

- define the system
- define **SCENARIOS** and
- identify hazards



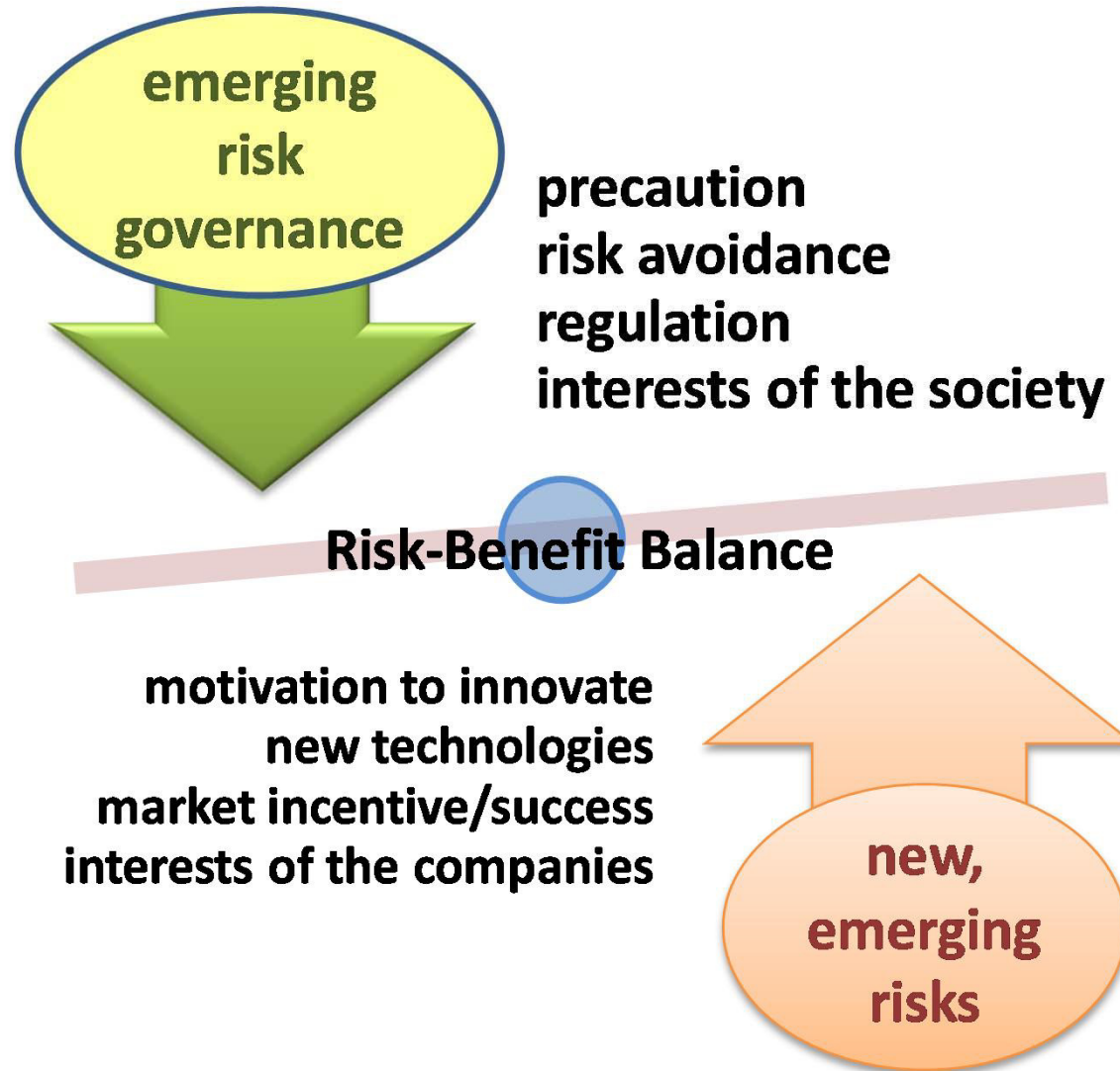
# CSR Decision-Making Framework

*The overall CSR framework ...*



# Risk vs. benefit of innovation

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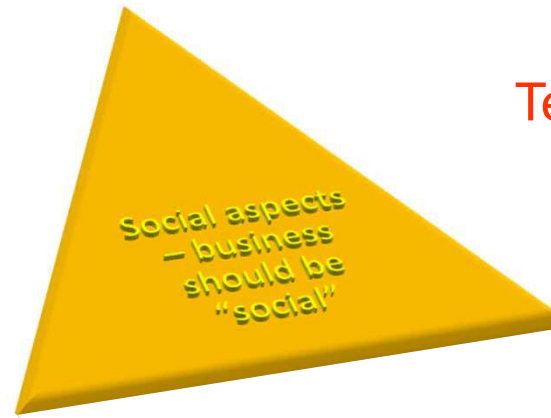
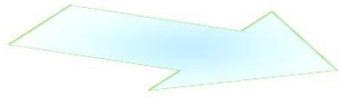


# From “social only” CSR to “integrated” CSR

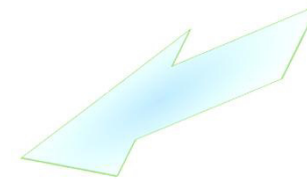
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iCSR

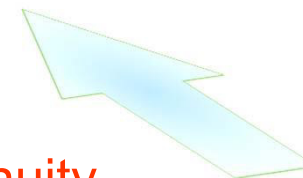
Business transparency –  
governance



Technology acceptance

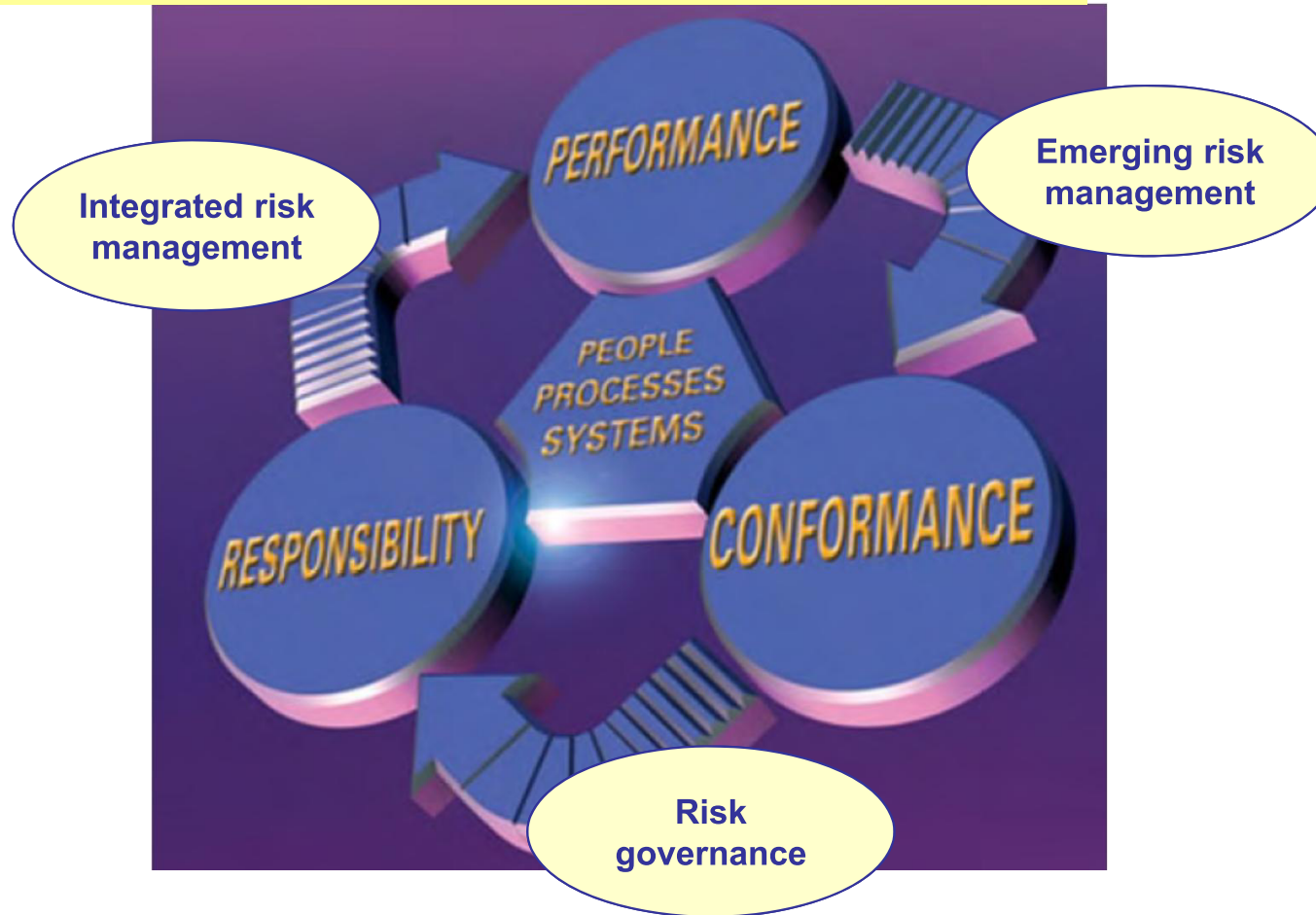


Business continuity



# CSR Decision-Making Framework

*The overall CSR framework ...*

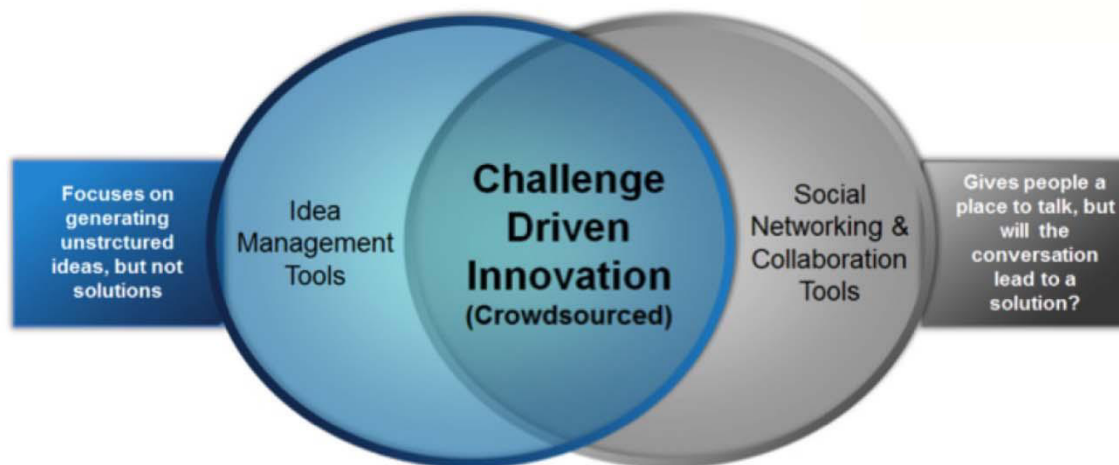
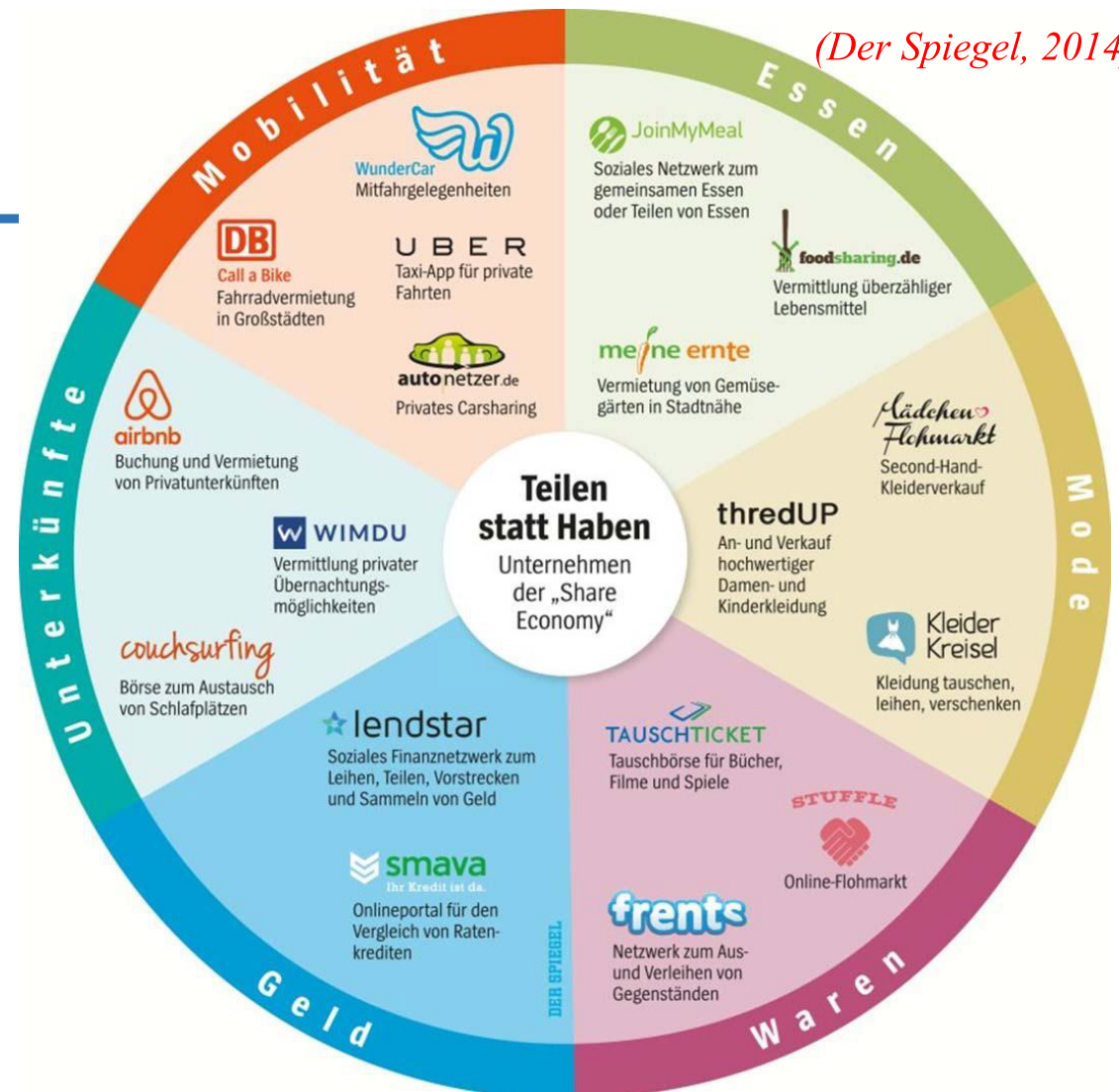


# Crowdsourcing

## Appealing

- Wisdom of the
- Social media
- Open innovation
- “Everybody does it”
- Challenge-driven innovation
- ...

(Der Spiegel, 2014)



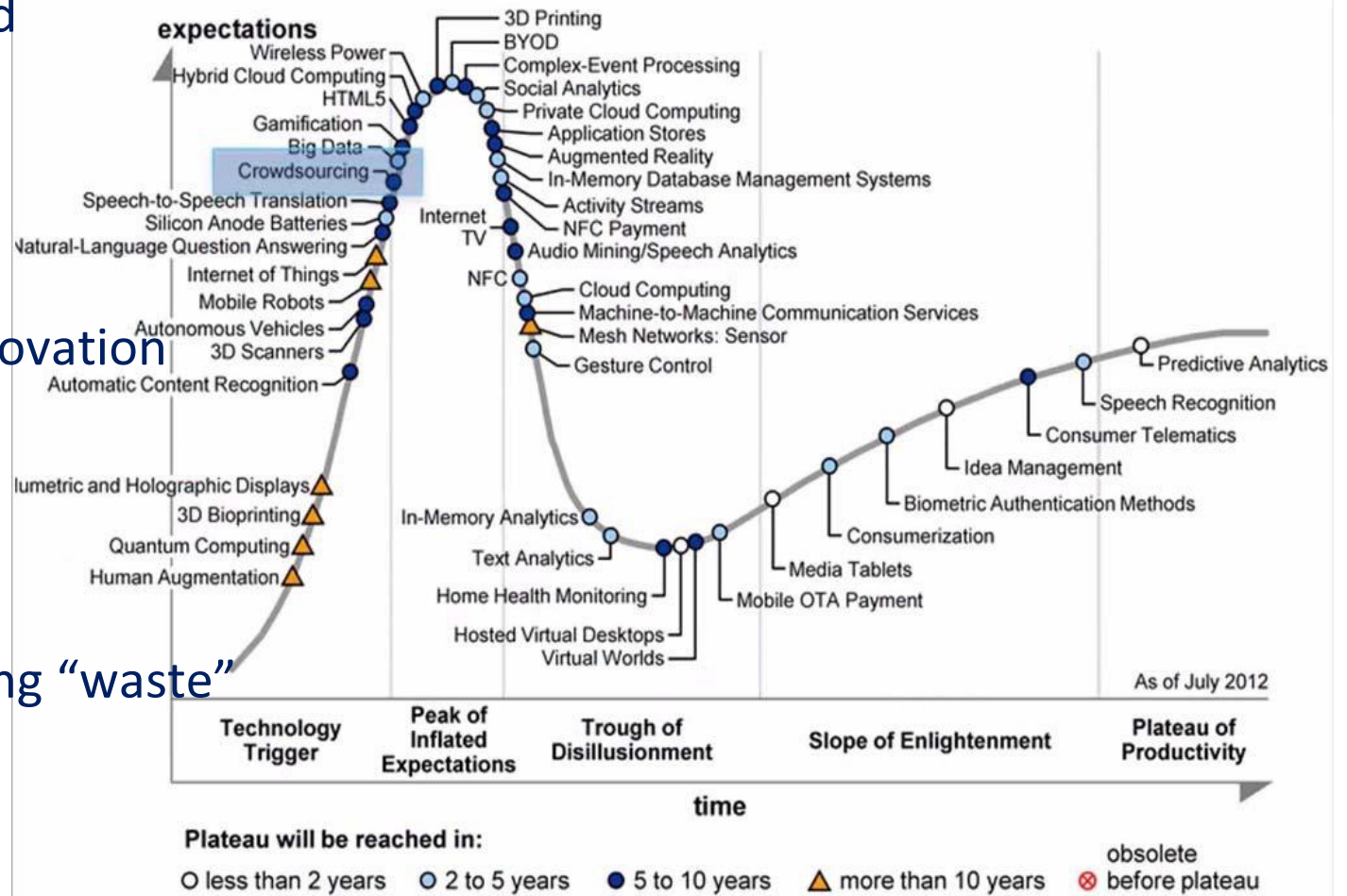
# Crowdsourcing

## Appealing

- Wisdom of the crowd
- Social media
- Open innovation
- “Everybody does it”
- Challenge-driven innovation
- ...

## Reality

- 99% useless
- Internal idea-crowding “waste”



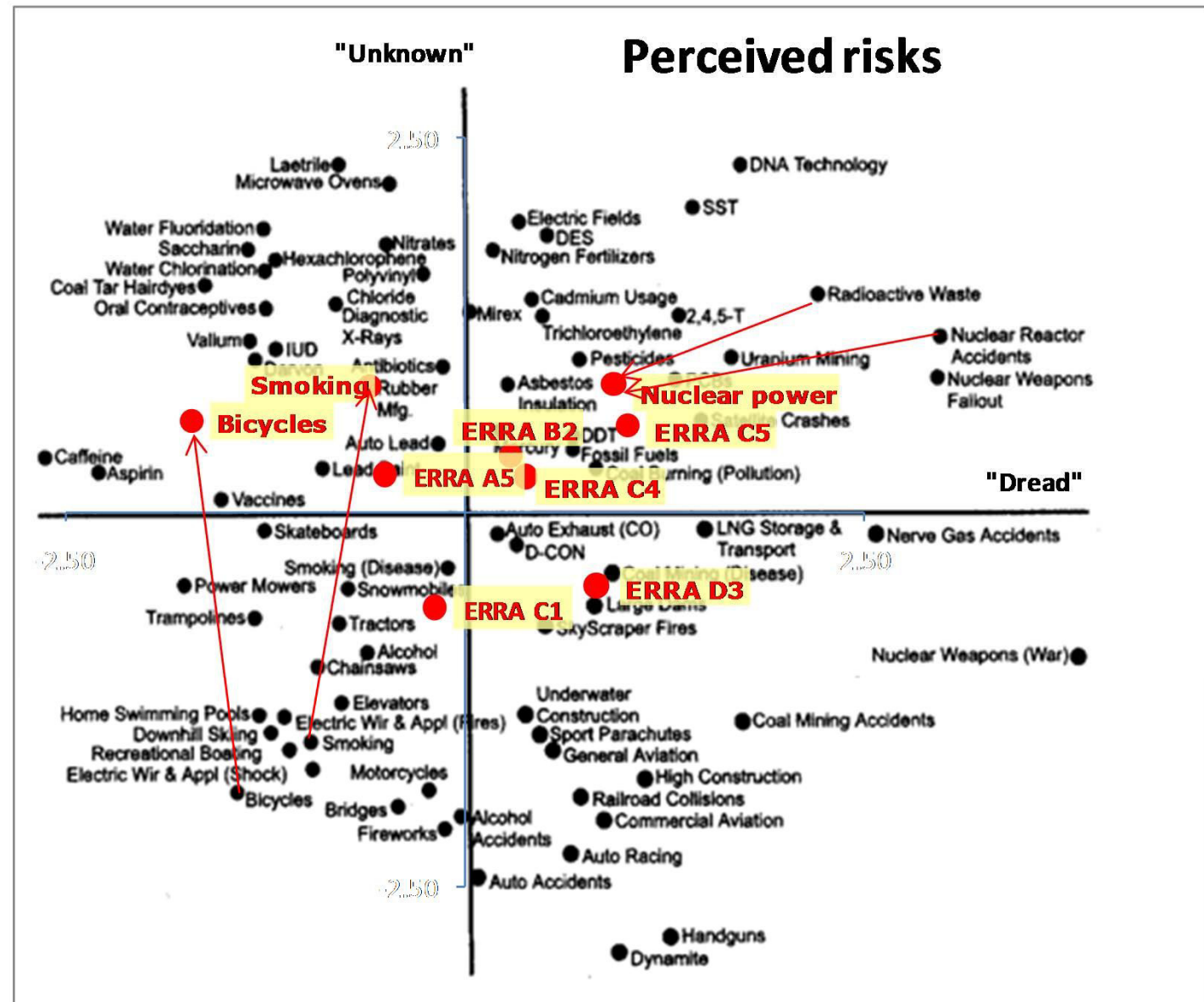


# Threats and Opportunities

Upside Risk			Likelihood	Downside Risk		
High	High	Medium	1:2 Probable	Medium	High	High
High	Medium	Low	1:10 Possible	Low	Medium	High
Medium	Low	Low	0:100 Unlikely	Low	Low	Medium
Major	Moderate	Minor		Minor	Moderate	Major
Consequence						
Multiple objectives exceeded beneficially.	Objective delivered significantly early, better, or cheaper.	Objective delivered slightly early, better or cheaper.	Objective-driven (Customer, people, society or key performance)	Slippage and minor deviation.	Failure to meet an objective.	Extinction of organisation.

Colour	Priority	Significance of the colour
Green	Low	Tolerable (no actions required)
Yellow	Medium	Intolerable unless it is not reasonably practicable to reduce
Red	High	Intolerable and must be reduced if possible
Bronze	Low	Ignore or enhance cost-effectively
Silver	Medium	Desirable to take or enhance cost-effectively
Gold	High	Take or enhance cost-effectively

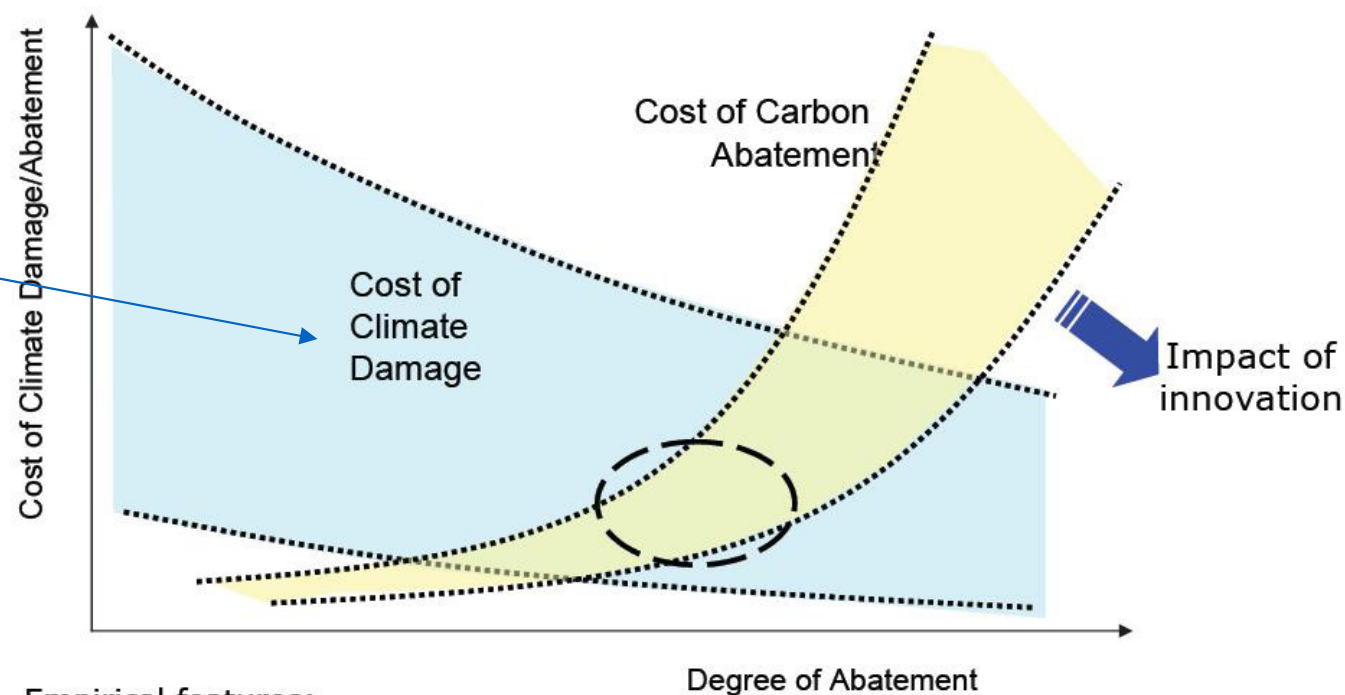
# Conclusion: ERMF helps mapping the complex world of emerging risks



# New risks (= also emerging risks!) need new instruments!

- technically
- organizationally
- financially – sustainable

**Cost of ANY emerging risk**



Empirical features:

- Damages uncertainty actually *much bigger* than illustrated here, & far bigger than MC range
- Mitigation costs are *highly convex*
- Mitigation today may have big influence on mitigation tomorrow (stock lifetimes, etc)

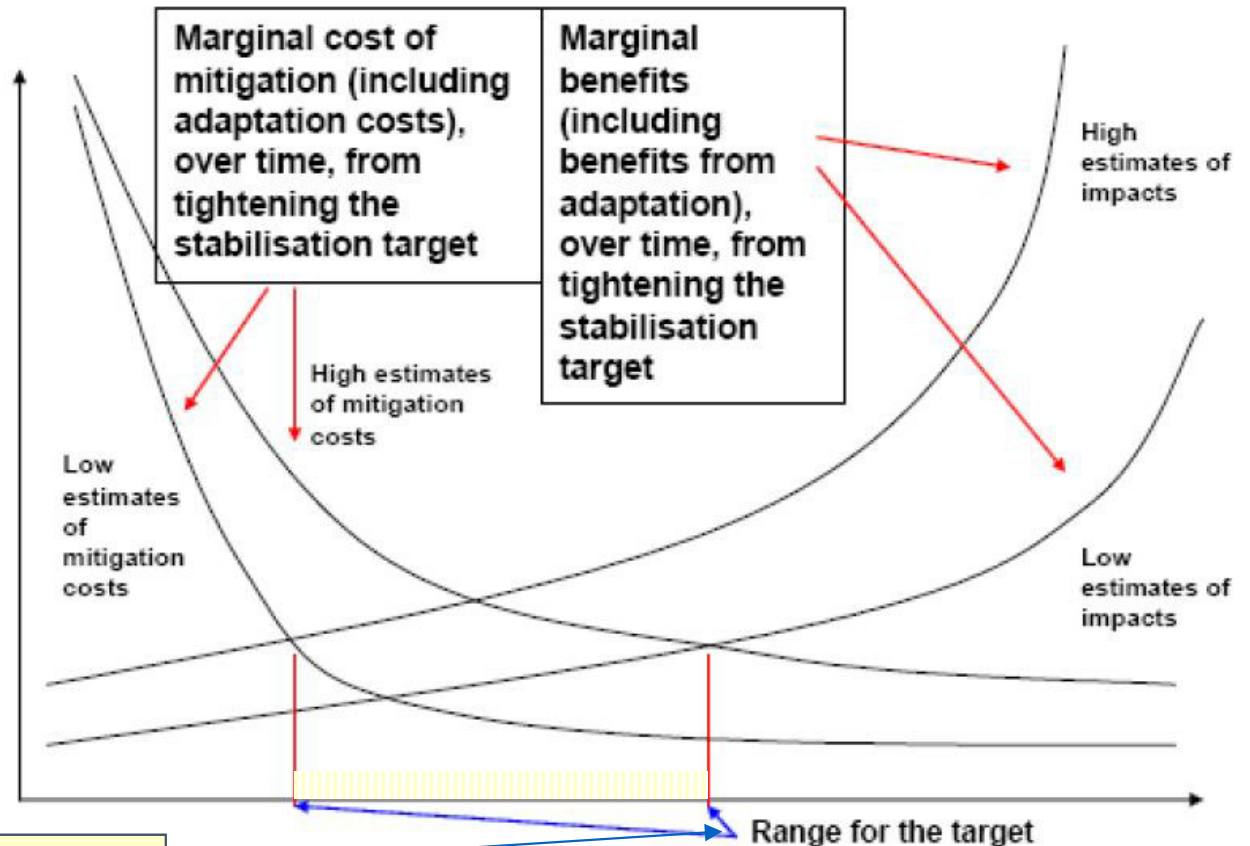
Source: From Grubb and Newbery, Ch.11 in Grubb, Jamasb and Pollitt (eds), A low carbon electricity sector for the UK: technology, economics and policy, CUP Forthcoming

# New risks (= also emerging risks!) need new instruments! ... and legal and financial forms!

- technically
- organizationally
- financially – sustainability!

**Cost and/or benefits of ANY emerging risk**

Marginal costs and benefits, measured in terms of the present value of expected discounted utility



Marginal cost of mitigation (including adaptation costs), over time, from tightening the stabilisation target

Marginal benefits (including benefits from adaptation), over time, from tightening the stabilisation target

**Target investment in abatement – e.g. in R&D, in “frameworks”, etc.**

Stabilisation target for ultimate atmospheric concentration of greenhouse gases

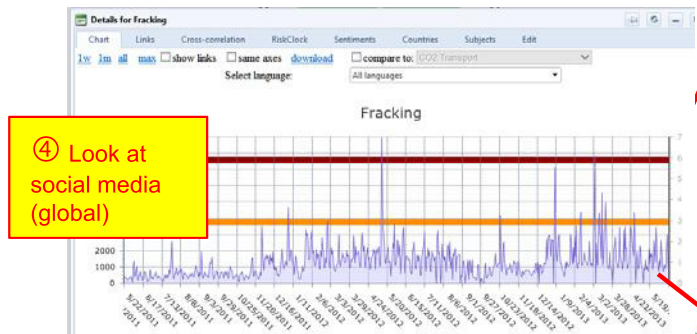
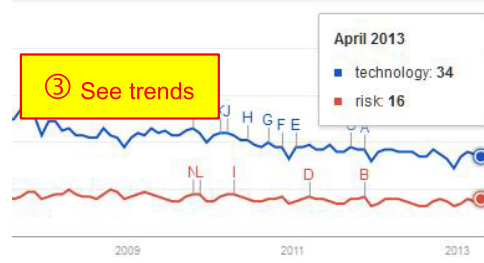
# Use Case(s)

## – e.g. Insurance

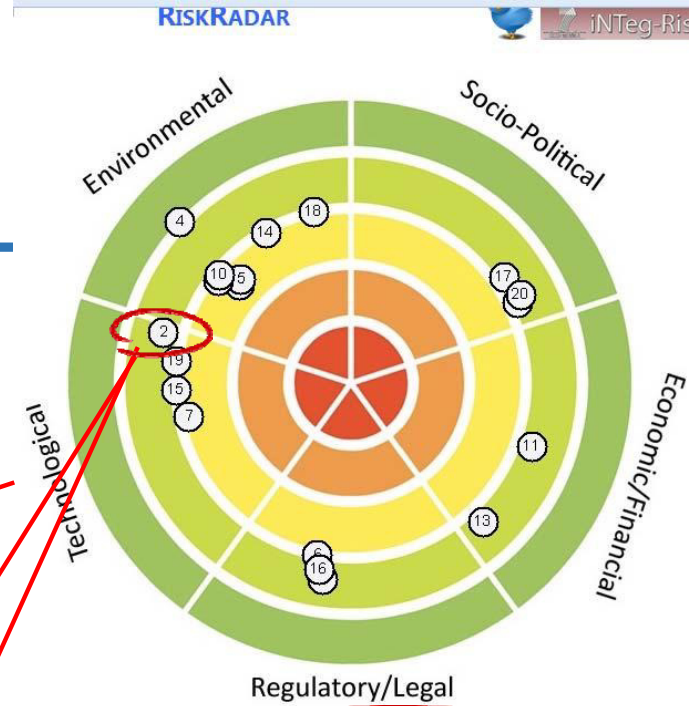
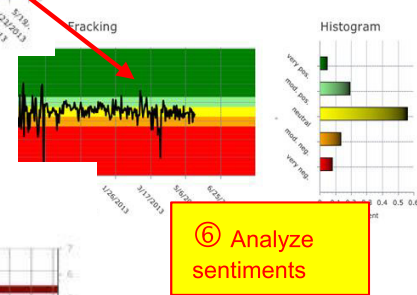
1. RiskRadar for CROF ERI initiative (industry view)
2. Use RiskEars to generate RiskSparks exported and distributed to internal and external stakeholders
3. Use RiskEars as a Wikipedia-like reservoir of risk information for risk /safety engineers
4. Use the standards, KPI's and recommendation section for client services (expert dialogues on site and during meetings)

① iNTEG - Risk home

② go to RiskRadar



⑤ Look at social media (local - here Catalan)



- 1 Usage of terahertz technology risk
- 2 Fracking
- 3 Biogas as a booming business
- 4 Fracking linked to energy storage
- 5 Misuse of antibiotics in the medic ...
- 6 Emerging risks related to the indu ...
- 7 Operational risks to spacecraft an ...
- 8 Potential release of large quantit ...
- 9 Potential release of large quantit ...
- 10 Climate change and global warming
- 11 Counterfeit (bogus/falsified) part ...
- 12 Perfectly sealed storage of hazard ...
- 13 Challenges to safety posed by outs ...
- 14 Deep Water Drilling linked to the ...
- 15 Liquid Natural Gas (LNG) re-gasifi ...
- 16 Potential side effects on human he ...
- 17 Safety and security of underground ...
- 18 Risks caused due to large emission ...
- 19 Emerging risks related to developm ...
- 20 Large scale storage H2 underground ...

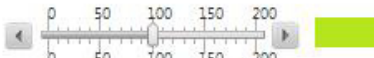
⑦ Look at / edit / assess the RiskSpark/ Risk Story

# ABM for New Technology Acceptance

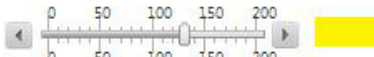
## Fracking in Germany

### Aspects relevant for public acceptance

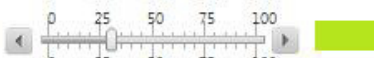
Personal benefit/benefit to people for whom one cares (in [%] compared to baseline level)



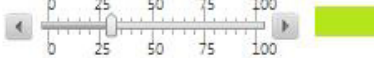
Knowledge about perceived risks/impacts (in [%] compared to baseline level)



Self-efficacy (the belief that one's actions can make a difference)



Identification with the proposed project or activity



### Simulation Control

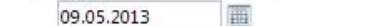
Time-steps to go



Simulation time-step equals



Select initial date



Go!

Current Simulation Time 26

Resources:

[Fracking in RiskTweet](#)

[Fracking in RiskEars](#)

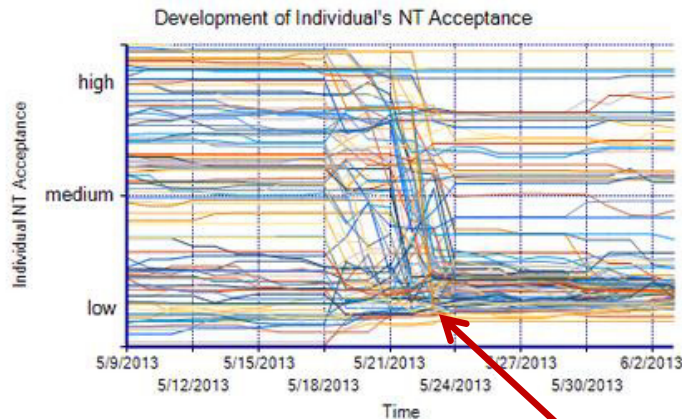
[News report: Giftige Gasgewinnung: "Fracking"](#)

Calibrate

Reset

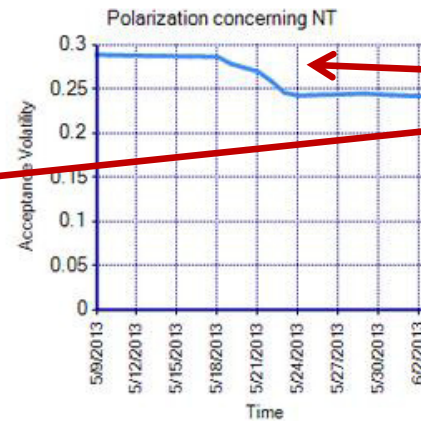
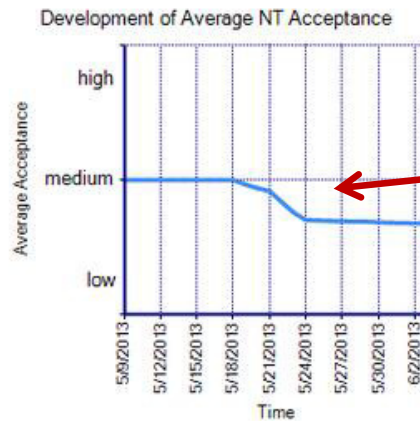
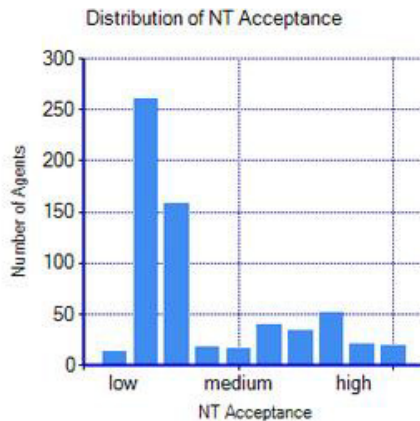
Save

Load/Delete



### Scenario Analysis:

How would public risk perception change, if tomorrow came a news report leading to an increase in perceived risks related to Fracking by 40%?

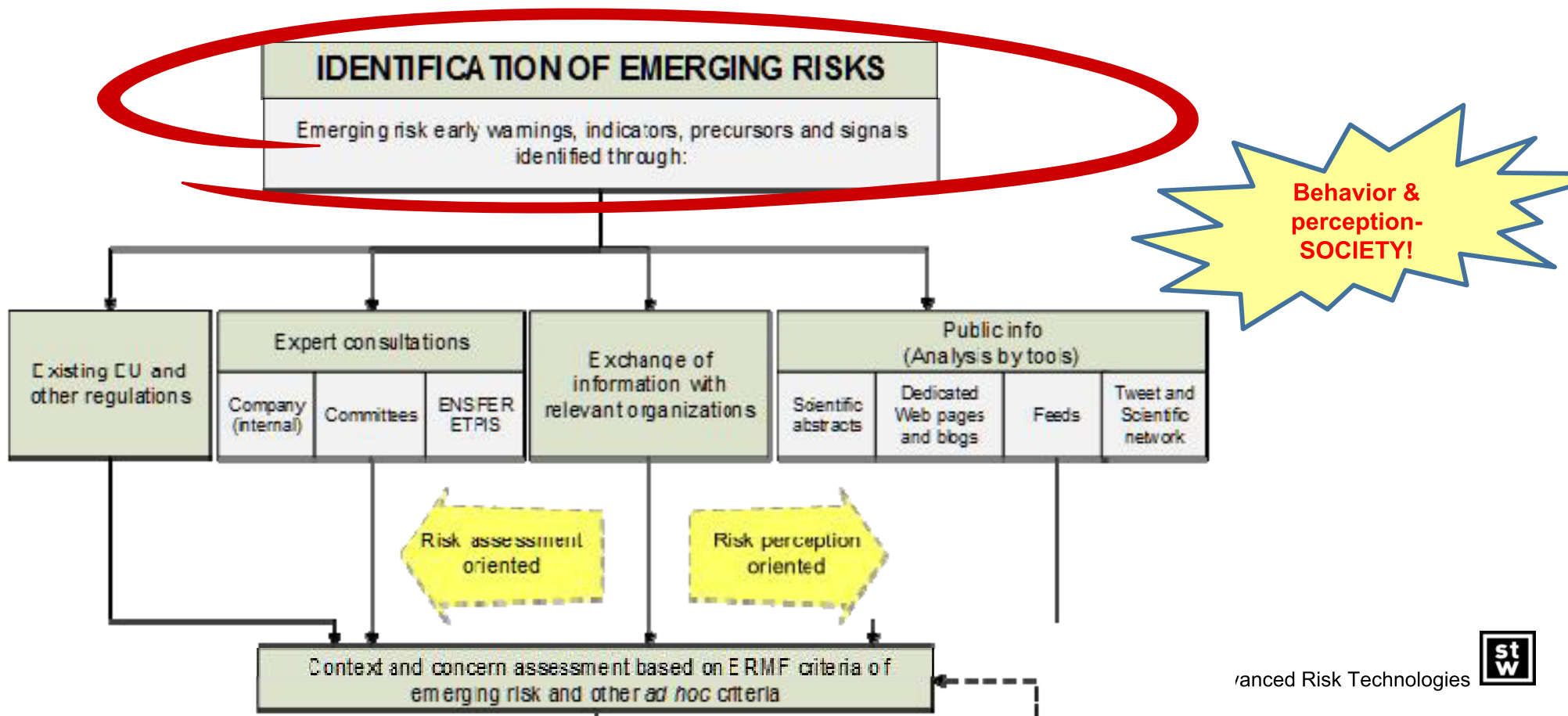
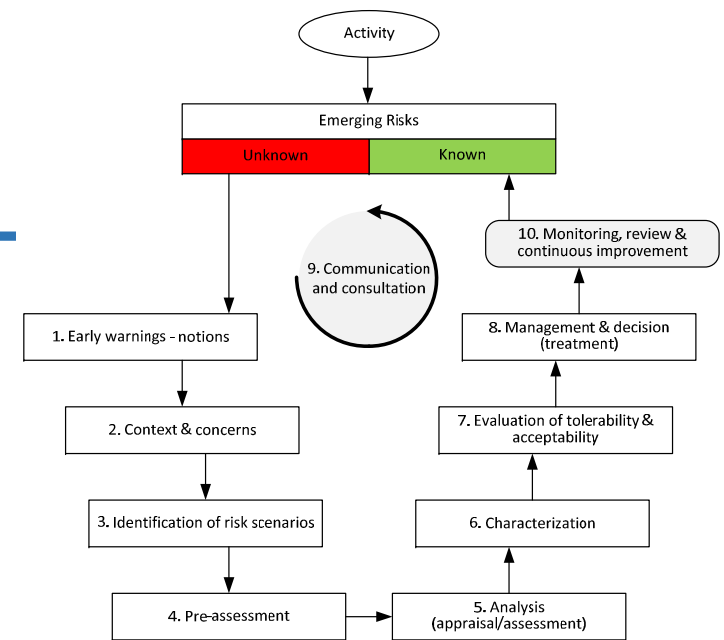


Model result: expected change in sentiments.

# Emerging Risks: CEN CWA 16649:2013

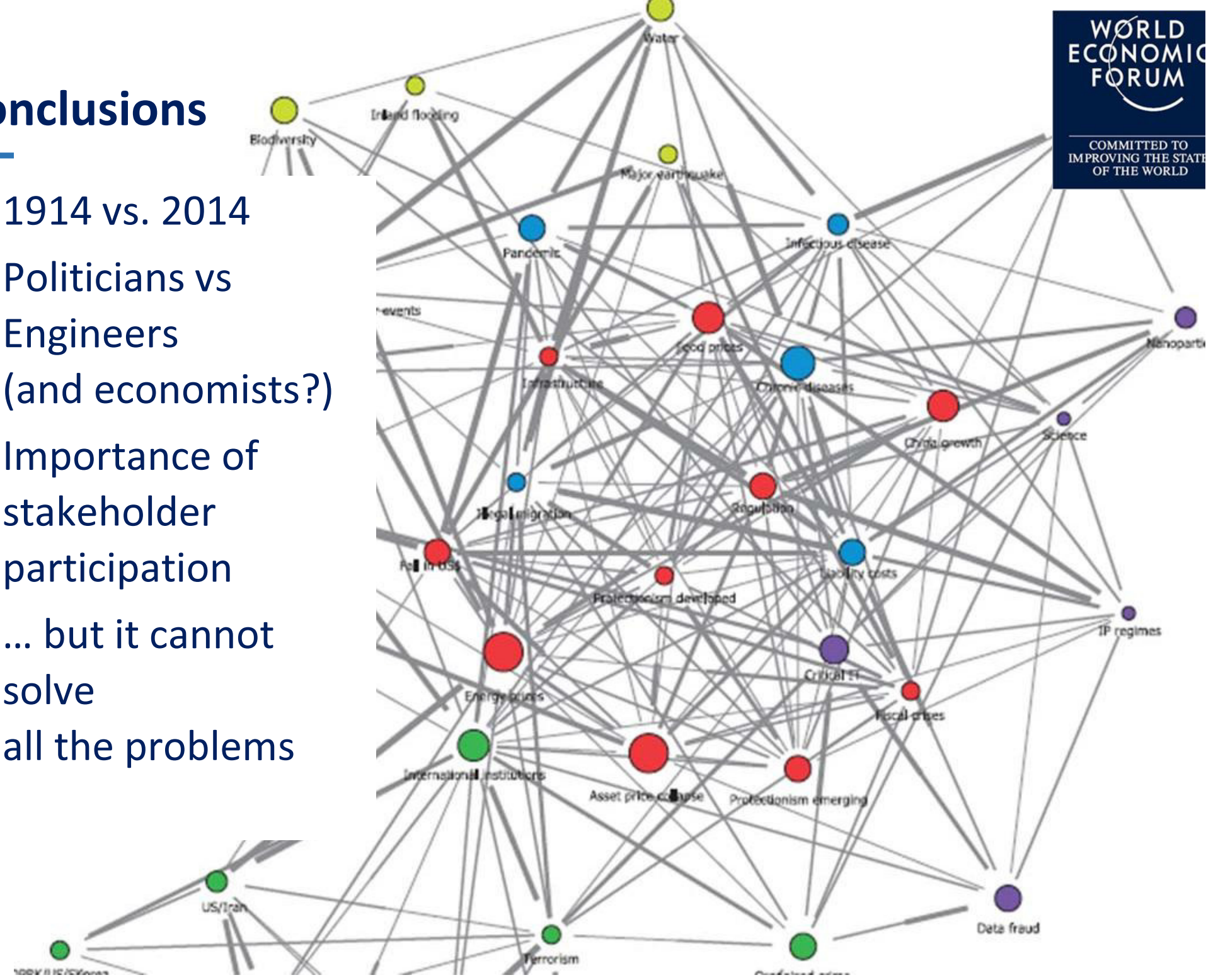
Summarize and exploit iNTEg-Risk project results

The CWA (published in June 2013): general Guideline and procedure) for the Emerging Risk Management Framework



# Conclusions

- 1914 vs. 2014
- Politicians vs Engineers (and economists?)
- Importance of stakeholder participation
- ... but it cannot solve all the problems







# Emerging Risks: Lessons learnt in iNTeg-Risk?

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1. Consider most risks as **multiple risks** ... and optimizing their risk and **avoid silo approaches!**
2. Explore the full **context** ... importance of **trade-offs**
3. Risk **ownership** **who is responsible for emerging risks?**
4. **Participation** Is risk management, is it an emerging risk in itself? Define “rules-of-the-game” for stakeholders’ participation and use of social media
5. **Resilience** Invest in resilience – it pays!



# Risk Radar (E2R2): The methodology for the clearing house of emerging risks

Starting from the data

- from existing sources and new data sources (public sources, industry, public institutions/bodies, ...)
- recognize emerging risks, monitor them and communicate them to
- general public
- industry and private sector supporting the initiative
- public institutions/bodies



# European Common House Industrial Safety

Common House  
of European Industrial Safety



Three main lines:

- **Conventional risks** ...  
taking into account  
technical, human,  
organizational and  
cultural aspects
- **Emerging risks**  
... safe innovation
- **EU Safety technologies, products and services**  
.... personal  
protective  
equipment, safety  
systems, inspection,  
control...)

## Common House of European Industrial Safety

### Conventional Risks

EU Directives and  
national standards

Compliance and  
responsibility

Safety culture &  
infrastructure

### EU Safety Technologies

Advanced  
methods

Leading  
competence

(integrated) Tools

### Emerging Risks & Issues

Stakeholders'  
involvement

Identification &  
Monitoring (E2R2)

Dedicated projects

**Risk Governance, Precautionary and Evidence-based approaches, Sustainability, Education, Standardization, Reporting and management systems**

**APPLICATIONS: Manufacturing, Buildings, Process industry, ...**  
**IMPACTS: Health, Safety, Environment, Society, Economy, Business Continuity ...**

# Conclusion -

## PARADOXES:

- 1. Decrease of the number of accidents => decrease of their tolerance
- 2. Not more communication, but more confidence increase acceptance

