

ESREL-SRA-E 2025 Joint conference 15th – 19th of June 2025

The gap between theory and practice in the risk and safety fields

Plenary panel 18th of June 2025

Panellists: Marja Ylönen, Luca Podofillini, Teemu Reiman, Jan Hayes and Kenneth Gould Pettersen

Panellists



Luca Podofillini Senior Scientist, Paul Scherrer Insitute, Switzerland



Teemu Reiman, Senior Safety Culture Specialist, Lilikoi, Finland



Jan Hayes, Professor of Organizational Accident Prevention, RMIT University, Melbourne Australia



Kenneth Gould Pettersen, Associate Professor, University of Stavanger, Norway

Gap between theory and practice

Theory

Scientific knowledge and research



Practice

1. Example

Integrated management of safety and security - theory vs. practice









Integrated management of safety and security theory vs. practice

2. Example Risk science knowledge vs. Traditional risk matrices

Consequences

Impact **Probabilities** Catastro Minor Moderate Severe 3 5 5 4 6 10 6 12 9 8 1210

Probabilities

Consequences

		А	В	С	D	E
		Negligible	Minor	Moderate	Significant	Severe
E	Very Likely	Low Med	Medium	Med Hi	High	High
D	Likely	Low	Low Med	Medium	Med Hi	High
с	Possible	Low	Low Med	Medium	Med Hi	Med Hi
в	Unlikely	Low	Low Med	Low Med	Medium	Med Hi
А	Very Unlikely Dette bildet av Ukj	Low ent forfatter er	Low lisensiert unde	Low Med	<mark>Medium</mark> □	Medium



Risk Science knowledge vs. traditional risk matrices



Why there is a gap between theory and practice? Why is it important to discuss the gaps?

Seeds for discussion



What are the biggest reasons for these gaps?



What can be done to bridge the gaps?



Some premises – from theory to become practice

- My perspective: Probabilistic Safety Assessment (PSA), nuclear industry
- The regulator prescribes the scope, content and many assumptions of safety analyses
- The regulator **reviews** the analysis, and may provide **recommendations** to improve safety and/or quality of the analysis
 - Methods should be accepted by the regulator (e.g. reviewed, validated, verified)
 - Assumptions and method application should be transparent and traceable, for external review
- Industry may use PSA for decision-making on plant operation, maintenance, outage

An example story – from theory to practice (Swiss experience)

- Treatment of errors of commissions (EOCs) in Probabilistic Safety Assessment (PSA)
 - -Long-standing issue: what to model, how to quantify probability
- Early days practice: no treatment in PSA
- 2009: Guideline ENSI-A05/e on PSA Quality and Scope
- d. Whether personnel actions with negative impact on the accident sequence ("Errors of Commission" - EOCs) have been identified shall be stated. In the case that EOCs have been identified, their consequences and possible countermeasures shall be discussed.
- 2019: revised: Guideline ENSI-A05/e
- d. In the full power PSA a search for potential Errors of Commission (EOCs) shall be conducted. For the identified EOCs, their consequences and possible countermeasures shall be discussed qualitatively.

Research advances

EOC: important contributors in real accidents

Identification /prioritization is feasible

Quantification still to improve on

- Subjectivity
- Resource intensiveness
 (we are working on a "Cookbook for EOCs")





Lessons learned on what works well

- Research and industry work together: aligned goals, leverage on existing tools/processes already in place
- Deliver tools/software/guidance on top of models/methods/concepts
- Results/recommendations point to specific insights and improvements that can be recognized and implemented
- Aim is not only to demonstrate / improve safety, also to optimize the process/design/performance

Challenges related to the gap between theory and practice – safety culture

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SAFETY CULTURE WITH PASSION

PERSONAL INTRODUCTION

- Experience from both research and practice
 - Researcher at VTT Technical Research Centre of Finland for 15 years focusing on safety management, leadership and culture in various safety-critical domains
 - Safety Culture Manager at a Finnish nuclear newbuild company for almost 8 years
- Consultant in my own company Lilikoi since 2022
- I recently finalized a book on safety, out later this year
 - This presentation is based on the ideas in the book
 - The presentation focuses on the concept of "safety culture"



Safety in Complex Organizations A Cultural Approach

Teemu Reiman

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SOME REFLECTIONS ON RESEARCH AND PRACTICE GAP 1/2

- Gap does not exist only between research and practice but between various research traditions, various ways of viewing at, and working on, safety
 - Facilitated by various ways of selling safety (consultants) and regulating safety (authorities, governments, public)
 - Confused by various types of hazards (local, core task related, psychosocial, external...)
- Gap is about cultural differences between groups, disciplines, industries
 - "Gap" between cultures, which co-exist with and partly overlap research and practice
 - Is it a gap or just different worlds / cultures formed from shared experience?
 - Different communities of practice need to understand others, not make everyone similar



SOME REFLECTIONS ON RESEARCH AND PRACTICE GAP 2/2

- Safety culture as a concept was introduced after Chernobyl nuclear accident in 1986 => after that it has spread to almost all safety critical domains
- The concept has been used and applied in various ways, referring to e.g. attitudes, values, basic assumptions, practices, routines, and behavior
- Practitioners often look for remedies, researchers for explanations
 - Safety culture as a concept was "caught in the crossfire" (cf. Silbey 2009)
 - Consultants have been selling "safety culture" as both the cure and the disease
- Ethnography of culture has long been based on thick description, but this tradition has been less salient in safety
- In addition, theories of culture emphasize the emergent and embedded nature of culture => four different views to safety culture

COMPARING THE FOUR APPROACHES

(EXPANDED FROM REIMAN, IN PRESS, CF. SILBEY 2009, GULDENMUND 2000, WHITE 2017, ALVESSON &

SVENINGSSON 2024)

	ΤοοΙ	Causal explanation	Dynamic process	Emergent structure
Purpose of the concept	INSTRUMENTAL: To <i>improve</i> safety by changing behavior	ANALYTIC: To <i>explain</i> why positive or negative safety outcomes occur	RELATIONAL: To <i>describe</i> how safety is constructed and enacted in interaction	STRUCTURAL: To <i>interpret</i> how safety is embedded in structures & assumptions
Culture and behavior	Culture <i>is</i> behavior	Culture <i>affects</i> behavior	Culture is <i>in</i> the behavior	Culture is <i>beneath</i> behavior
Proof of usefulness	Does it help in <i>solving</i> problems	Does it help in <i>specifying</i> and <i>solving</i> problems	Does it help in identifying patterns	Does it help in asking more elaborate <i>questions</i>

SAFETY CULTURE - CONSEQUENCES OF MULTIPLE DEFINITIONS

- None of the four approaches is the "perfect approach"
 - Culture as a tool or a remedy easily focuses on individuals
 - Culture as an explanation for organizational outcomes can overemphasize the causality of cultural features – alternatively quantitative aspects
 - Culture as a dynamic process may remain too descriptive
 - Culture as an emergent structure can be too nuanced and academic
- There is often a translation issue when models are taken into use in domains where they were not originally developed in
 - Often the premises are "lost in translation"
- Different definitions lead to different actions, different measurements, and different results
 - This is a problem especially when these premises are not communicated (cf. the iceberg models of culture)





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SAFETY CULTURE WITH PASSION



Thank you!

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The gap between theory and practice:

A sociologist doing industry-based research

Jan Hayes RMIT University, Melbourne, Australia



Acknowledgement of Country

RMIT University acknowledges the people of the Woi wurrung and Boon wurrung language groups of the eastern Kulin Nation on whose unceded lands we conduct the business of the University.

RMIT University respectfully acknowledges their Ancestors and Elders, past and present.

RMIT also acknowledges the Traditional Custodians and their Ancestors of the lands and waters across Australia where we conduct our business.

Artwork 'Luwaytini' by Mark Cleaver, Palawa



What does industry (usually) want from research?

- A solution to an immediate problem
- Action oriented, not just understanding
- If it's cultural, preferably requires change on the part of others (not us)
- New to them, but perhaps not new to us.







Typical starting assumptions about risk research

- Risks are knowable
- Uncertainty is resolvable by more analysis
- The past is a good predictor of the future
- Rules can be written covering all cases
- Good people do as they are told
- Even if they might challenge these generalized statement, they behave as if they are true.





Bridging the gap

- It's a long term proposition so champions are needed
- Negotiate over the subject of research: Help with a practical problem but also collect research data on something more fundamental
- Build trust over longer term
- Develop understanding on both sides
- If necessary, ignore the social hypocrisy about who is leading
- Know that research impact can take time to manifest.
- For researchers, it's (mostly) a privilege to help close the gap from both directions.





Some questions:

- Is the gap inherently a problem?
- How much of the gap is because academia does not understand the needs of industry?
- What's the role of consultants here?
- "we outsource thinking"

Managing the gap between theory and practice

Kenneth Pettersen Gould, University of Stavanger

Risk and safety fields = real-world research

- Both the safety and risk field deal with problems that influence and affect people, with the scientists trying to provide help
 - Problems range from local, practical issues to complex global developments of multidisciplinary nature
- Both risk and safety are cross-disciplinary applied fields of research
- Scientists in both fields need to find ways to balance between discipline-advancing and contributing to solve practical problems





To the risk and safety scientist:

- Get out of your offices and laboratories more!
 - Seek prolonged engagement
 - But remain sensitive to how involved...
- Remain true to your scientific attitude,
 - Systematic, sceptical and ethical
- Approach theoretical and methodological pluralism as part of the solution, not a problem
- Be humble of the actual contexts where the problems associated with risks and safety have to be dealt with
- Be wary of academic/philosophical idealism



To the risk and safety practitioner:

- Engage with scientists, at all stages of research:
 - Setting the research agenda, identifying research problems
 - Support data collection
 - Support validation/testing of results
 - Use research results
- ...but do not interfere in the analysis
- Allow for scientist/researcher access. If collaboration works, go for prolonged access!
- Demand impact from science, but you are also responsible for that impact
 - Be wary of not becoming a vacuum where research results disappear.
 - Not all impacts are direct, but can be of broader and a more collective nature



Managing the gap – some current challenges

- Overcoming the false dichotomy of science versus practice
- Having the necessary tools and techniques for integrating knowledge from across sciences and professional practice's
- What knowledge do we have about the 'health' of our institutions across both science and professional practice?
- Collective values and rights are under pressure
- Lack of institutional capacity: we do not have 'common good' organizations within our fields that can match the type of large global organizations who 'own' and manage many of the major risk and safety problems?



Thank you for your attention!



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Further reflections

Limitations of theory and practice Power of theorists/practitioners Sensitivity to different perspectives

The role of structures (e.g. laws, standards)



Different disciplines, research interests, and types of research