

## A1) Challenges for future of safety research

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In this paper I give my perspective on the main challenges for future safety research.

Talking about the future, it is important to note that the concept “safety” always has a time dimension. It is regarded as ‘safe’ when there is the (justified) expectation that no accidents or incidents will happen in the foreseeable future. Safety and future are therefore an intrinsically linked combination. The time dimensions of safety are likely to be the reason that more dynamic definitions of safety have recently come to the forefront.

**Methodological challenges.** Let’s start with some methodological challenges. A main challenge remains to improve the predictive qualities of safety research. When technological issues formed the heart of safety, and the laws of natural science were dominant, it was not too difficult to make reliable predictions. However, today organisational and behavioural issues are coming more to the forefront, while the contexts are increasingly turbulent and complex.

If we use Weick’s description of ‘safety as a dynamic non-event’, this immediately implies a challenge from a research point of view: how to assess and evaluate a dynamic non-event? Safety is much more difficult to assess than accidents or incidents. A related challenge concerns leading (or positive) performance indicators. How can we validate leading indicators in the absence of (statistically significant changes in) accidents or incidents? A similar paradox is relevant for research on what is now called ‘Safety 2’.

A strong focus on the internal validity of the research design favours research wherein only one factor is changed and evaluations are made over time. However, in many situations, safety takes place in organisational settings, whereby the context is dynamic and cannot be left out of the equation; otherwise the external value of the research will be very limited. We need combinations of academic research and practical wisdom; smart combinations of scientific and practical evidence.

Snowden (2000) distinguished four types of context. In simple and complicated contexts traditional scientific methods are fine. That is not the case for complex or chaotic contexts, where we have to deal with uncertainties (including the unknown unknowns), and ambiguities, and self-enhancing processes. Resilience engineering, high reliability organisations, post-normal science and risk governance, are four competing but also complementary ‘schools of thought’ to deal with safety challenges in such contexts, and develop appropriate research methodologies.

We also have to recognise that the safety research community is of limited size. We have to make optimal use of knowledge development in related areas (quality, sustainability, security) and of the many supportive (technological and social) disciplines. We also have to acknowledge that leading companies are developing innovative ways to improve safety in their organisation, which are sometimes not yet related to safety research.

### **Technology related challenges**

Technology is one of the main determinants of safety, and there is still a need for technology related safety research. A continuous challenge concerns the safety implications of emerging technologies. Technological developments go faster than ever, and it is important to proactively deal with the risks of new technologies (not only for safety, but also for health and environmental sustainability). New technologies can imply risks as well as opportunities for safety. This is illustrated by the information and communication technology. On the one hand ICT implies great opportunities for better monitoring, data gathering (big data?) and communication. On the other hand, our production systems are increasingly depending on the functioning of ICT systems, and a bug in the ICT system can easily imply (mostly unforeseen) safety challenges. Technological developments also imply opportunities for hazard reduction (inherently safer production), risk reduction through engineering solutions

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(robotisation) etc. Indeed there are great opportunities for synergies between safety and innovation (both technological and workplace innovation), but it seems that safety engineers and researchers, usually leave that for the researchers in science and technology.

### **Organisation related challenges**

Organisation is another main determinant of safety, and here we have seen a rapid proliferation of safety management systems. These were initially developed as 'one issue' management systems, but nowadays it is increasingly recognised that a stand-alone management system is not preferable: in critical periods businesses and managers give higher priorities to the core business. While safety managers are responsible for the functioning of safety management systems, the line managers are responsible for the safety performance. A first challenge is therefore to develop good safety performance indicators that have the potential to link the safety management system with business operations. However both for occupational and process safety it is not an easy task to develop a concise set of validated leading safety indicators with practical added-value.

A second challenge is to mainstream safety into normal business operations. The line managers (as well as the workers) are integrally responsible for production, including, among others, safety. Strategies to mainstream safety are therefore increasingly, in large organisations with management systems as well as small enterprises where these barely exist. What can research and development contribute to the slogan 'good safety is good businesses'? And under what conditions is it justified to say 'good business is good safety'?

This addresses is associated with the economic dimension of safety (the economic impacts of safety for organisations, society and personal life), the development of business and value cases, the effectiveness of economic incentives, etc. There is also the challenge to develop and evaluate long-term strategies for continuous improvement of safety (beyond interventions). Then there are questions how to deal with the pressure for cost savings and to make sure this does not chronically undermines safety margins (drift to danger or disaster - associated with cost cutting in areas such as maintenance, manpower and training, qualification of contractors, quality of suppliers, etc.)?

Other relevant issues are: What can be achieved via 'commitment strategies' such as those based on 'vision zero', as an alternative for traditional 'risk management strategies'? How can valuing safety become a natural aspect of the organisational identity? How can safety become a core value of organisations, and does that really make a difference? What moral aspects of safety are most important from a 'business ethics' or corporate social responsibility point of view?

### **People related challenges**

The third determinant of safety, the people aspects have become more important now that many technological and organisational issues are solved. The people aspects have a risk dimension (reducing human error and unsafe behaviour) and an opportunity dimension (making use of human capacities to improve safety including Reason's 'heroic recoveries') which come more to the forefront now that our workforces are better educated than ever. On the risk dimension I expect that the increasing prevalence of psychosocial hazards and their impact on work and behaviour will be increasingly recognised as *also* a safety issue. On the positive side, I expect that we will address and clarify the importance of human competencies, leadership, empowerment, social capital, etc.

Furthermore we have the challenges implied by interpersonal processes (associated with ambiguities e.g. leadership and communication), safety culture and safety in periods of organisational or personal change. There are issues about our (often unconscious) beliefs and the nature of our mind-sets which influence risk perception and safety awareness. There is also the challenge of social marketing of safety and using socialisation processes for that goal.

### **Addressing unintended consequences**

Another category of challenges that should be addressed are the unintended consequences of efforts to improve safety. An important issue is the 'risk regulation reflex', i.e. the reflex to come up with new procedures or regulations in the aftermath of a disaster or an accident. This leads to the bureaucratisation of safety, all too often leading to safety of the 'paper tiger' kind or, as the UK's Prime Minister called it: the health and safety monster. Indeed, not each action intended to improve safety achieves its goal, and often we don't know because a decent evaluation is not performed. It can easily turn out that a false sense of safety is generated. Similarly, we have to address situations of 'false unsafety'. Though this may seem irrelevant, in a dynamic safety perspective it is directly leading to useless actions intended to improve safety, which cost money and undermine the confidence in real safety measures.

### **The organisation and funding of safety research**

Finally, I want to underline the importance of European safety research, which has been stimulated very much by the SAFERA programme. The relevant research institutes are used to get the overwhelming part of their funding from national sources; they tend to see this as 'their natural funding'. From their perspective, international cooperation is certainly interesting and relevant, but at the project level it also implies additional costs, and challenges in terms of communication and cooperation.

At the same time, many national research funds have reduced funding available. The research institutes therefore struggle to maintain their research capacities, if not to survive. It is therefore not in their short term interest to spend part of the national available resources on international cooperation. I therefore want to suggest that the national research funding organisations earmark part of their funds (e.g. 20 %) as dedicated to European cooperative research projects, in order to overcome this.