



STRATEGIC ANALYSIS



“Human & organisational factors in high-risk companies”

Research seminar

January 24-26, 2018
Royaumont Abbey, France



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Welcome



On behalf of FonCSI, the Foundation for an industrial safety culture, welcome to the third strategic analysis on “Human and organisational factors in high-risk companies”. The five-year programme of the foundation (2015-2019) has commissioned the GSAS (Scientific Committee for Strategic Analysis) to conduct four strategic analyses within the 5 years :

- Skills and competencies
- Safety culture and safety models
- **Human and organisational factors in high-risk companies**
- New industrial organizations and safety.

Each analysis runs for 18 months and involves four steps under the responsibility of the same committee made of academics and industrial representatives.

The first step overviews the literature and prepares a plan for analysis, rephrases the problem, including the identification of world experts contributive to the domain.

The second step, where we are today, consists in a two-day residential seminar with invited international experts. An open access book to be published by Springer is planned to reflect content and debate of this second step.

The third step analyses the contribution, and confronts the material with industrial practices (how far the various academic concepts captured in step 1 and 2 have been ‘bought’ and ‘translated’ by industry, how far they have been recognized as relevant, efficient, at what cost, for what continuity of results).

The fourth and last step is a one-day seminar with industrial partners internalizing and mainstreaming lessons learned, thinking and practices.

This current seminar is an arena for debate and exchange. Even more important, I want it first and foremost to be a meeting place.

Enjoy the place and this opportunity to meet and share ideas with friends.

René Amalberti, CEO FonCSI



Position statement and expectations of the group



Human and organisational factors in high-risk companies. What strategies, for what purpose?

Many companies are keen for human and organisational factors (HOF) to be taken into account in industrial safety policy, albeit at different paces. Some companies recruited specialists a long time ago and have structured their approach, whilst others are still at the initial contact stage.

Depending on their context, companies can face difficulties in defining the notions of human and organisational factors and industrial safety. What are the concepts, the approaches by discipline and the professions (ergonomists, HF specialists, sociologists, etc.) that need to be mobilised? What relations should be built between a safety culture approach and an HOF approach?

In parallel, this raises questions about implementation strategies: how can a HOF approach to industrial safety be structured in a large group? Should it be centralised or organised according to the specific features of activities and local contexts? How should the role of HOF experts be organised and combined with networks and operational players? Should some of the expertise and knowledge be looked for outside of the company, or should the competencies of existing staff be developed? With what training? What are the most appropriate timeframes: should there be simultaneous implementation on a wide scale or should it be based on pilot operations?

The question of tools is also strongly present: are some approaches and methods considered to be international reference standards in a specific area of activity, to the extent that they can be quite simply imported directly into the organisation? Or is each organisation responsible for building its own approach?

Lastly, how can the extent of the company's inclusion of HOF be evaluated? What are the indicators that allow the degree of maturity and the progress needed to be measured?

These strategic and operational questions differ according to the origin of the decision to implement an HOF approach in the company. Is this a response to an external obligation, that requires justification to a regulatory authority? If yes, does this obligation make reference to more or less standardised methods? Is it an internal management decision, as a result of observations made in terms of internal or international accidents? Is it in line with the more general development of approaches relating to corporate social responsibility?

A company facing these questions must also accept that the issue of human and organisational factors is not limited to the challenges of industrial safety. In particular:

- The usability, even the attractiveness of products can mobilise specialist human factors in the design phase – whether the safety issues are obvious and important (aeronautics, railway equipment, industrial equipment, medical equipment, transport networks, IT processes) or less direct (tertiary IT, products for the general public).
- Productivity and production quality may already be the focus of approaches with an HOF dimension (work station ergonomics, lean production, motivation systems, etc.).
- Health and safety at work is probably already mobilising specialists in human functioning (work situation ergonomics, prevention of workplace accidents and work-related diseases, prevention of psychosocial risks, etc.)



- Human resources management relates to questions such as age and skill management, the organisation of inception courses, the prevention of psychosocial risks, etc.
- Social relations examine social dialogue, the dynamics of employee participation, discussions about the work, etc.
- The structure of management messages (operational excellence, lean, coaching, etc.) more or less explicitly includes a vision of the human and organisational factors.
- Lastly, corporate social responsibility efforts and the developing obligation for large companies to engage in non-financial reporting also raise the question of the place of human beings in global performance.

These various issues are subject to a variety of standards and norms: ISO 9000 (quality), ISO 10002 (customer satisfaction), OSHAS 18001 (health and safety at work management system), the future ISO 45001, ISO 14001 (environment), ISO 26000 (social responsibility), all of which more or less explicitly include a vision of the human contribution to the overall company performance.

Depending on the industrial group, their history (and notably the nature of their risks, the accident history of the branch and the practices of their regulatory authorities), these different challenges vary in importance. They mobilise skills in human and social sciences to a greater or lesser extent, assigned to various departments. They make reference to various areas of activity, which may be managed in isolation or linked by inter-departmental collaborations. They have become a part of the culture of the organisation and of all managerial practices to a variety of degrees.

And yet, the “human and organisational factor” approaches that are implemented to meet these various objectives can have quite substantial differences. The aspects of the human being that are mobilised (biological, cognitive, psychological, social dimensions) can be very diverse. The same applies to the organisational models that come into play: is the organisation seen as a structure that is implemented and/or as a set of social interactions? The players who are recognised as being necessary to drive change can also vary: do we count on expert-led top down methods and/or participative approaches – what types of coalition and negotiation does this involve?

A company that wants to develop the consideration of human and organisational factors of industrial safety is thus directed towards a set of new questions. Does progress in industrial safety suppose that there are links or confrontations, and if so of what type, between the issues and competencies specific to this area and the other dimensions of the human being at work that are dealt with by other specialists in other areas of the company? Is it possible/desirable/necessary to achieve a unified vision of the place of human work in productive performance, notably within the Executive Committee / Board of Directors, and more broadly along the chain of command?

What are the pathways, either existing or needing creating, that facilitate the shift from an “HOF approach” led by specialists, to a “generalisation” of the taking into account of human and organisational factors in all practices and notably managerial? What can be learned from the collective reflective processes of the stakeholders bearing these various issues and skills (professional inter or intra-company seminars for the various professions leading to the HOF being taken into account)?



Is it possible to anticipate developments in society (changes in the employee population, in public opinion, managerial methods, regulations, etc) that would be likely to modify the industrial issues and the responses to these questions?

The aim of the academic seminar on 24-26 January 2018 is to allow the discussion of these questions between the invited international experts and the permanent experts of the strategic analysis group.

Some more questions

The issues presented can be summed up as the following list of themes:

1. How can a HOF approach to industrial safety be structured in a large group?
2. Is it possible/desirable/necessary to achieve a unified vision of the place of human work in productive performance, notably within the Executive Committee / Board of Directors, and more broadly along the chain of command?
3. Shift from an “HOF approach” led by specialists, to a “generalisation”?

How can a HOF approach to industrial safety be implemented in a large group?

The history of Human and Organizational Factors in industry varies from one company to another. Yet, a common core of questions arises regarding the structuring and organizing of such approaches:

- What are the triggering factors? What leads to considering there is a HOF issue as such to be addressed as such (accident, pressure from regulatory body, keen internal suggestion from impassioned stakeholders, new trends and fashions in the industry ...)?
- What is the importance of the “labelling” process of the implementation of HOF approaches to industrial safety? Should a clear claim be given to the wording “HOF”, or does it matter if one does it even if it is not labelled as such?
- How can safety related HOF be structured, resourced and deployed in a large group (steering from a central department vs. distributed net in local units, necessary resources, competences, ...)?
- What is the influence of the existing HOF “market” offer (from consultancy firms and the academy) on the outputs of such approaches?

Is it possible/desirable/necessary to achieve a unified vision of the place of human work in productive performance, notably within the Executive Committee / Board of Directors, and more broadly along the chain of command?

Human and Organizational Factors embed a vision of the contribution of human work to industrial performance (which is not only compliance to rules and procedures); as well as a vision of organizations seen not only as structures, but also as living processes of organization. These paradigms may be far from the top managers’ representations of human work and organizations.



In this context:

- To what extent does the successful implementation of HOF in industrial safety require a prior “conversion” of the managers to these views? Should one bet on a progressive evolution, or is a kind of rupture necessary?
- Should HOF explicitly incorporate the role of top management decision making processes as a contributing factor, emphasising the importance of thinking both human factors & organisational factors?
- Should the implementation of an HOF approach be supported by broad training campaigns for everyone, including senior executives?
- Should HOF be used as a tool to support a reflective approach of managers on their own activity and that of their teams?

Shift from an “HOF approach” led by specialists to a “generalisation”

The issue of generalisation may be viewed in different perspectives:

- HOF concepts disseminate in the different activities and processes of the organization (design, maintenance, operation, etc);
- The number of sponsors of HOF approaches among managers increases;
- Bringing in HOF approaches in the organization’s processes becomes commonplace;
- There is a shift from interventions led by HOF specialists to the development of basic common skills embedded in managers’ normal activities (e.g. collecting data after an event);
- Etc.

To what extent do the progresses in HOF analyses lead to corrective actions that are less individual-centred and more focussed on organisational issues? Is there a “glass ceiling” to the possible influence of HOF on fundamental organisational issues, namely that senior managers include themselves as first actors of the HOF of the organisation? What are the ways to challenge it?



Programme



Wednesday, January 24, 2018

17:00	Registration at the hotel
20:00	Welcome dinner

Thursday, January 25, 2018

7:00-8:30	Breakfast
9:00	Opening session <ul style="list-style-type: none"> • Welcome address by René Amalberti, Director of FonCSI • Position statement and expectations of the group by Claude Gilbert, President of FonCSI's Strategic Analysis Committee
9:30	<ul style="list-style-type: none"> • Brendan Ryan: <i>"Accounting for differing perspectives and values: the rail industry"</i> Debate launched by Hervé Laroche
10:30	Coffee break
10:45	<ul style="list-style-type: none"> • Kathryn Mearns: <i>"Safety leadership and HOF: where do we go from here?"</i> Debate launched by Christian Neveu
12:00	Lunch
13:45	<ul style="list-style-type: none"> • Ivan Boissières: <i>"Organisational factors, the final frontier?"</i> Debate launched by Philippe Noël
14:45	<ul style="list-style-type: none"> • David Woods: <i>"Developing strategic agility for organizations in a turbulent world"</i> Debate launched by Valérie Lagrange
15:45	Coffee break
16:00	<ul style="list-style-type: none"> • Caroline Lacroix: <i>"Risk management and judicialization"</i> Debate launched by Claude Gilbert
17:00	Wrap up
18:00	Guided tour of Royaumont abbey
20:00	Dinner



Friday, January 26, 2018

7:00	Breakfast
8:30	<ul style="list-style-type: none"> • Daniel Maurino: <i>“Turning safety into a business function: is this the end of the innocence?”</i> Debate launched by Benoît Journée
9:30	<ul style="list-style-type: none"> • Paul Schulman: <i>“Integrating human and organizational factors in the analysis of safety and risk”</i> Debate launched by Corinne Bieder
10:30	Coffee break
10:45	<ul style="list-style-type: none"> • Florence Reuzeau: <i>“The key drivers to set up a valuable and sustainable HF approach in a high-risk company as Airbus”</i> Debate launched by François Daniellou
12:00	Lunch
13:45	Synthesis
14:30	Conclusion and follow-up
16:00	Shuttle to Airport



Participants



Key speakers

Ivan Boissières, ICSI, France

Ivan Boissières is General Manager of the Institute for an Industrial Safety Culture (ICSI), an organization in the field of industrial safety. He holds a PhD in the sociology of organizations, and since 2010 has been Affiliate Professor at ESCP Europe. His work focuses on the managerial and strategic dimensions of safety, based on three principal themes: human and organizational factors, safety leadership, and safety culture. Finally, he is a member of various commissions and committees.

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Caroline Lacroix, University of Haute-Alsace, France

Caroline Lacroix is research Professor in private law and criminal sciences at the University of Haute Alsace and member of the European Center for Research on Risk, Collective Accidents and Catastrophic Law (CERDACC). Her research focuses on the restoration processes and compensation efforts deployed for disaster relief. Her current work more directly deals with the role played and value added of justice and criminal law in the evaluation of major risks and the rights of victims.

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Daniel Mauriño, ICSI Latam, Argentina

Daniel Mauriño is the Technical Director for ICSI Latam. He was the coordinator of the Flight Safety and Human Factors Programme for the International Civil Aviation Organization (ICAO) since its inception in 1989 until its integration into the Safety Management Programme in 2004. He was subsequently appointed project manager for the Safety Management Programme since 2004 until his retirement in 2010. Dan is a former airline captain.

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Kathryn Mearns, Amec Foster Wheeler, United Kingdom

Dr. Kathryn Mearns has worked on human and organizational factors in the offshore oil and gas, nuclear, air traffic control, healthcare, manufacturing, maritime, construction and power generating sectors. She has over 100 publications and conference presentations in her 25 years experience as an academic, regulator and consultant.

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Florence Reuzeau, Airbus, France

Florence Reuzeau is an Aviation Engineer and has a PhD in cognitive ergonomics. She entered Airbus in 1988. She set up the Integration of Human Factors in Design and Certification and installed the Human science competences (psychology, physiology, sociology, learning,..) in the various organisations of Airbus. She is currently Human Factors Executive Expert (July 2014) for Airbus overall including Airbus Commercial, Defence and Space and Helicopters. She is European expert for European Research program evaluation.

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Brendan Ryan, Nottingham University, United Kingdom

Brendan Ryan is an Assistant Professor at the University of Nottingham. He has a broad range of experience of research in rail human factors, with established working relationships with Network Rail, RSSB (Rail Safety and Standards Board), ERA (European Railway Agency) and UIC (International Union of Railways). His research has had a particular focus on what people do at work, what can go wrong, and the evaluation of safety interventions. Recent work has focused on prevention of rail suicide and trespass. Brendan has also worked as a National Accident Investigator at Network Rail in Great Britain.

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Paul Schulman, Mills College, USA

Paul R. Schulman is a Senior Research Associate at the Center for Catastrophic Risk Management at the University of California, Berkeley and Emeritus Professor of Government at Mills College in Oakland, California. He has written extensively and consulted on managing hazardous technical systems to high levels of reliability and safety, within organizations and across networks of organizations. He has been a consultant to the Canadian Nuclear Safety Commission, the California Independent System Operator and the California Public Utilities Commission.

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David Woods, Ohio State University, USA

David Woods is Professor at the Ohio State University in Department of Integrated Systems Engineering. He began developing Resilience Engineering in 2000-2003 as part of the response to several NASA accidents and is Past-President of the Resilience Engineering Association. Over his 39 years of R&D on the interaction of people and technology in high risk, high performance settings, he has received many awards.

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Strategic analysis committee

René Amalberti, FonCSI, France

Doctor of Medicine and Cognitive Psychology, a former Chair and Professor of Medicine at the Val-de-Grâce military hospital, René Amalberti was previously healthcare safety advisor at the French National Health Authority (Haute autorité de santé) and Risk Prevention manager at a medical insurance company (the MACSF group). He has been Director of FonCSI since June 2012.

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Corinne Bieder, ENAC, France

Corinne Bieder is an engineer and holds a Master's Degree in Risk Management and a Specialised Master's Degree in Ergonomics. After working at EDF, Dédale and Airbus, she joined ENAC (the French Civil Aviation University) where she is responsible for the Safety and Security research program.

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François Daniellou, ICSI-FonCSI, France

A graduate of the *École Centrale de Paris* and Professor of Ergonomics, from 1993 until spring 2015 François Daniellou taught at the *École nationale supérieure de cognitive* at the INP Bordeaux, where he headed the Department of Complex Systems Ergonomics. His research interests notably include human factors in hazardous industries (nuclear, chemical, etc.) and the prevention of psychosocial risks. He became Scientific Director of FonCSI and ICSI in September 2015.

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Claude Gilbert, CNRS, France

Claude Gilbert is Director of Research at the CNRS and a political scientist. He has run several research programmes on collective risks and crises. He chairs the Economic, Ethical and Social Committee of the High Council of Biotechnologies. Claude Gilbert is president of the FonCSI's Strategic Analysis Committee.

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Nicolas Herchin, GRTgaz, France

Nicolas Herchin is program manager in the Research and Innovation division of GRTgaz, in Paris. After graduating from École Centrale de Paris (2007) and Cambridge University, UK, he has been leading since 2010 a project in the field of Industrial Safety and Risk Management, particularly considering Human and Organizational Factors of Safety. His key realizations include HOF accident and risk analysis, “collective mindfulness” diagnosis, HOF trainings and sensitization, and work on developing a just culture.

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**Benoît Journé, Nantes University, France**

Benoît Journé is a Professor at the University of Nantes in France, researcher at the LEMNA. He works on high reliability organizations and human factors. He is head of the RESOH research project at the *École des Mines de Nantes*.

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**Valérie Lagrange, EDF, France**

Valérie Lagrange holds a PhD in Ergonomics. For 15 years, she has been the Safety management & Human Factor Expert at the Corporate level of the French nuclear fleet. She designed strategies for the development of safety management & Human Factor approaches. She led international missions with the IAEA and WANO. She has been Head of the Human Factor group’s research and development center of EDF.

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**Hervé Laroche, ESCP Europe Paris, France**

Hervé Laroche is a Professor in the Strategy, Organizational, Behaviour and Human Resources department at ESCP Europe. His research concerns strategic decision processes, strategy formation, decision-making under risk and organizational reliability. He is director of the PhD programme at ESCP Europe and scientific co-director of the Specialized Executive Master in Human and Organizational Factors of the Management of Industrial Safety.

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**Jean-Christophe Le Coze, INERIS, France**

Jean-Christophe is a safety scientist with an interdisciplinary background, including engineering and social sciences. He works at INERIS, the French national institute for environmental safety. His activities combine ethnographic studies and action research programmes in various safety-critical systems, with an empirical, theoretical, historical and epistemological orientation. Outcomes of his research have been regularly published in the past 10 years.

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Christian Neveu, SNCF, France

Christian Neveu is head of the Organizational and Human Factors (OHF) section of SNCF's System Safety Department. After 25 years in the railway business, he joined the safety department in 2008 to deploy OHF integration initiatives in all SNCF group activities. Holder of an executive master's degree in OHF, he is also an expert with the Nuclear Safety Authority, chairman of the FOH working group of the International Union of Railways and speaker at the European Union Agency for Railways.

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Philippe Noël, Total, France

Philippe Noël holds a degree in chemical engineering and an Executive Master in human and organizational factors. In 2009, he joined the Refining and Chemicals branch of TOTAL as Safety Management Systems Coordinator. In parallel of the deployment of an internal HSE standard, he was invested since 2012 in Safety Culture aspects through the integration of human and organizational factors. He works now as Safety Culture Program Manager since 2015.

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Myriam Promé-Visinoni, ICSI, France

Myriam Promé holds a specialised Diploma in Ergonomics. She was the “Human and Organisational Factors of Safety” expert for the Areva group, where she participated in the deployment of safety/security culture at all levels of the organisation. She has more than 25 years’ experience of working in various industrial sectors, both in France and elsewhere. Myriam is responsible for training in “Finding root causes in event analysis” at ICSI and leads the Discussion Group on the human and organisational factors of event analysis.

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Scientific coordination & Organisation

Caroline Kamaté, FonCSI, France

Caroline holds a PhD in immunology. She has post-doctoral experience in academy (University Medical Center, Utrecht, Netherlands) and in industry (Sanofi-Aventis, France). Her interest for scientific communication led her to join FonCSI in 2007 where she is involved in the management of research programmes and the dissemination of results. She coordinates three strategic analyses: “Skills and competencies for industrial safety”, “Safety culture and safety models” and “Human and organisational factors in high-risk companies”.

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Abstracts – Position statements



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- *Organisational factors, the final frontier?,*
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Accounting for differing perspectives and values: the rail industry

Brendan Ryan, Nottingham University, United Kingdom

My background is quite diverse: Environmental health and safety inspection and enforcement; consultancy; accident investigation; research and teaching in ergonomics. For the last 14 years my focus has been on rail ergonomics. I have had the opportunity for different perspectives on work; as an observer, interviewer, auditor (of documents and processes).

Key aspects of the FonCSI project include safety culture and effectiveness and efficiency of safety governance, bridging academic knowledge and practice. There is a particular focus on the implementation of human and organisational factors (HOF) approaches: how do organisations deal with this, either internally by developing knowledge and training or with expert help from outside; safety culture approach vs HOF approach; centralised or localised; top down or participatory; specialist led initiatives or HOF in all practices?

Working in and studying the railway context gives some unique insights that contributes to the FonCSI goals: the railway is complex; distributed in time, space and function; dynamic/changing, though with many legacy systems; significant production pressures; multiple jobs and roles and influence from outside (e.g. public, customers). There is rarely one organisation involved (inter-organisational relationships and influences) (Stiles, Golightly and Ryan). Questions around maturity of safety/HF approaches need to be considered across multi-organisational projects. How do people perceive the culture of the project, their own organisation, other organisations (see also the safety culture stack by Eurocontrol)?

Much of my work has focused on the following: What do people do? What can go wrong? Do safety interventions work and in what circumstances? Early work in this area included function or activity analysis and risk assessment. This looked in depth at maintenance processes, especially traditional systems of access (getting people to the place of work on the track), considering production and safety risks, and the tension or trade-offs between these (Wilson et al, 2009). Lessons are being used now to inform new maintenance opportunities as the railway and associated technologies are changing (e.g. access for robots, drones). Qualitative, descriptive approaches were valuable (Schock, Ryan, Wilson), obtaining value by looking harder and doing a lot with what is seemingly a little. However, there were difficulties in collecting, interpreting and representing the breadth of relevant information (efforts included the HF Case, also Kirwan, Eurocontrol), in particular so that it resonated with the industry. Resilience engineering has been an attractive concept in considering the different priorities and values (Ferreira, Ryan, Sharples, Wilson), though non-experts can encounter difficulties. What do people (e.g. practitioners) understand about concepts such as emergence or resonance (Farooqi, Ryan, Cobb)? The work on rail engineering has been developed to produce a macro understanding of a wider set of roles in the industry in a framework to support the integration of human factors in railway processes (Ryan et al, for ERA). The central focus has been on understanding and promoting the roles of people (frontline staff), mapping human functions to system goals, and identifying safety relevant activities and examples of the contexts in which these are carried out.

Our clients often have a different understanding of the role of HF experts. We can usually get agreement of a project remit in principle, but it can be difficult to obtain full commitment to our HF approaches and simple things can overcome successful implementation of HOF projects, such as time, day to day support, access (Ryan, Wronska, Stevens), especially when HOF projects are not aligned carefully enough to the day to day work and architecture of the industry.

What do the business leaders want and need, when reflecting on concepts linked to HOF? Interviews with 25 of the most senior executives and managers in the industry focused on the structure of the industry, safety leadership, change management, decision-making, goals and objectives (Nolan-McSweeney, Ryan and Cobb). These interviews identified challenges of misaligned goals, unclear roles, ambiguous authority, silo focused employees and



resistance to change. There was commonly mixed opinions (e.g. on whether to restrict or widen responsibilities of staff). Funding of the railway was frequently mentioned as a constraint in an industry with funding over five year periods. Many advocated the need for implementation of a matrix organisational structure to cope with complexity, embracing change in a dynamic environment and respond to customer needs. Safety leadership may be a vital component (Stiles, Ryan, Cobb), though how this is applied and the factors affecting this can be different across parts of the supply chain. There are many examples of top-down business change (e.g. simplifying large numbers of industry standards to produce a set of 100 business critical rules, Nolan-McSweeney, Ryan, Cobb), but it is not easy to ensure that these can be accepted by and applicable to frontline staff (to be explored in future work). Interviews have also been used with leaders of business functions to explore implementation of policy on additional concepts (e.g. sustainability, Ryan and Wilson). Other wider scale consultation with operational staff (n=4000) has been completed using the REQUEST audit tool (Ryan et al).

The railway is usually safe, but not always. Rail suicide and trespass fatality incidents (Ryan), occur somewhere on most days on the railway and are constant reminders of the fragility of life and the threats to the operation of the rail system. By taking a new perspective of the railway system, what can be learned about distributions of events, the influencing factors, the value of incident investigation and the type of ethical decision-making that is needed?

Our vision is not necessarily the same as others (e.g. HF vs engineers vs industry programme managers). The relative importance of people, the environment, technology and the system may depend on the focus or purpose of the work, or the framing of the question. What steps are needed to recognise a broad range of values (e.g. safety, production, cost, sustainability, ethics, diversity, customer satisfaction, innovation) in developing a more supportive culture, spanning multiple organisations in this type of industry?



Safety leadership and HOF: where do we go from here?

Kathryn Mearns, Amec Foster Wheeler, United Kingdom

After 25 years of working on human and organisational factors (HOF) in high-risk industries, my paper is a reflection of the frustration I feel at the lack of progress in persuading (or convincing) senior managers to take HOF seriously.

I have worked in the offshore oil and gas, conventional power generation, air traffic control, shipping, healthcare and nuclear sectors. Some of these industries seem to take the 'Human' in HOF seriously, particularly human factors in design, ergonomics and human performance at the individual and team level, e.g. crew resource management and non-technical skills training. However, addressing organisational factors appears to remain a challenge.

Measuring safety culture/climate is my main area of research and practice although recently I have also been involved in assessing safety leadership. I believe that these assessments provide insight into the organisational factors that can potentially contribute to adverse events in the future. Over the past 25 years, I have found that, no matter what the industry, the same issues emerge from safety culture/climate assessments: perceived lack of senior management commitment to safety; inadequate communication; inadequate procedures; inability to 'speak up' about safety and lack of organisational learning. On providing senior managers with feedback from their safety culture/climate surveys, there is often disbelief that the workforce can view the organisation in the way they do. As a result, there can be a reluctance to do anything about the findings. Action plans are developed but evidence of serious implementation is not necessarily forthcoming. Senior managers are very good at talking about the importance of safety but seem less able to address the organisational issues that undermine safety. Why is this?

One possible reason is that the regulators of high-risk industries also seem to have struggled to address both HOF and leadership for safety. Without the threat of enforcement, there is limited incentive for managers to take action. However, the UK Office for Nuclear Regulation (ONR) has recently issued guidance for inspectors to assess Leadership and Management for Safety based on four Safety Assessment Principles (SAPs): MS1 - Leadership; MS2 - Capable Organisation; MS3 - Decision Making; MS4 - Learning Organisation. Each SAP consists of a number of components, e.g. Leadership attributes; Control of organisational change; Decision-making processes and Learning culture, etc. Other regulators, e.g. the Health and Safety Executive (HSE) and industry bodies, e.g. Energy Institute have issued safety leadership guidance in response to the UK's Corporate Manslaughter and Corporate Homicide Act 2007. I believe that clear guidance and strong regulatory scrutiny, may be the only way to provide the necessary incentive for organisational leaders and senior managers to focus on improving their own decision-making processes and behaviour and appreciate the central role they play in developing and reinforcing HOF within the organisations they are responsible and accountable for.



Organisational factors, the final frontier?

Ivan Boissières, ICSI, France

A large number of high-risk companies often present the incorporation of human and organisational factors (HOF) as the last step in their safety strategy, after having first taken essentially technical then procedural measures. There is no doubt that this approach has allowed progress to be made in the dissemination of the major concepts illustrating the human contribution to safety (growing acceptance of the difference between the prescribed approach and reality, promotion of managed safety as a complement to rule-based safety, shifting away from purely behavioural approaches), as well as providing a certain structure to the place given to HOF in the workplace (generalisation of training in this area, networks of correspondents or internal consultants, creation of dedicated departments, etc.).

However, some practices are struggling to truly evolve.

- Major reorganisations are still essentially technocratic in their structure and rarely anticipate their impact on work groups and safety.
- Investment in HOF skills training for operational managers – beyond the veneer of awareness-raising training but with no real follow-up – is very difficult to obtain.
- The enlightened leadership of some managers cannot compensate for the high turnover of staff, so possibilities for sustaining efforts are limited.
- Safety is still only marginally integrated into the organisation's key processes (design, HR, finances, etc.), meaning that its place in the strategic decision-making process can be seriously weakened when the company is experiencing financial turbulence.
- Etc.

On closer inspection, these blockages seem to be concentrated around organisational factors in the broadest sense of the term. Could it be that the catch-all term HOF actually hides a much more nuanced reality? On the one hand there is the progress made by the HF approach, which focuses closely on workers and the reality in the field, while on the other hand there is a relative failure to redraw the lines of the organisational and managerial model, both in terms of strategic and change processes.

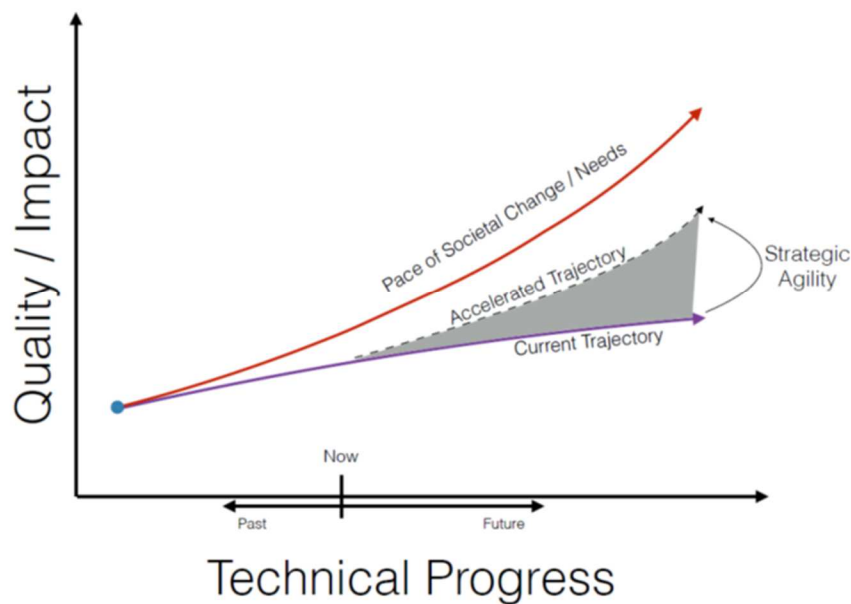
This is the hypothesis that we propose to examine in more detail through an assessment of actual approaches to human and organisational factors of safety (HOFs) carried out for more than 10 years in high-risk companies. Going beyond the conclusions that could be drawn, we will pay particular attention to the potential causes of this blockage, not from the demand side (resistance from organisations to making changes to their practices) but from supply on the organisational factors side: suitable profile of mainly HF experts (psychologists and ergonomists, to the detriment of sociologists and managers whose presence is still scarce in this field)? An uncomfortable relationship with company leaders (the fear of being instrumentalised or losing legitimacy on the ground)? Difficulty in gaining ownership of these areas (change management, management leadership, organisational processes) as they are mainly covered by generalist consultants and gurus considered to have weak scientific grounds for their theories?



Developing strategic agility for organizations in a turbulent world

David Woods, Ohio State University, USA

Today's innovation organizations must be agile and resilient in a rapidly changing, complex interdependent world. Successful groups within such organizations often have the potential to function with agility and resilience, based on a proactive tactical mindset. But this approach needs to be supported by strategic agility to adapt to a faster changing and more complex world. The challenge is illustrated in the figure below. While the quality and impact of specific innovation and research groups' activities grow, the trajectory can not keep pace with the rapid change in societal needs as new opportunities arise, complexities grow, new threats emerge. Organizations as a whole need to develop strategic agility to accelerate the trajectory of technical developments to match the scale and pace of societal change as indicated in the figure. The new efforts to be proactive strategically, coordinated across all parts and levels of an organization, must dynamically balance a wide range of activities that address different time scales of change and adaptation.



Management needs to develop and support mechanisms to build strategic agility. This challenge is not unique to a single entity but applies to all R&D and innovation organizations today. Strategic agility is not simply a matter of top down directions from management or increasing resources to increase the output rate of specific groups. The qualities and track record of specific research groups are one important ingredient to be strategically agile. Strong interdisciplinary groups can function as leading catalysts that link science and innovation to human and societal factors. In order to seize this opportunity, the entire R&D process, management, and research groups need to be more agile, flexible and aggressive. This is not just a state of mind, but also refers to a type of leadership which sets the conditions for the organization, in collaboration with partners and stakeholders, to develop these necessary capabilities.



Risk management and judicialization

Caroline Lacroix, University of Haute-Alsace, France

The question of the judicialization of risky activities has just found a new example in the recent news. On October 31th, 2017, the Paris Court of Appeal convicted the Grande Paroisse company and his director about the AZF disaster case.

In France, the trend towards criminal justice for major risks is a process that is effectively and widely observable. It is essential for all risk activities.

This process of criminalization of major disasters is not without raising questions or oppositions. In particular, it is argued that the fear of the criminal court imposes a strict respect for procedures, thus limiting innovation and ultimately undermining security.

This protest movement is particularly marked in civil aviation. In 2006, the Civil Air Navigation Services Organization (CANSO), the Royal Aeronautical Society in England (RAeS) and the National Academy of Air and Space (ANAE) in France, adopted a Resolution on the penalization of aviation accidents in which the signatory organizations stated that they “(...) are convinced that judicial investigations and criminal proceedings in the context of aviation accidents can affect the efficiency an investigation into the circumstances of an accident, and to prevent the probable causes from occurring in a timely and accurate manner, and to draw recommendations to prevent its recurrence”. Such a position has been reaffirmed several times. For example, in the “Charter for a Just Culture”, on 2009 March 31th adopted by the social partners of the European civil aviation sector and in resolutions adopted at the 38th session of the International Civil Aviation Organization in October 2013 in Montreal. This promotion of a “culture of security” would be in opposition to the philosophies of “just culture” and “blame culture”.

The philosophy of “just culture” would be part of the concern to give the actors a margin of maneuver sufficient to allow them to share their mistakes during security investigations without the risk of being systematically prosecuted in criminal cases. However, the criminalization of disasters would lead precisely to the opposite effect: the actors fearing to be pursued criminally would prefer to remain silent. This would cause a lock in the feedback experience.

Accidents and disasters are often caused by a combination of factors: compliance with standards, rules and procedures, and behavior of safety actors. The industrial security policy is analyzed by the criminal judge. This will stigmatize the absence, the inefficiency of the implementation of this policy. The judge is also interested in human and organisational factors in high-risk companies.

In reality, through the judgments rendered is recalled the essential respect for safety in high-risk institutions. The analysis of the various decisions rendered makes it possible to draw up a typology of the behaviors that can lead to the conviction as well as the profile of potential leaders in the event of a disaster. Beyond the last protagonist chronologically at the origin of the disaster, the chain of causalities extends to the decision makers. In court decisions, we find not only the decision-making and security hierarchy of the company, but also the simple performers. Beyond, these malfunctions in terms of security, can also be attributed to the legal person. In the end, these court decisions also make it possible to build HOF's approach to industrial safety in a large group.

The AZF disaster has highlighted the problem of security in industrial sites related to outsourcing: dilution of information, training, the involvement of men in a team. This is an increased risk factor. In the context of an industrial security approach in a large group, the question of delegations of authority will also be the focus of the debate.



Turning safety into a business function: is this the end of the innocence?

Daniel Mauriño, ICSI Latam, Argentina

Safety is the Holy Grail of sociotechnical systems. It is zealously lauded and its importance is extolled with almost religious fervour; in fact, it is frequently asserted as the first priority of the organization. However, when the time comes to – borrowing from the American vernacular – “put the money where the mouth is”, zeal and religious fervour capitulate to rational pragmatism.

Approaches to safety throughout the history of sociotechnical systems are a compendium of shifting paradigms supported by a range of engineering and social disciplines that reflect specific needs at particular times. From the early days of “operate-break-fix-operate”, through system safety, through Human Factors, through organizational factors, through “cognition in the wild”, different disciplines have contributed to the success and the containment of failure of sociotechnical systems, safety-wise. Yet, sociotechnical systems have been unable to alter the status of safety within the organizational hierarchy: safety might be asserted as the first priority, but in actual organizational life is a simile of the sweepers who clean the garbage at the rear end of the parade.

A number of reasons underlie the role of safety in socio-technical systems as organizational garbage sweeper; only two are mentioned. First and foremost, safety has been historically addressed as an outcome, without much focus on its building (or destroying) blocks; this is, on its underlying processes. Second, safety has been overloaded with ethical and moral overtones, thus becoming rather abstract and ethereal, and foreign to the language of those accountable for the bottom line of the organization: delivering the service or generating the product within existing (and always limited) resources. Thus, safety becomes a heavy burden beyond the possibilities of the most determined sweeper to brush off.

The proposal underlying this paper is that if safety is to meet the social imperatives of the present day, and support the needs of sociotechnical systems in the Twenty-first Century, it must become a business function, along the same lines and at the same level of the financial, legal, quality, human resources or any other business function of the organization. Safety must be “brought down to the earth” from its philosophically lofty but in practice hollow perch.

It is suggested that the tool to achieve this transition is a system for the management of safety that evolves from the integration of knowledge from system safety, human, organizational and cognitive factors, and business management practices, surrounded by a protective cocoon of institutional arrangements. Procedures and a language that parallel the procedures and the language of other business functions must guide safety. The output of such management system would support an evidence-based allocation of safety resources. Central to this system is the operation of an effective front-line employee safety reporting programme.

This paper provides an outline of such a system, and suggests an agenda for research to fill-in voids product of the so-far piecemeal attempts at developing such management system in transportation industries.



Integrating human and organizational factors in the analysis of safety and risk

Paul Schulman, Mills College, USA

My statement is presented in the form of the following propositions:

1. Human and organizational (HO) factors are essential to understanding safety and risk in technical systems. They have been shown to have a major role in accidents. High-hazard organizations are always in fact operating socio-technical systems.
2. HO factors are beset by large conceptual, technical, methodological, practical and political differences from those physical factors applied to the analysis of technical systems. HO concepts and definitions are typically expressed in natural language with all of its ambiguities and imprecision. "Safety" itself is conceptually ambiguous (Is it really defined by accident rates or through risk calculations?). As variables HO factors often are treated as nominal categories rather than expressed in continuous scales of measurement.
3. But to understand, assess, manage and regulate safety and risk we will have to combine both physical and HO factors in additive ways in analyses that describe the interactions between the two.
4. One potential arena for this integration is the analytic process of risk analysis and assessment widely practiced in academic, production and regulatory organizations.
5. Currently these analyses focus primarily on physical variables. HO variables are neglected and indeed resisted as subjective, ambiguous, arbitrary and subject to unreliable measurement.
6. But HO variables can be more carefully defined and can be represented through proxy measures and indirect indicators. For example, communication patterns can be mapped as proxy measures of authority. Attitudinal surveys can be used as indicators of culture.
7. In addition, ambiguities in HO factors and their measurement can be important in tempering a false precision in probability and consequence estimates of many risk assessments. HO factors can allow the incorporation of uncertainty in risk and risk mitigation models.
8. To improve efforts at additive and interactive risk and safety analyses more flexibility in the scope and time-frame of analysis might be helpful.
9. Micro-level operations analysis could reveal how physiological factors, communication patterns, perceptions and attitudes affect the real-time performance of specific tasks in operations and maintenance.
10. Larger, organization-wide or inter-organizational analyses over longer time spans can reveal how planning, leadership strategy and goals, rewards and punishments, training and aspects of organizational culture affect behaviors over time in design and operation of technical systems that affect their safety and reliability.
11. A wider range in analytic scope and time-scales may reveal new impacts of HO factors on safety, with potential generalizations across diverse organizations, beyond HO analyses grounded in single case studies. These findings can also inform us about challenges to the management of safety implicit in features of technical design.



The key drivers to set up a valuable and sustainable HF approach in a high-risk company as Airbus

Florence Reuzeau, Airbus, France

The development of HOF approaches in a large group depends on the expected benefits, obligations (certification), induced cost and organisational structure of the company. Airbus performed historical investment in HOF approaches in the industrial production mainly for Health & Safety considerations. In 1984, the first “Ergonomics department” was set up in the manufacturing organisation to develop the “work analysis” as a key methodology to support the introduction of new and novel machines, tools, product lines, new buildings. This included the working organisation, job instructions, training, etc. In 1993, it was decided to get one ergonomist position per plant and assembly line to support the management decision. The great diversity of Human factors issues (physical ergonomics, cognitive ergonomics, health, mixed workers generation, competences, robots/cobots, new technologies as augmented reality, ...) and the chasing of non-quality induced by human, make this job quite challenging. Today, they are engaged in the digital transformation through the factory of the future. Airbus mandated an ergonomist coordinator to gather and share the best practices among the facilities distributed in Europe.

The Airbus Training Center was also provided with a small team of Human Factors competences in charge of developing and deploying the Crew Resource Management courses

Early 1990’s, it was decided to set up a new HF organisation for supporting the commercial aircraft design process with the objectives to enhance safety and customer efficiency. Even if this evolution was first initiated by an Airbus employee, it must be put in the context of an epoch for aviation and human science. 1996, the US authorities threw a worldwide review of HF integration in the aeronautical domain, FAA called very well-known and legitimate HF scientists. Following upon statistical analyses of the commercial accidents and incidents, it was pointed and still point the human errors as a first-rate causal factor. At the same time, it had become obvious that the human sciences had not only an explanatory value of the aviation accidents but should also provide a positive contribution in aircraft design and operations. Then a first lever to get an efficient HOF approach was the “FAA strong recommendation” to use the “at the edge human science knowledge». This shared awareness between industries, academics and regulators gradually drove to an evolution of the certification texts. Standards and regulations are today available to support the new projects (CS 25-1302, RTCA SC-233).

Airbus fully defined and integrated its “HF design & certification process” as part of its engineering processes as quality, safety, and validation processes. Today it is considered as a mature process to address the current Human challenges. The Airbus Human Factors Design Process (HFDP) is a set of activities at system and aircraft level that consists in Defining (1) the end-users tasks and needs;(2) the HF issues related to human(s)-machine interaction; (3) the HF objectives to demonstrate: the HF issues and the expected performance;(4) the validation plan and demonstrate the HF objectives through analysis or simulation with end-users in the loop using a scenario-based approach; and finally demonstrating the compliance to HF certification. The HF process application is led by HF specialists who are working in an integrated team (end users, designers, HF) for the duration of a technical project. As for the other Airbus processes, standardisation is key and can be considered as a second lever to set up a long-term change in the industry: the Airbus design office is counting several thousands of engineers over the world and even more when encompassing the extended enterprise perimeter. Standardised HF process, requirements and guidelines (as a Cockpit Philosophy) and shared HF evaluation methods are contributing factors for developing a consistent cockpit and cabin whatever the diversity of design teams, diversity of profiles, culture, experiences and job assignment in the supply chain. Eurocontrol is also creating a common HF process with the Air Navigation Service Providers to develop and deploy new Air Traffic Management principles that should allow increasing traffic capacity.

The third lever is the HF governance. Engineering and Customer Services top management mandated in 2015 a HF



Board to ensure proper decision and follow up on HF activities. This Decision Board reinforces the recognition and the authority of HF in the company.

The fourth lever is the competence management. The in-service event analysis shows that the Runway Excursion, Loss of Control, Control Flight Into Terrain are persistent events. As more than 60 % of the event involves a human error in the root cause, it means that we need to reinforce the HF education in the aviation community: HF related to approach and landing management, energy management, attention allocation, crew fatigue, manual flying following automation degradation, procedure management. As such, the competences implemented to apply the HF approach are a combination of Human sciences (cognitive psychology, linguistics, physiology, human-machine interaction, sociology), operational knowledge (pilots, cabin crew...) and engineering skills.

Nevertheless, these four levers cannot be enough to guaranty HOF approach success. HF specialists are always a bunch of people among thousands of engineers. They are considered as “cost/time “constraint and of course as troublemakers when challenging against the “expected human behaviours assumptions” taken by the engineering staff. As a minority, they are too often contested and must demonstrate their added value daily. The education in HF of a large number of engineers and managers should help to reinforce the efficiency of a multidisciplinary team. But we can ask ourselves how to develop a stronger footprint looking at how “UX” community has done. Even if UX has a direct impact on Sale and Revenue as they are directly impacting the “Mass Buyer” whereas HOF in industry is generally impacting the employee performance, a source of cost and not a source of revenue. The four levers identified in this paper apply to design as well as production and customer services.

Quite recently and after a long period of “independence” the different HF organisations (engineering, customer’s services and production) moved closer to exchange on topics as “human and robots”, smart tools, Cognitive assistants and the use of big data to better understand the actual human operator behaviour. The better connection between Engineering and Manufacturing is not specific to HF, it is part of the Factory of the future project to better consider the manufacturability requirements in the design to reduce the lead time and cost of operations. HF should be involved at the appropriate level for the benefits of the workers and work organisation.

One of our most important project is now to collectively review the current HOF to face the future challenges as new concepts of operations (Reduced Team Operations, Factory of the future, remote control room...) and new kind of technologies as Increased Automation, Augmented Intelligence Systems, robots/cobots... New HF competences, new ways of working and new Standards need to be invented.

As a conclusion, we may recommend two key principles to set up efficient HOF approaches. First, to integrate the HF processes into the other company processes, with the same level and the same visibility. Second, to set up a HF governance at the high level of management to share the risks of Not having an appropriate HOF approaches and define the suitable HF strategy.







The Foundation for an industrial safety culture (FonCSI) is a french public-interest research foundation created in 2005 and located in Toulouse, France.

The FonCSI funds research projects concerning potentially hazardous industrial activities and their interaction with society, and aims to encourage open dialogue with all stakeholders (associations and NGOs, industrial firms, local government, regulators, researchers, trade unions, etc.).

Our originality is the interdisciplinary nature of our activities, in France and internationally, as well as a strong commitment to innovation and to anticipating tomorrow's issues.

Our mission:

- identify and highlight new ideas and innovative practices;
- develop and fund research into industrial safety and the management of technological risks;
- contribute to the development of a research community in this area;
- transfer research results to all interested parties.