

Evaluate to Learn and Improve: a Safety Culture Model for European Railways

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In 2017, the European Union Agency for Railways launched an ambitious programme to foster the development of a positive safety culture across European railways. The programme includes the design of methods and tools to evaluate the safety culture of railway operating companies, in particular infrastructure managers (IMs) and railway undertakings (RUs). The interest in such developments has been reinforced recently with the publication of European secondary legislation¹ which introduced new requirements for the safety management systems implemented by IMs and RUs.

Some of those requirements indeed specifically relate to safety culture. In the context of the fourth railway package, IMs and RUs will have to demonstrate that they have implemented a strategy to continually improve their safety culture². Safety culture assessments, for which methodologies have been implemented in several sectors, should provide valuable inputs for devising such a strategy.

The objective of this paper is to present the European railway safety culture model, which is the conceptual framework of processes that aim at evaluating the safety culture of railway operating companies. These evaluation processes may be implemented by operating companies, but also by national safety authorities (1). The model has been designed this year with a cooperative approach and is to be tested in 2019 (2).

This work reflects how the European Union Agency for Railways is engaged in getting everybody on board to drive continuous safety improvements and overall performance through positive behavioural change.

1. ASSESSMENT AND REGULATORY OVERSIGHT: TWO EVALUATION PROCESSES TO DRAW A SAFETY CULTURE PICTURE

Any safety culture evaluation of an organisation requires the capture of qualitative information that reflects and characterises collective ways of thinking and acting. The result is an organisation's **safety culture picture** (1.1). Whether it is conducted internally, subcontracted or within a peer review arrangement, such an evaluation is commonly designated as a **safety culture assessment** (1.2). While it is the role of the operating company to engage in initiatives to develop a positive safety culture, national safety authorities (NSAs) also play a role vis-à-vis safety culture and may implement a **safety culture regulatory oversight** process (1.3).

¹ Commission Delegated Regulation (EU) 2018/762 of 8 March 2018 establishing common safety methods on safety management system requirements pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulations (EU) No 1158/2010 and (EU) No 1169/2010.

² Annex I and II – Section 7.2.3: “The organisation shall provide a strategy to continually improve its safety culture, relying on the use of expertise and recognised methods to identify behavioural issues affecting the different parts of the safety management system and to put in place measures to address these.”

1.1. Safety Culture Picture: the Evaluation Output

Safety culture relates to organisational culture, which is a complex concept³. One should not try to encapsulate the results of such an evaluation into a numerical dashboard. If the evaluation is successful, it should lead to a safety culture picture, which is *an insight, at a given moment in time, into the drivers that shape organisational behaviour patterns, safety consciousness and safety performance*.

The resulting safety culture picture consists of *cultural strengths and weaknesses*. These should be considered by the operating organisation's senior management as valuable inputs to design a strategy to improve its safety culture.

If developed by the NSA in the context of regulatory oversight, the safety culture picture should support the NSA in the elaboration of a judgment of the strategy proposed by the duty-holder, as a starting point for further dialogue.

1.2. Features of Safety Culture Assessments

Methodologies have been developed in a broad range of sectors⁴. They usually involve two important stages of the assessment: **data collection** and **data analysis**.

The methods to gather data on safety culture which are commonly used are the following:

- *Document review*. Useful documentation encompasses safety policy, business plan, SMS, audit reports, accident and incident investigation reports, minutes of selected meetings, and other safety related documents. The document review is usually a first step to understand and assess how safety beliefs and values are formalised in an organisation.
- *Safety climate survey*. Through a questionnaire, information is collected on the perceptions and beliefs of staff with regard to safety. The questionnaire is sent to all individuals at all levels and positions⁵. Items for which results indicate gaps between perceptions of different populations may be considered as valuable information for the identification of cultural strengths and weaknesses. However, the results must be completed with information collected via other methods to better approach attitudes and behaviours to be able to draw a comprehensive safety culture picture.
- *Individual interviews*. Semi-structured interviews are a fruitful (and resourceful) technique to collect valuable information related to how safety is integrated within an organisation. Questions should be asked in a non-directive manner. Among common pitfalls: ambiguity or uncertainty about language and terminology; lack of clarity about the information required; combining multiple questions into one question; making unjustified assumptions.
- *Focus groups*. Interaction of groups can prompt and sustain valuable discussions on shared patterns of safety thinking and acting. It provides a means of collecting data that is not constrained or

³ This has been developed further in Accou 2017 and Rolina 2017, presented at the IRSC conference last year.

⁴ The good practices mentioned in this section are based on the authors' experience in assessing safety culture of nuclear and oil & gas facilities. They also rely on a broad review of technical literature (see safety culture documentation published by the International Atomic Energy Agency (IAEA) and the Institute for an Industrial Safety Culture (ICSI).

⁵ Statistical validity is based on a threshold of acceptability.

limited by the preconceptions of individuals. As a good practice, it is important to constitute groups of professionals with the same hierarchical level.

- *Observations.* Observation of operational activities and meetings may provide valuable information on how safety is integrated into business and on how professionals interact. Furthermore, it is an effective technique to assess the implementation of managerial expectations. It also allows the exploration of the effectiveness of formalisation and dissemination. As good practices, the assessors should put observed people at ease. They should not interfere unless an unsafe act is being performed and not interrupt at critical times.

While collecting data, the following principles are followed:

- Keep an open mind;
- Maintain a questioning attitude and consider the credibility of sources;
- Keep detailed notes and records;
- Look for examples of both strong and weak performance (balanced approach);
- Stick to the facts and consider the context of their occurrence.

To support the analysis stage, data collected must be accurate and self-standing. Data is analysed against a safety culture model to allow the identification of strengths and weaknesses.

Good practices to be considered for an organisation to conduct a safety culture assessment are the following:

- *Project management approach.* A safety culture assessment should be managed as a project. This includes appointment of a dedicated team and allocation of resources.
- *Commitment of (senior) management.* Leadership plays a key role with regard to organisational culture. It is a paramount prerequisite that the senior managers demonstrate their support throughout the assessment process.
- *Composition of assessment team.* The team of assessors should include professionals with operational background and expertise in human and organisational factors. Data collection methods and collective analysis require experience, understanding of operational situations and expertise in qualitative approaches.
- *Use of multiple data collection methods covering all levels of organisation.* This favours the development of a reliable safety culture picture.
- *Results.* Results are communicated to all staff. They are integrated into an improvement plan of which implementation is monitored by the senior management.
- *External communication.* Communication to authorities, contractors and the civil society is considered.

The company may decide to conduct the assessment in-house (*self-assessment*). It may also involve external consultants (*independent assessment*) or peers (*peer review*).

The NSAs may also approach operating companies' safety culture via their regulatory activities.

1.3. Features of Regulatory Oversight of Safety Culture

In the context of their supervision programme⁶, NSAs' staff may have opportunities to collect safety culture data on the duty holder's organisation, mainly via document reviews, individual interviews and observations. To this end, the identity of the NSAs' representatives may be a hurdle. Staff and managers of an operating company may express views or demonstrate behaviours in front of the inspectors that hardly reflect workplace reality. This difficulty with access to safety culture data is however counterbalanced with the unlimited duration of the data collection process: while assessment has a limited duration to draw the safety culture, regulatory oversight of safety culture allows continuous updates of the picture that enrich its quality.

This characteristic ("continuousness") is considered as one of the three "pillars" of regulatory oversight of nuclear safety culture, as described in the specific guidance published by the International Atomic Energy Agency⁷:

- **Common understanding of safety culture:** The nature of safety culture is distinct from, and needs to be dealt with in a different manner than a *compliance-based approach*. Its understanding is crucial in achieving a common language and framework that supports both the regulator and the [duty holder] in their communications and promotion of the significance of safety culture in safety performance.
- **Dialogue:** To gain better understanding of safety culture, dialogue is necessary to share information, ideas and knowledge that is often qualitative. Dialogue enables the [duty holder] and the regulator to have open discussions with respect to each other's role. Dialogue supports a more creative and constructive way to find solutions for continuous safety improvements.
- **Continuousness:** Safety culture improvement needs the continuous engagement of the [duty holder]. Regulatory oversight of safety culture therefore ideally relies on a process during which the regulator continuously influences the engagement of the [duty holder].

These three pillars may be easily transposed in the railway sector. The guidance also details the components of a specific regulatory oversight process to develop the safety culture picture of the duty holder and details good practices to design and implement such a process.

Whether it is an assessment requested by the operating company or a regulatory oversight conducted by the NSA, the safety culture evaluation relies on a framework. *The safety culture picture is indeed a perspective, at a given moment in time, on the safety culture data collected and analysed against a safety culture model.* Therefore, the European Union Agency for Railways decided to develop the European railway safety culture model.

⁶ Due to the strong relationship between SMS and safety culture, valuable information may be collected during audits and specific inspections on the duty holder's SMS.

⁷ See IAEA TECDOC 1707 "Regulatory Oversight of Safety Culture in Nuclear Installations" (2013).

2. THE EUROPEAN RAILWAY SAFETY CULTURE MODEL

The experience of the Agency safety culture team combined with a review of literature allows the identification of the key characteristics of the two evaluation processes described above. To design an appropriate framework with broad scope of application, it was decided to create an ad hoc task force under the aegis of the Human and Organisational Factors Network⁸ (2.1). The safety culture model articulates two components allowing it to be both a *heuristic* for inquiring into the organisational culture and a *framework* against which analysing the roots of this culture (2.2). The model is now ready to face a reality test: a pilot phase has been defined in cooperation with several IMs, RUs and NSAs to this purpose (2.3).

2.1. An Ad-Hoc Task Force Under the Aegis of the Agency's Human and Organisational Factors Network

The composition of the ad-hoc task force aimed at reflecting the diversity of organisations involved in the EU railway sector. Representatives from the organisations in **Figure 1** participated in the task force and met three times during April and September 2018. The meetings relied on interactive working methods to foster exchanges between the members.



Figure 1: Ad Hoc Task Force on Railway Safety Culture Assessment: Participating Organisations

During the first meeting, participants shared their views on the characteristics of safety culture. Specificities of the model to be designed have been agreed. In particular, the participants expressed the wish to have a railway safety culture model, which integrates the peculiarities of the sector.

A draft version of the model was proposed by the Agency's safety culture team as an input for the second meeting, during which the model was enriched. These discussions allowed the definition of twenty four attributes, together representing how organisational culture develops to support safety and sustainable performance, as well as a list of "signals", which are examples of safety culture related information captured via data collection methods that can illustrate the attributes.

The model with its attributes and the list of signals have been fine-tuned during the last meeting.

⁸ The Agency created the Human Factors Network in 2012 to promote the integration of human factors across EU railways. Since 2012, the network has met 13 times. It has recently been renamed into the Human and Organisational Factors Network to emphasise the important impact of organisational factors to safety (as an example see French 2018, presented during the current conference).

2.2. Model's Components

The model is made up of two components: the **railway safety fundamentals** which are principles that shall be fulfilled by any railway operating company to maintain safety and sustainable performance; and the **cultural enablers** which shape the company's organisational culture.

The railway safety fundamentals represent four overarching principles, based on the characteristics of the railway sector and on existing safety culture frameworks that have been developed in several high-risk industries: A positive railway safety culture is characterised by a *collective commitment to (F1) manage major railway risks with anticipation and resilience, (F2) understand workplace reality, (F3) cultivate a continuous learning environment and (F4) integrate safety into business at all levels.*

The railway safety fundamentals themselves rely on the core principle of the ergonomics of activity⁹, which distinguishes the *task* (prescribed work: expected results under defined conditions) from the *activity* (effective work: observed results under real conditions). **Figure 2** illustrates this central distinction.

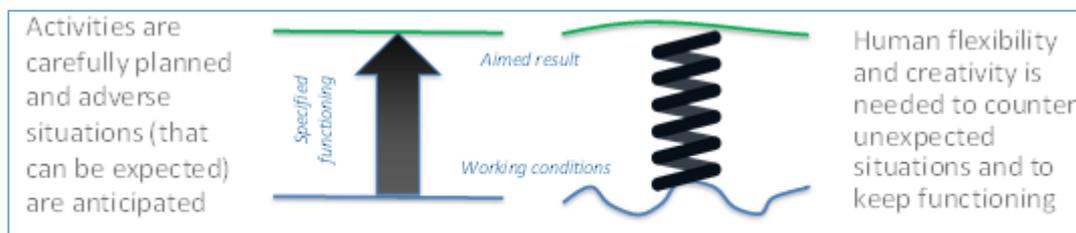


Figure 2: The Central Distinction between Task and Activity

As all situations may not be foreseen, the capability to face expecting events should be developed. The first railway safety fundamental emphasises the importance of identifying and managing railway major risks with anticipation and resilience. The second railway safety fundamental underlines the importance of understanding actual work practices and improvement, within a continuous learning environment (third fundamental). The fourth fundamental states that safety is always considered and contributes to create value, when integrated into the business.

An organisational culture develops through different elementary activities within a company. Adapted from Guldenmund¹⁰ (2015, 2018), we have distinguished the following four cultural enablers that shape the company's organisational culture: Through **(E1) Interacting**, members of a group exchange meanings through formal and informal dialogue, giving rise to mutual adjustments, agreements and expectations with regard to each other's behaviours. Based on this shared understanding (of safety), the organisation starts **(E2) Formalising** through the distribution of tasks, roles, and responsibility, the description of procedures and rules as well as more physical structures like technology. In the **(E3) Disseminating** stage organisational structures, rules and procedures are instructed through various forms

⁹ This distinction characterises the French speaking approach to ergonomics institutionalised with the creation of the French-speaking Ergonomics Society (SELF) in 1963. For example see Guérin, Laville et al. 2007, "Understanding and Transforming Work: The Practice of Ergonomics". This essential distinction between task and activity has recently gained new nobility with current developments on *work-as-imagined* and *work-as-done*.

¹⁰ "Organizational Safety Culture" in The Wiley Blackwell Handbook of the Psychology of Occupational Safety and Workplace Health (ed. Clarke, Probst et al. 2015) and "Understanding Safety Culture Through Models and Metaphors" in Safety Cultures, Safety Models: Taking Stock and Moving Forward (ed. Gilbert, Journé et al. 2018).

of information and education. Through **(E4) Enforcing**, meanings, standards and expectations are accepted as the ‘way to do things’. Members of the group will now share a comparable understanding of reality, and structures and meanings are enforced and reinforced through various organisational processes, with an important role played by leaders.

Figure 3 shows the articulation between the two components of the model and their “intersections” which are the patterns of acting and thinking, shared within a company that characterise its organisational culture.

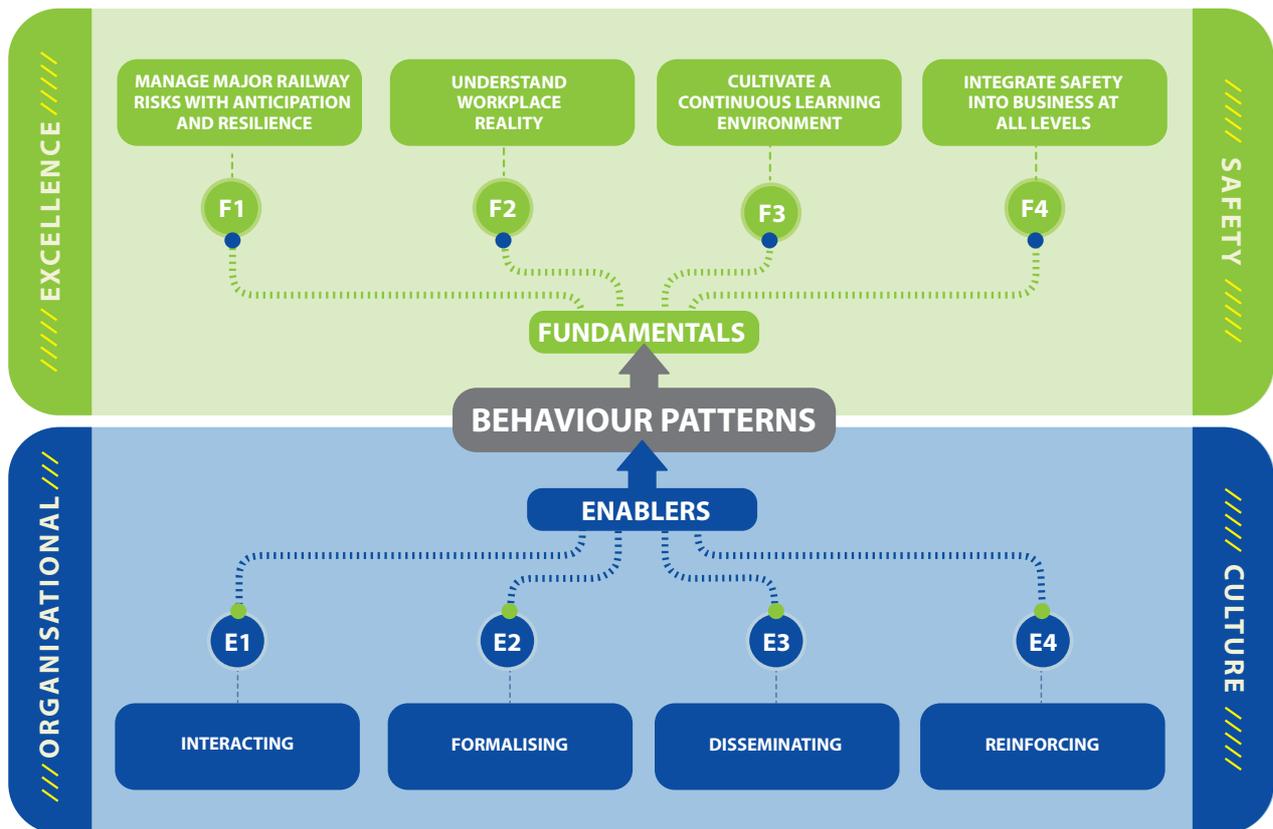


Figure 3: the European Railway Safety Culture Model

To further support inquiry and evaluation, each cultural enabler and railway safety culture fundamental is broken down into three attributes each (see Appendix).

We expect the model to be the appropriate tool to support the composition of the safety culture picture of an operating company through an assessment or a regulatory oversight process performed by the NSA. The next step is to test this model with practical implementation.

2.3. Future Activities

Several Ad-Hoc Task Force members who have contributed to develop the draft European railway safety culture model offered to be candidates to experiment with it in their organisation. Contacts have been made with other EU operating companies and NSAs to define a pilot that will take place in 2019.

In a preparatory phase, supportive tools will be developed. This includes a first version of a guidance on railway safety culture evaluation to further describe the different stages of processes, the methods and the use of the model during the data collection and analysis stages. Training material will be

extracted from the guidance to prepare the assessors and a specific safety climate survey based on the model will be developed and tested in the context of a company's safety culture assessment.

The experience gained during the pilot will be shared with the community. It will be reflected in a second version of the guidance that includes practical examples. The model may also be reviewed in light of the pilot's results.

These developments are intended to support the EU railway community in reinforcing theoretical and practical knowledge on safety culture. They will also serve the objective of fulfilling the Agency's task as set out in article 29 of the EU railway safety directive¹¹: "the Agency shall evaluate the development of a safety culture including occurrence reporting. It shall submit to the Commission, by 16 June 2024, a report containing, where appropriate, improvements to be made to the system."

CONCLUSION

The European railway safety culture model is now ready to be tested. Its major innovation is to distinguish two components: the "railway safety fundamentals", which represent the objectives that will lead towards sustainable and safe performance and the "cultural enablers", which may be considered as means to shape the behaviour patterns that support the achievement of the fundamentals. Evaluate to learn and improve: By supporting the identification of actions to improve safety culture, this model offers more than the classic frameworks that consist in a one-dimensional list of safety culture attributes.

The model should also be seen as a tool to establish a common understanding of the railway safety culture across the EU. In this perspective, it complements a major initiative taken by the Agency earlier this year. During the first European rail safety summit, organised jointly with the European Commission, the Agency has promoted the European railway safety culture declaration¹², which has been signed by more than sixty European leaders.

By raising awareness on safety culture and equipping the sector with appropriate tools to evaluate and improve it, the European Union Agency for Railway is demonstrating a key role in the development of a positive railway safety culture. We are indeed convinced this constitutes a prerequisite to make the railway system work better for society.

¹¹ Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety (recast).

¹² See the link to the declaration and the instructions to become part of the community of signatories here: https://www.era.europa.eu/activities/safety-culture_en

APPENDIX: EUROPEAN RAILWAY SAFETY CULTURE ATTRIBUTES

F1	MANAGE MAJOR RAILWAY RISKS WITH ANTICIPATION AND RESILIENCE
F1.1	Individuals at all levels are aware of major railway risks and understand their personal contribution to risk management.
F1.2	The organisation recognises that complex technologies and systems can fail in unpredictable ways.
F1.3	The capability to operate safely under unexpected situations, which relies on the competence and flexibility of frontline operators and managers, is recognised and developed.

F2	UNDERSTAND WORKPLACE REALITY
F2.1	Human and organisational factors, including frontline experience, are systematically considered following safety events, deviations, and during design and change.
F2.2	Routine and abnormal deviations from anticipated performance are recognised, reported and analysed.
F2.3	Measures to identify and mitigate organisational silence are implemented.

F3	CULTIVATE A CONTINUOUS LEARNING ENVIRONMENT
F3.1	Individuals at all levels avoid complacency, challenge assumptions and support organisational learning.
F3.2	Safety related feedback is perceived an opportunity to improve performance and is acted upon.
F3.3	Collaboration within and across organisational boundaries is nurtured to operate safely.

F4	SAFETY IS INTEGRATED INTO BUSINESS AT ALL LEVELS
F4.1	Safety is a primary consideration in the allocation of resources.
F4.2	Individuals at all levels are convinced that safety and operations go hand in hand. They demonstrate their commitment to safety through their behaviours and decisions.
F4.3	The organisation recognises that working conditions, such as time pressure, workload and fatigue influence safe behaviours.

E1	INTERACTING
E1.1	Individuals and work groups coordinate their activities within and across organisational boundaries to support railway safety fundamentals.
E1.2	Trust, respect and openness permeate the organisation and characterise inter-organisational relationships at all levels. Opposing views are encouraged and considered.
E1.3	Healthy regulatory relationships exist and ensure that the accountability for safety remains with the operating organisation.

E2	FORMALISING
E2.1	Roles, responsibilities and authorities are understood and accepted.
E2.2	Processes, from planning to implementation and review, support railway safety fundamentals
E2.3	Documentation, rules, procedures and technical solutions support railway safety fundamentals.

E3	DISSEMINATING
E3.1	Safety information is openly shared, up, down and across the organisation and with audit and regulatory organisations.
E3.2	Training maintains a knowledgeable workforce and supports railway safety fundamentals.
E3.3	Safety leadership skills are systematically developed.

E4	REINFORCING
E4.1	Leaders ensure that incentives, sanctions and rewards reinforce behaviours and outcomes that support railway safety fundamentals.
E4.2	Leaders exhibit behaviours that set the standard for safety. They are seen in working areas observing, coaching, and reinforcing standards and expectations.
E4.3	Innovative methods and arrangements are implemented to promote safe behaviours and support railway safety fundamentals.