

Summary

The relevance of safety culture as a regulatory concept and management strategy in professional transport

TOI Report 1668/2018

Authors: Tor-Olav Nævestad and Ross Phillips

Oslo 2018. Pages: 113 English

The Swedish Transport Agency (STA) has defined safety culture as part of the regulatory strategy. This involves focusing on safety culture in audits (through a 28-point checklist) and in the STA's contact with the companies. Taking this strategy as the point of departure, the present study compares whether the different regulatory branches of the STA use the safety culture concept, and if so how they define and assess it in their company audits. We compare this with results from the companies' in each sectors development of good safety culture as a safety management strategy. We also include experiences from the Swedish nuclear industry, as the nuclear industry is recognized to be in the forefront when it comes to safety culture regulation. The study is based on 40 qualitative research interviews. At the time of the interviews, regulators in aviation and rail assessed safety culture systematically in audits. Regulators in the maritime sector largely focused on the International Safety Management code, indirectly covering some aspects of safety culture, while regulators in the road sector did not focus on safety culture. Regulators in aviation and in the nuclear industry asserted that the safety culture concept provides an important perspective which is omitted in a purely rule-based regulatory approach. Results indicate that the following factors influence sector authorities' different focus on safety culture: 1) legislative frameworks, 2) regulatory strategy and priorities, 3) regulatory competence and resources, 4) competence and resources of the transport companies, 5) the business structure of the sectors, 6) trust between regulators and the regulated, 7) different organisational maturity levels within the sectors, and 8) the consideration of equal conditions for competition. Results from the companies' use of safety culture as a safety management strategy did, with some exceptions follow, the pattern of the regulators.

Background and aims

The relationship between safety culture/climate and safety outcomes is well documented across industries and countries, and the concepts have been implemented by companies in several domains, including transport. Additionally, regulators in different industries have attempted to account for and apply safety culture in recent years. This also applies to transport safety authorities. Given the documented importance of safety culture/climate, there is reason to believe that it would benefit transport safety if companies were provided with the opportunity to develop safety culture as a safety management strategy, and if regulators were given the opportunity to focus on safety culture in audits and assist companies in their development of safety culture.

Considering the implementation of safety culture strategies in transport companies, it is however important to remember that some transport sectors (e.g. road) are relatively new to measures focusing on organisational safety management in general, and the safety culture perspective in specific. The transport sectors are very different when it comes to their focus on work related factors like safety culture and safety management systems (SMS). SMS typically include formal routines and measures enabling the organisation to work systematically with safety, by identifying and correcting risks, e.g. appointment of key safety personnel, risk assessments, safety training, safety procedures and safety

performance monitoring. Moreover, safety culture is a relatively new regulatory concept with a utility which is not well defined, and previous research has noted several challenges related to its use. Although early studies report of promising results, they also describe social processes that seem hard to foresee and influence.

In accordance with the recognized importance of safety culture for safety outcomes in transport, the Swedish Transport Agency (STA)¹ has defined contributing to a high safety culture in transport companies as one of the key elements in the regulatory strategy. Taking, this strategy as the point of departure, the present study examines the relevance of safety culture in Swedish professional transport, comparing the experiences of regulators in the different branches of the STA (aviation, maritime, rail and road transport) and the companies that they relate to. We compare regulators' and companies' views on and use of safety culture. We also include experiences from the Swedish nuclear industry, as the nuclear industry is recognized to be in the forefront when it comes to safety culture regulation.

The aims of the study are to:

- 1) Examine the relevance of safety culture as a *regulatory concept for transport authorities*, focusing on: a) Whether it is included as an audit tool by regulators, b) why it is included, c) how it is defined and d) how it is assessed.
- 2) Examine the relevance of establishing good safety culture as a *safety management strategy in transport companies*, focusing on: a) Whether it is used, b) why it is used, c) how it is defined, and d) status on key indicators of safety culture (management commitment to safety, employee involvement, reporting, just and learning culture).
- 3) Examine the relationship between regulatory authorities and companies within each sector.
- 4) Discuss whether and how the sectors could increase their focus on safety culture.

Data sources and methods

The study is based on 40 qualitative research interviews with 19 interviewees from the STA, 19 interviewees from companies in the Swedish transport sector, and two representatives from the Swedish Radiation Safety Authority. Thus, when referring to «authority representatives» from the transport sector, we always refer to STA employees. This applies to all transport sectors. Table S.1 shows the number of authority and company interviewees in each of the sectors.

Table S.1 The number of authority and company interviewees in each of the sectors

Sector	Nuclear	Aviation	Maritime	Rail	Road	Total
Authority interviewees	2	6	3	5	5	21
Company interviewees	0	5	5	4	5	19

It is important to note that the descriptions of the situation in the different transport sectors in this study are based on interviews with limited groups of people at a given point of time. Thus, the current situation may be different from what we describe; strategies,

¹ There is no official acronym for the Swedish Transport Agency. Thus, the acronym STA is created solely for this report.

efforts, experiences, relationships etc. may have changed since the time of the interviews. It must also be noted that the sample of interviewees is very small in several of the studied groups. This influences the basis from which conclusions can be drawn, e.g. our abilities to generalise about each sector, based on the interviews and also our comparisons between sectors. Additionally, the selection of interviewees may also influence our results. Interviewees were, however, largely interviewed as «expert interviewees», who were invited to talk both generally and specifically about the current situation in their own sector, and they often discerned between what they do themselves, and what is common among their colleagues. Thus, we do not believe that such a sampling bias is very strong. We offered the STA to conduct a survey among inspectors within each sector to check the validity of our results, and examine whether our results are reflected in the answers of the population of inspectors within each sector. This would have provided us with a more robust basis for drawing conclusions about the relevance of safety culture within the sectors. This offer was turned down, as STA personnel, were exposed to several processes and activities simultaneously at the time. We recommend that such a survey is conducted at a later stage.

Safety culture as a regulatory concept for transport authorities

The STA centrally has defined safety culture as part of the regulatory strategy. This involves focusing on safety culture in audits (through a 28-point checklist) and in the STA's contact with the companies. The STA conducted systematic reviews of the legislation applying to Safety Management Systems (SMS) in each transport sector, to examine the extent to and how these rules justified a focus on safety culture in audits. Our results indicate that although these steps legitimized the different sector authorities' focus on safety culture in audits, their focus on safety culture varied substantially.

Results indicate that the following factors influence sector authorities' focus on safety culture: 1) legislative frameworks, 2) regulatory strategy and priorities 3) regulatory competence and resources, 4) competence and resources of the transport companies, 5) the business structure of the sectors, 6) trust between regulators and the regulated, 7) different organisational maturity levels within the sectors, and 8) the consideration of equal conditions for competition.

Authority representatives in *aviation* had at the time of the interviews recently started to use the safety culture concept systematically in audits, where inspectors fill out a 28-point checklist at the end of SMS audits. The safety culture concept is also used in other communication with the companies, e.g. in seminars with company representatives, and on webpages. It is, however, important to note that the safety culture audits in aviation not were fully implemented at the time of the interviews. At this stage, some sectors within aviation had started to focus on safety culture. Later, we heard that the safety culture audits in aviation had been suspended (we do not know for how long).

In the *maritime* sector, much of the audits are delegated to class societies, and companies relate to several different national authorities in port state and flag state controls. When asked whether they use safety culture in their work, authority interviewees in the maritime sector answered; «not directly», and that they do not have a strategy or procedures related to safety culture. Although they did not use the safety culture concept, maritime authority interviewees underlined that many of the SMS-requirements of the International Safety Management (ISM) code of the International Maritime Organisation (IMO) concern safety culture. The STA's safety culture audit strategy also applies to the maritime branch of the STA, and thus it seems that the maritime authority interviewees also should have been

familiar with this. What seems to be a lacking focus on this could, however, be due to a delayed implementation process, delayed communication etc.

All but one of the authority interviewees in the *rail* sector said that they recently had started to use the safety culture concept systematically in their work, that they seek to evaluate safety culture in their inspections, and that they talk a lot about it. They mentioned that they started to focus more on safety culture partly as a response to an initiative from the STA centrally.

Authority interviewees from the *road* sector reported that they do not use the safety culture concept in their work, neither do they assess the safety culture of the companies that they audit. There is no legislation in the road sector requiring SMS or safety culture, although the STA review of the legislation in the road sector indicates that these rules to some extent can justify focusing on safety culture.

The nuclear sector. In Sweden little attention was given to nuclear safety culture until the beginning of 2000's. There was an incident in Barsebäck in 2003, and in 2006, there was another incident at Forsmark. Both incidents spurred an increased focus on safety culture. Interviewees in the nuclear sector have a strong focus on safety culture, which currently is related to management system requirements in the industry (IAEA Safety Requirement GS-R-3). At the time of the interviews (2017) interviewees said that this soon would be covered in separate legislation. They have also gone through an internal review of the safety culture of the authority, to clarify how their own safety culture may affect their influence on the safety cultures of the companies. Assessing safety culture in the licensees (companies), the authority inspectors in the nuclear industry look for indicators of «underlying patterns» (i.e. culture). They maintain a database with information about the respective companies to build a comprehensive collection of observations and indicators. Inspectors from the authority are relatively often visiting the licensees, and after each visit, they must record their observations and experiences in a common database. In this manner, the authority can build a relatively comprehensive picture of the safety culture in the licensees. The authority interviewees in the nuclear sector reported that the relationship to the licensees was positive.

Safety culture as a management strategy for companies

Discussing the relevance of developing good safety culture as a safety management strategy in transport companies, the study indicates that companies' in each sectors' focus on safety culture largely seems to follow from 1) the legislative frameworks within each sector (SMS requirements), including 2) regulatory authorities' focus on safety culture in their inspections, and the sectors' 3) safety management traditions. Additionally, experiences from the maritime sector and the road sector also indicates the importance of 4) requirements from third parties, like transport buyers, insurance companies and class societies. Finally, the road sector illustrates the importance of 5) the companies own strategies related to SMS and safety culture development.

All of the companies in aviation worked actively with safety culture development, stressing the importance of maintaining informed, reporting, just and learning cultures. Company interviewees in the maritime sector generally work with the ISM code and they do largely not focus directly on safety culture, although they noted that the ISM code indirectly focuses on safety culture through the SMS requirements. Additionally, the rail companies mainly work with safety culture indirectly, by maintaining their SMS, but they do largely not use the concept.

Company interviewees in the road sector do not use the safety culture concept systematically. Because of lacking SMS requirements in road, other actors than regulatory authorities work to maintain a higher SMS and safety culture level than legally required in the sector. The bus owner association has for instance developed a set of safety policies for the sector, and procurers (state, county and local authorities) set SMS requirements in the long-term contracts with bus companies. However, given the lack of legal requirements for SMS and safety culture in the sector, it seems that the internal variation between companies in this respect is considerable.

Table S.2 outlines the relevance of safety culture among authorities and companies in the studied sectors, focusing on whether they focus on safety culture (SC), how this focus is justified, how safety culture is defined and assessed, the relationship between authorities and companies in the sector and the potential of the safety culture approach in the sector, based on our analysis and the viewpoints of the interviewees.

Table S.2. The relevance of safety culture in the studied sectors. (Auth.=authorities, Com.= companies, SC-focus= safety culture focus, Def./Assessm.= definition and assessment of safety culture, IAEA=International Atomic Energy Agency, ERA=European Rail Agency).

Sector	Level	SC-focus	Justification	Def./Assessm.	Relationship	Potential
Nuclear	Auth.	Yes	SMS-rules	Underlying patterns. IAEA	Positive	Positive. Soon requirement
Aviation	Auth.	Yes/«test»	SMS-rules & STA strategy	7 themes/28-points	Positive	Positive
	Com.	Yes	SMS-rules	Reporting, just, learning	Positive	Systematic efforts
Maritime	Auth.	Not directly	ISM-focus	«Living system»	Positive	Within ISM?
	Com.	No/little	ISM-focus	Not applicable	Diverse	Content with ISM?
Rail	Auth.	Yes	SMS-rules & STA strategy	STA & ERA	Positive	Positive
	Com.	Not directly	Challenges?	Not applicable	Diverse	Some challenges
Road	Auth.	No	Equal conditions of competition	Not applicable	Good/previously strained?	Difficult?
	Com.	Heterogeneous	Transport buyers, industry org.	Not applicable	Good/previously inflexible?	Industry organisations

The relationship between regulatory authorities and companies

Interviewees in *aviation* reported a good relationship between the regulators and the companies. Company interviewees in aviation said that they believe that their relationship to the STA is good and that it contributes to increasing their safety level. They said that they inform the STA early and openly when they plan something, and that they get relevant information about new things well in advance. In the *maritime* sector, much of the audits are delegated to class societies and companies relate to several flag states and port states. Maritime company interviewees experiences with the STA were mixed, although it should be noted that interviewees generally had registered their vessels in foreign flag states. Company interviewees in the *rail* sector mentioned great changes in the sector in recent years when we discussed their relationship with regulating authorities, e.g. deregulation, competition and new organisational changes (e.g. splitting large state-owned companies into small private firms). Company interviewees' experiences with the STA were also mixed

in rail. In the *road* sector, some of the authority interviewees said that the STA used to have a somewhat difficult relationship with the transport companies and the business associations, but that this fortunately is improving. Company interviewees in the road sector generally asserted that the relationship with regulatory authorities was good. Some of them noted that the driver's hours inspections could be more flexible, arguing in favour of a more function-based approach. Finally, company interviewees were also worried about how lacking resources of the police could negatively affect enforcement.

Issues for future research

Is it possible to give general advice on safety culture development?

In line with previous research, the present study indicates that each transport sector is unique with different legislations, key actors, technologies and histories etc. Accordingly, we see that the sectors' work on safety is adapted to these contexts, and that the transport sectors are very different when it comes to their focus on work related factors like safety culture and SMS. Our discussions with the authority interviewees also indicates the importance of remembering that each company is unique, with different histories, managements, organizational structures, traditions and cultures. Each company has their own ways of solving things (e.g. legal requirements), their respective strengths and weaknesses, and they should be able to do things their own way.

Based on this, we discuss what the four different transport sectors actually have in common. We conclude that the different transport sectors are involved in the same basic activities, they deal with the same negative side effects related to their basic activities, and they face the same organizational challenges when trying to avoid these side effects. Some of the sectors clearly have reached a very high level in this respect, which is a good argument to study the sectors together and examine what the sectors with less developed organizational safety management may learn from those with the most developed approaches.

Following the above-mentioned lined of argumentation, we also discuss whether it is possible to describe universal traits of safety culture interventions that apply to all companies in all the transport sectors. We conclude in line with Nævestad, Hesjevoll & Phillips (2018), who review safety culture interventions within road, sea, air and rail companies. They argue that the interventions are very different depending on the sectors and the companies in question, they seem to comprise four key elements:

- 1) Appointing a key responsible person
- 2) Institutionalizing joint discussions and risk assessments of work place hazards
- 3) Implementing and monitoring measures based on these discussions
- 4) Maintain effective communication about safety issues in the organization

Thus, although it may not be feasible to give general advice on safety culture development, as each sector and company is unique, regulators may take these four key elements as their point of departure, when developing their advice to companies.

Based on our elaborations on the relationship between SMS and safety culture in aviation, the maritime industry and rail, we discuss whether a good safety culture is the same as successful SMS implementation. We conclude that facets of safety culture (e.g. reporting and just culture) cannot be viewed separately from the facets of SMS (reporting system). Research indicates that many of the key aspects of safety culture and SMS are similar (e.g.

management commitment to safety). This is interesting, as it indicates how tightly interwoven formal (structure) and informal (culture) aspects of safety are. It may therefore be difficult to tell which comes first, and subsequently how to influence the safety level of a given transport sector. Thus, the four key elements described above could perhaps also apply to successful SMS implementation.

Organisational maturity, trust and self-regulation

Research discerns between a «rule-based regulatory approach», specifying what companies should do, and a «function-based regulatory approach», specifying the goal for companies and leaving them up to choose methods for achieving safety themselves. Although most regulatory regimes mix these approaches, Grote (2012) states that recent years have witnessed a tendency to move away from the «rule-based» to the «function-based» regulatory approach. This promotes companies' self-regulation, and the regulatory role becomes more focused on giving advice and supervising than on compliance with rules. An important issue that was mentioned by several of the authority interviewees, is that function-based regulation, involving a high degree of company self-regulation requires a high level of maturity from the companies. Self-regulation, involving internal audits conducted satisfactorily, is dependent on a high level of trust, knowledge and shared goals between regulators and companies. Some interviewees gave examples of this: While the serious companies pointed to their own flaws and weaknesses, the less serious companies did not report non-conformities. Instead, they answered in accordance with what they thought that the authorities «would like to hear». This illustrates the importance of trust between the regulator and the regulated in a function-based approach involving a high incidence of self-regulation.

Going further with this paradox, it is interesting to recall that one of the most common ways of evaluating organizational maturity is to use measurements of safety culture. Thus, the paradox seems that to be an effective subject of safety culture measures, organisations should already have reached a certain safety culture level. Based on the views of the interviewees, organisations with poor safety cultures are not likely to have any use of regulatory efforts to facilitate safety culture development. This is interesting and should be examined in future research.

Many of the interviewees held the view that organizational maturity evolves through gradual implementation of measures aimed at developing organizational safety management. It seems that the level of organisational maturity and thus trust was generally high in aviation and lower in the road sector. It seems that this allows for more advisory-based strategies and self-regulation in aviation, while more rule-based regulatory strategies were common in the road sector.

Increased focus on safety culture and SMS in the road sector?

The road sector has a lower focus on SMS and safety culture compared with the other sectors. We discuss six reasons for this: 1) The business structure of the sector. Road sector interviewees, said that it is easier to focus on safety culture e.g. in aviation and in rail, where you have a smaller number of large and mature organisations, compared to the road sector, which has thousands of small companies. 2) Regulatory competence and resources, 3) Company competence and resources of the transport companies, 4) The organisational maturity level of companies, 5) Trust between regulators and the regulated, and 6) The consideration of equal conditions for competition.

We also discuss whether and how these factors can be surpassed by regulators, to allow for an increased focus on safety culture in the road sector. First, we suggest that regulators

should use the «Safety ladder» approach for the small road companies with few resources and low organisational maturity (Nævestad et al 2017). This approach is sensitive to the huge share of small companies in the sector. Second, we suggest that regulators mainly should focus on safety culture in their regulation of the larger road transport companies. The larger companies are likely to have more resources and to be more organisationally mature. Additionally, because of their size, the large companies employ a high share of the drivers in the sector. Third, we suggest that the regulatory role of advisory-based assistance with safety culture measurement and development could be the role of business organisations in the road sector, instead of the regulator. It is difficult to avoid the road sector argument regarding equal conditions for competition, stating that domestic companies could complain that additional requirements imposed on them (and thus additional costs) could make them more vulnerable to competition from hauliers in other countries.

Are safety culture assessments more subjective than assessments of compliance with rules?

Interviewees in several sectors, both from authorities and companies mentioned that assessments of safety culture are subjective. Authority interviewees in some sectors, e.g. rail were skeptical to regulating safety culture, as the concept is abstract, while they stated that SMS components are very specific and easier to evaluate. Other interviewees, e.g. authority interviewees from aviation underlined that safety culture assessments also are made systematically, based on the 28-point checklist, summing up seven themes. Using this checklist requires a lot of knowledge, and it is important that the inspectors using the checklist have a relatively similar understanding of the content of each of the 28 points, and how to evaluate them. Inspectors are therefore educated on the safety culture concept and in the use of the checklist. Nevertheless, these interviewees also underlined the importance of subjective assessments when using the checklist.

Based on the interviews, it seems that the contention that safety culture assessments are subjective may mean different things. First, subjectivity may mean imply that assessments of safety culture are (solely) based on individuals' personal or subjective views, and thus personal and contestable («strongly subjective view»). Second, subjectivity may mean that assessments of safety culture require a certain degree of personal judgment («mildly subjective view»). The first view indicates that safety culture assessments are arbitrary, and that a certain safety culture assessment is «in the eye of the beholder». According to this former view, different people may describe the safety culture in a company differently, and that there are no standards to guide the judgements. The second view indicates that safety culture assessments require a certain amount of discretion, but that this not necessarily is subjective in the sense that it may vary strongly between individuals, or that it is arbitrary. Rather, safety culture assessment are done according to a known common standard (e.g. a 28 point checklist). Such an assessment is also made in inspectors' assessments of rule compliance. This also involves a certain extent of subjective discretion. Thus, it could be argued that authority inspectors' assessments of safety culture not necessarily are more subjective than other assessments that they conduct in their audits.

Illustration of factors influencing the relevance of safety culture

Figure S.1 provides an illustration of factors influencing regulators' use of the safety culture concept in audits and companies' development of safety culture as a safety management strategy. The depicted relationships are based on the interview data, and we should thus treat them as hypothesized relationships that should be examined further in future research.

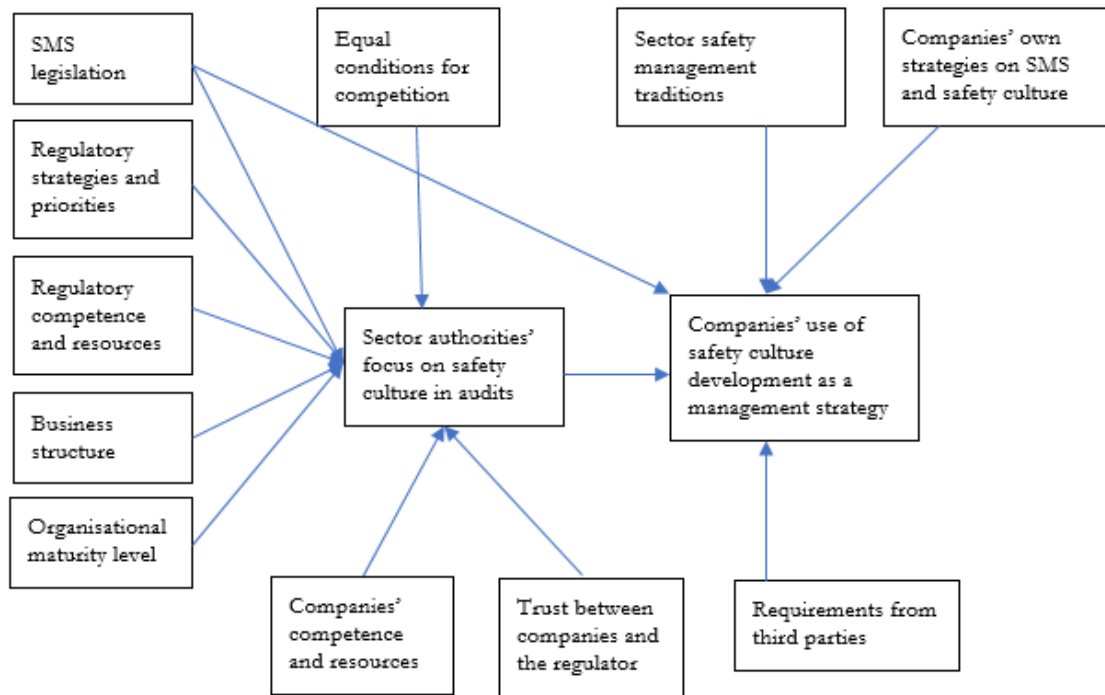


Figure S1. Illustration of factors influencing regulators' use of the safety culture concept in audits and companies' development of safety culture as a safety management strategy. The figure depicts hypothesized relationships, based on the interview data.

A key result of the study is that neither regulatory authorities, nor companies are «bounded» by the legislative framework governing safety within their sectors. Regulatory authorities may foster a safety culture focus through strategic decisions, but companies may also choose a stronger (or perhaps weaker) focus on safety culture and SMS than what is required by the legislative frameworks. Our study shows, as noted, that each sector and each company is unique, and that regulators' and companies' efforts to focus more on safety culture must be adapted to these sectorial and organisational contexts. The safety culture perspective must be perceived as useful and concrete by key actors; it must be seen as a complementary resource, adding additional insight, to what they are already doing.

