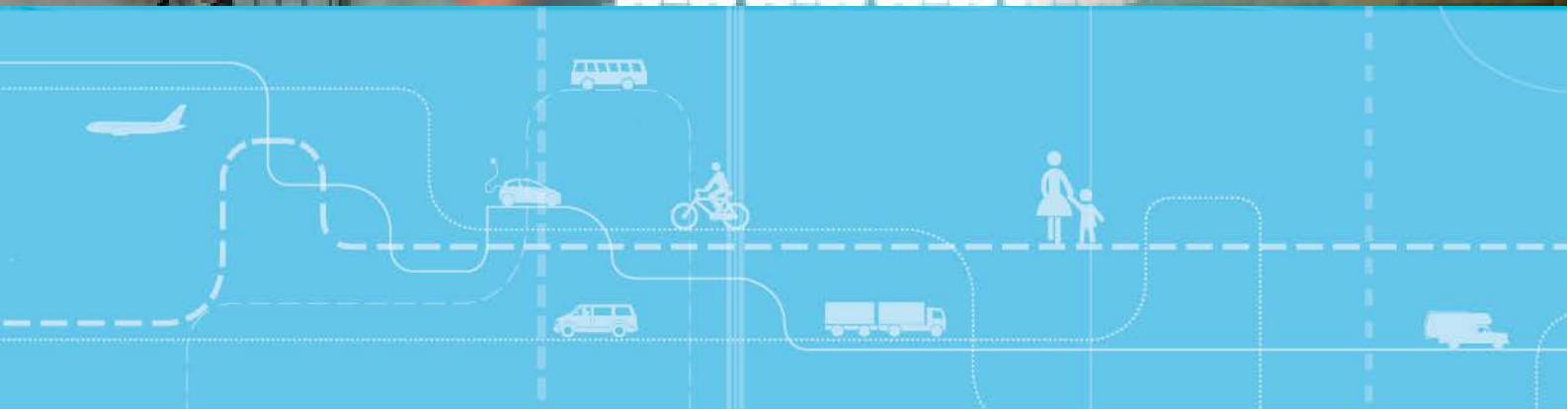


The relevance of safety culture as a regulatory concept and management strategy in professional transport

Comparing the experiences of regulators and companies from four sectors



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Ross O. Phillips

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Sammendrag:

Den svenske Transportstyrelsen har definert det å fokusere på sikkerhetskultur som en del av sin tilsynsstrategi. Den foreliggende studien tyder imidlertid på at bruken, relevansen og potensialet til sikkerhetskulturbegrepet varierer betydelig mellom sektorene. Mens det var sterkt fokus på sikkerhetskultur i luftfart og jernbane, var det mindre eksplisitt fokus i maritim sektor og ikke fokus på sikkerhetskultur i vegsektoren. Vår analyse tyder på at sektormyndighetenes ulike fokus kan relateres til følgende faktorer: 1) Sektorenes juridiske rammeverk, 2) Myndighetenes strategier og prioriteringer, 3) Myndighetenes kompetanse og ressurser, 4) Bedriftenes kompetanse og ressurser, 5) Bedriftssammensetningen i sektorene, 6) Tillit mellom myndigheter og bedrifter, 7) Ulike organisatoriske modenhetsnivåer innenfor sektorene, og 8) Hensynet til like konkurransevilkår.

Summary:

The Swedish Transport Agency (STA) has defined focusing on safety culture as part of the regulatory strategy. This study suggests, however, that the use, relevance and potential of the concept varies widely among sectors. While there was strong focus on safety culture in aviation and rail, there was little explicit focus in the maritime sector and no explicit focus on in the road sector. Our analysis indicate that sector authorities' different focus is due to factors like: 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.

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Preface

The present study about the relevance of safety culture as a regulatory concept and management strategy in Swedish professional transport and in the nuclear industry is financed by the Swedish Transport Agency (Transportstyrelsen). Some of the work with the report has also been financed by the Norwegian research council.

Our contact person in the Swedish Transport Agency has been Inger Engström. We are very grateful to Engström and her colleagues for good cooperation and interesting discussions throughout the project. We are also very thankful to the Swedish Radiation Safety Authority for participating in the study.

The study is based on 40 qualitative research interviews with 19 interviewees from the Swedish Transport Agency, 19 interviewees from companies in the Swedish transport sector, and two representatives from the Swedish Radiation Safety Authority. We are very thankful to all the people who agreed to be interviewed in the project, and who shared their expertise, time and enthusiasm for safety with us.

Senior researcher Tor-Olav Nævestad has written the report, and he has conducted most of the interviews. Chief Research Psychologist Ross Phillips has also conducted interviews, and contributed to the report. Research director Michael Sørensen has been responsible for the quality assurance of the report, while Trude Rømming has prepared the report for publication.

Oslo, September 2018

Institute of Transport Economics

Gunnar Lindberg
Managing Director

Michael Sørensen
Research Director

Content

Summary

Sammendrag

1	Introduction	1
1.1	Background	1
1.2	Aims	2
1.3	The status of safety culture in different transport sectors.....	3
1.4	The Swedish Transport Agency	4
1.5	The nuclear industry	5
1.6	Structure of the report.....	6
2	Previous research	7
2.1	Organisational safety culture.....	7
2.2	Safety culture as a regulatory concept for authorities	8
2.3	Developing good safety culture as a management strategy for companies	11
3	Method	14
3.1	Interviews	14
3.2	Analysis	15
4	Results from the nuclear sector	17
4.1	Why do they focus on safety culture?.....	17
4.2	Key traits of nuclear safety culture	18
4.3	Strong internal focus on safety culture.....	20
4.4	Inspection methods used by the authority	21
4.5	How is safety culture assessed in the licensees?.....	22
4.6	The relationship to the companies.....	24
4.7	Future alternatives for safety culture as a regulatory concept.....	25
4.8	Summing up	26
5	Results from aviation	28
5.1	Results from the regulatory authorities	28
5.2	Results from the companies.....	34
5.3	Summing up	39
6	Results from the maritime sector.....	40
6.1	Results from authorities.....	40
6.2	Results from the companies.....	46
6.3	Summing up	55
7	Results from rail	57
7.1	Results from authorities.....	57
7.2	Results from companies	62
7.3	Summing up	69
8	Results from the road sector	70

8.1	Results from the authority	70
8.2	Results from companies	75
8.3	Summing up	82
9	Concluding discussion.....	84
9.1	Methodological weaknesses and possible bias	84
9.2	The relevance of safety culture as a regulatory concept	85
9.3	Safety culture as a safety management strategy for companies	88
9.4	The relationship between regulatory authorities and companies	88
9.5	Future potential of increasing the focus on safety culture in the sectors	94
9.6	Increased focus on safety culture and SMS in the road sector?	98
9.7	Regulating a fuzzy concept: what can we learn from the radiation authority and aviation?	101
10	Conclusion.....	102
11	References	103
	Appendix 1: Interview guide - authorities	108
	Appendix 2: Interview guide – companies	111

Summary

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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
	Com.	Yes	SMS-rules	Reporting, just, learning	Positive	Systematic efforts
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.

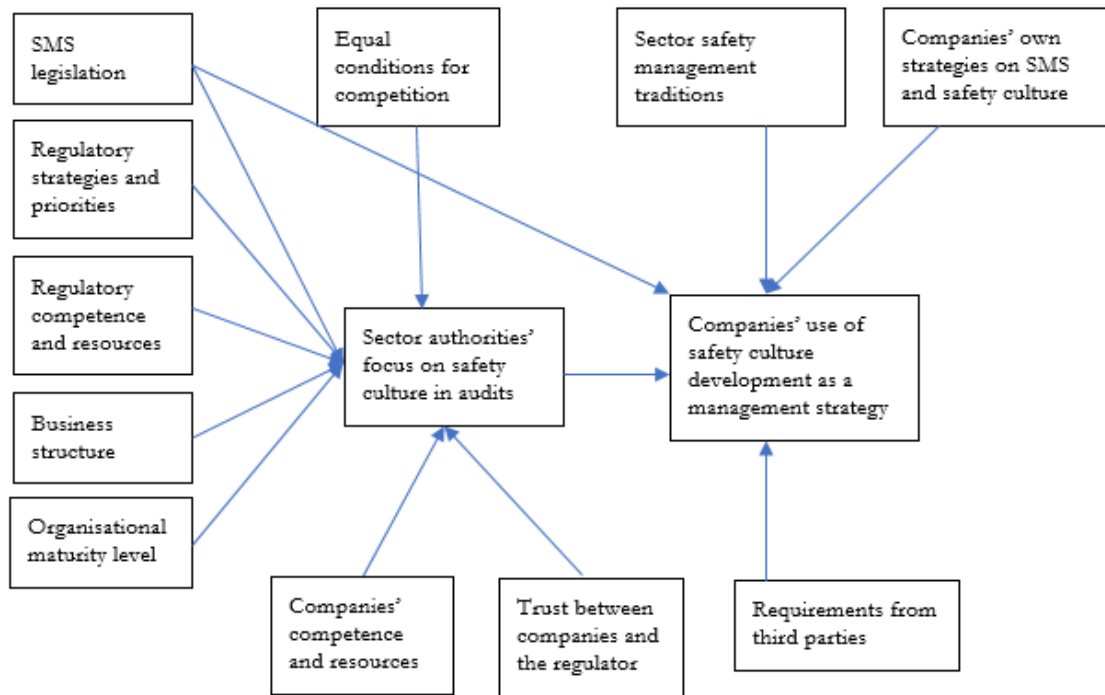


Figure S1. Illustration of factors influencing regulators' use of the safety culture concept in audits and companies' development of safety culture as a safety management strategy. The figure depicts hypothesized relationships, based on the interview data.

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.

Sammendrag

Relevansen til sikkerhetskultur som tilsynsbegrep og ledelsesstrategi i profesjonell transport

TØI rapport 1668/2018

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Transportstyrelsen i Sverige har definert sikkerhetskultur som en del av sin tilsynsstrategi. Dette innebærer fokus på sikkerhetskultur i tilsyn (gjennom en 28-punkts sjekkeliste) og gjennom Transportstyrelsens kontakt med bedriftene generelt. Den foreliggende studien tar utgangspunkt i denne strategien, og sammenligner hvorvidt de ulike sektoravdelingene i Transportstyrelsen bruker begrepet sikkerhetskultur, og i så fall hvordan de definerer og evaluerer bedriftenes sikkerhetskultur i sine tilsyn. Vi sammenligner dette med resultater fra bedriftene i de respektive sektorene, for å vurdere om bedriftene arbeider systematisk med å utvikle god sikkerhetskultur. Vi inkluderer også erfaringer fra den svenske kjernekraftindustrien, siden kjernekraftindustrien er ansett som en av de fremste når det kommer til regulering av sikkerhetskultur. Studien er basert på 40 kvalitative intervjuer. På tidspunktet som intervjuene ble gjennomført ble sikkerhetskultur systematisk vurdert i tilsyn i luftfart og jernbane. Myndighetsinformantene i maritim sektor fokuserte hovedsakelig på ISM-koden («International Safety Management code»), som indirekte dekker noen av aspektene ved sikkerhetskultur, mens myndighetsinformantene i vegtransport ikke hadde direkte fokus på sikkerhetskultur. Myndighetsinformantene i luftfart og i kjernekraft understreket at sikkerhetskultur gir et viktig perspektiv som blir utelatt ved en ren regel-basert tilnærming til regulering. Resultatene indikerer at følgende faktorer påvirker sektormyndighetenes fokus på sikkerhetskultur: 1) Sektorenes juridiske rammeverk, 2) Myndighetenes strategier og prioriteringer, 3) Myndighetenes kompetanse og ressurser, 4) Bedriftenes kompetanse og ressurser, 5) Bedriftssammensetningen i sektorene, 6) Tillit mellom myndigheter og bedrifter, 7) Ulike organisatoriske modenhetsnivåer innenfor sektorene, og 8) Hensynet til like konkurransevilkår. Resultatene viser at bedriftenes bruk av sikkerhetskultur som sikkerhetsstrategi er i tråd med tilsynsmyndighetenes fokus, med noen unntak.

Bakgrunn og formål

Forholdet mellom sikkerhetskultur/klima og ulykker/hendelser er godt dokumentert på tvers av industrier og landegrensar, og begrepet har blitt implementert av bedrifter på flere områder, også innen transport. Regulerende myndighetene i flere ulike næringer og sektorer har i de senere årene også forsøkt å ta hensyn til, og å bidra til å implementere sikkerhetskultur. Dette gjelder også myndigheter i transport. Gitt den dokumenterte betydningen av sikkerhetskultur/klima for sikkerhet, er det rimelig å anta at det vil være til nytte for transportbedrifter å få muligheten til å utvikle sikkerhetskultur som en sikkerhetsstyringsstrategi. Det er også rimelig å anta at det vil være nyttig for regulerende myndigheter å få muligheten til å fokusere på sikkerhetskultur i tilsyn og å bistå bedrifter med utvikling av god sikkerhetskultur.

Når man vurderer sikkerhetskulturbegrepets relevans i ulike transportsektorer er det imidlertid viktig å ta høyde for at noen transportbedrifter (for eksempel innen vegsektoren) i liten grad fokuserer verken på organisatorisk sikkerhetsstyring generelt eller sikkerhetskultur spesielt. De ulike transportsektorenes fokus på arbeidsrelaterte faktorer som sikkerhetskultur og sikkerhetsstyringsystemer varierer sterkt. Sikkerhetsstyringsystemer består gjerne av formelle rutiner for systematisk arbeid med

sikkerhet, for eksempel: risikoanalyser, korrigerende tiltak, sikkerhetsopplæring, sikkerhetsprosedyrer, monitorering av sikkerhetsindikatorer og utnevning av sikkerhetspersonell. Det må også nevnes at sikkerhetskulturbegrepet er et relativt nytt begrep i tilsynssammenheng, med en nytteverdi som ikke er tydelig avklart. Studier har også identifisert flere utfordringer knyttet til bruken av sikkerhetskultur som tilsynsbegrep. Til tross for at tidlige studier rapporterer om lovende resultater, beskriver de også sosiale prosesser med resultater som er vanskelig å forutse og påvirke.

På bakgrunn av den anerkjente betydningen av sikkerhetskultur for faktisk sikkerhet i transport, har Transportstyrelsen definert det å bidra til god sikkerhetskultur i transportbedrifter som en del av sin tilsynsstrategi. Den foreliggende studien tar utgangspunkt i denne strategien og undersøker relevansen til sikkerhetskultur i svensk profesjonell transport. Studien sammenlikner erfaringene til de ulike sektormyndighetene i Transportstyrelsen (luftfart, sjø, jernbane og veg) og bedriftene som sektormyndighetene forholder seg til. Vi sammenlikner myndighetenes og bedriftenes syn på og bruk av sikkerhetskulturbegrepet. Vi inkluderer også erfaringene til svensk kjernekraft, siden kjernekraft er kjent for å være blant de fremste når det gjelder regulering av sikkerhetskultur.

Studiens formål er å:

- 1) Undersøke relevansen til sikkerhetskultur som et *tilsynsbegrep for transportmyndigheter*, med fokus på a) om det er inkludert som et tilsynsverktøy av myndighetene, b) hvorfor det er inkludert, c) hvordan det blir definert, og d) hvordan det blir evaluert i bedrifter.
- 2) Undersøke relevansen av å etablere en god sikkerhetskultur som *sikkerhetsstyringsstrategi for transportbedrifter*, med fokus på a) om det blir brukt, b) hvorfor det blir brukt, c) hvordan det blir definert, og d) status på nøkkelindikatorer for sikkerhetskultur (ledelsesforpliktelse til sikkerhet, involvering av medarbeidere, rapportering, rettferdig- og lærende kultur).
- 3) Se på *forholdet mellom tilsynsmyndigheter og bedrifter* innen hver sektor.
- 4) Diskutere hvorvidt og hvordan sektorene kan *øke fokuset på sikkerhetskultur*.

Datakilder og metoder

Studien er basert på 40 kvalitative intervjuer, med 19 informanter fra Transportstyrelsen, 19 informanter fra bedrifter innen svensk transportsektor, og to representanter fra Strålsäkerhetsmyndigheten. Når det refereres til «myndighetsrepresentanter» fra transportsektoren, vises det alltid til ansatte hos Transportstyrelsen. Dette gjelder for alle transportsektorer. Tabell S.1 viser antall personer fra myndighetene og bedriftene for hver sektor.

Tabell S.1 Antall informanter fra myndigheter og bedrifter i hver sektor

Sektor	Kjernekraft	Luftfart	Maritim	Jernbane	Vei	Totalt
Informanter fra myndighetene	2	6	3	5	5	21
Informanter fra bedrifter	0	5	5	4	5	19

Situasjonsbeskrivelsene som fremkommer i denne studien er basert på intervjuer av en begrenset gruppe mennesker på et gitt tidspunkt i transportsektoren. Det er derfor viktig å merke seg at dagens situasjon kan være annerledes enn den som beskrives i den foreliggende rapporten: Strategier, tiltak, erfaringer, forhold mellom parter etc. kan ha endret seg siden intervjuene ble gjennomført. Det er også viktig å påpeke at utvalget av informanter er veldig lite i flere av gruppene vi undersøkte. Dette kan ha innvirkning på datagrunnlaget og konklusjonene vi trekker, for eksempel hvorvidt funnene for sektorene og sammenlikningen av dem er generaliserbare.

Utvalget av informanter kan også ha påvirket resultatene. Intervjuene ble imidlertid gjennomført som «ekspertintervjuer», hvor de intervjuede ble bedt om å fortelle både generelt og spesifikt om den nåværende situasjonen innen sin sektor. De skilte dessuten ofte mellom hva de gjorde selv, og hva som var vanlig blant deres kolleger. Med tanke på dette, innebærer utvalget av informanter antakeligvis ikke stor skjevhet. Vi tilbød Transportstyrelsen å gjennomføre en spørreundersøkelse blant tilsynspersonell i hver sektor, for å kontrollere resultatenes validitet; om funnene fra intervjuene ville blitt reflektert i en spørreundersøkelse. Dette ville ha styrket funnene og gitt et mer robust grunnlag for å trekke konklusjoner om sikkerhetskultur innen hver sektor. Tilbudet ble imidlertid avslått, siden de aktuelle medarbeiderne i Transportstyrelsen var engasjert i flere prosesser og prosjekter samtidig på dette tidspunktet. Vi anbefaler at en slik spørreundersøkelse gjennomføres på et senere tidspunkt.

Sikkerhetskultur som tilsynsbegrep for transportmyndigheter

Transportstyrelsen sentralt har definert sikkerhetskultur som en del av sin tilsynsstrategi. Dette medfører fokus på sikkerhetskultur i tilsyn (gjennom en 28-punkts sjekklister) og i kontakten med bedriftene generelt. Transportstyrelsen har gjennomført systematiske evalueringer av lovgivningen for sikkerhetsstyringssystemer i hver transportsektor for å undersøke hvorvidt, og i hvilken grad disse reglene kan brukes for å begrunne et fokus på sikkerhetskultur ved tilsyn. Resultatene våre tyder på at selv Transportstyrelsens strategi og regelgjennomgang legitimerte sektormyndighetenes fokus på sikkerhetskultur i tilsyn, varierte fokuset på sikkerhetskultur vesentlig i de ulike transportsektorene.

Resultatene tyder på at følgende faktorer påvirker sektormyndighetenes fokus på sikkerhetskultur: 1) Sektorenes juridiske rammeverk, 2) Myndighetenes strategier og prioriteringer, 3) Myndighetenes kompetanse og ressurser, 4) Bedriftenes kompetanse og ressurser, 5) Bedriftssammensetningen i sektorene, 6) Tillit mellom myndigheter og bedrifter, 7) Ulike organisatoriske modenhetsnivåer innenfor sektorene, og 8) Hensynet til like konkurransevilkår.

Da intervjuene ble gjennomført hadde representantene fra myndighetene innen *luftfart* nylig begynt å bruke sikkerhetskulturbegrepet i sine tilsyn, blant annet ved at inspektører fylte ut en 28-punkts sjekklister for sikkerhetskultur ved slutten av Transportstyrelsens sitt tilsyn. Sikkerhetskulturbegrepet ble også brukt i annen kommunikasjon med bedriftene, for eksempel ved seminarer med representanter fra bedriftene og på hjemmesider. Det må likevel nevnes at sikkerhetskultur ikke var fullstendig implementert som tilsynsobjekt på det tidspunkt intervjuene ble gjennomført. På dette tidspunktet hadde noen sektorer innen luftfart begynt å fokusere på sikkerhetskultur. Vi fikk senere høre at luftfartsavdelingen i Transportstyrelsen hadde tatt en pause i sine tilsyn med sikkerhetskultur (vi vet ikke for hvor lenge).

I *maritim* sektor var de fleste tilsynene delegert til klasseselskap, og rederiene forholder seg til ulike nasjonale myndigheter ved havnstats- og flaggstatskontroll.

Myndighetsinformantene i maritim sektor svare «ikke direkte» da de ble spurt om de bruker sikkerhetskulturbegrepet i sitt arbeid. De sa også at de ikke har noen strategi eller prosedyrer knyttet til sikkerhetskultur. Selv om informantene ikke brukte sikkerhetskulturbegrepet, ble det understreket at mange av kravene til sikkerhetsstyringssystem i ISM-koden omhandler sikkerhetskultur. ISM-koden refererer til «the International Maritime Organisation» (IMO) sin «International Safety Management Code». Transportstyrelsens tilsynsstrategi for sikkerhetskultur gjelder også maritim sektor, og det kan derfor innvendes at de intervjuede fra denne sektormyndigheten burde vært kjent med dette. Det som ser ut til å være et manglende fokus på sikkerhetskultur kan imidlertid skyldes en forsinket implementeringsprosess, forsinket kommunikasjon etc.

Alle utenom én av myndighetsinformantene i *jernbanesektoren* sa at de nylig hadde begynt å bruke sikkerhetskulturbegrepet systematisk i sitt arbeid, at de forsøker å evaluere sikkerhetskultur ved sine tilsyn, og at de snakker mye om det. De nevnte at de har økt fokuset på sikkerhetskultur delvis som en respons til Transportstyrelsens initiativ sentralt.

De intervjuede myndighetsrepresentantene fra *vegsektoren* rapporterte at de ikke bruker sikkerhetskulturbegrepet i sitt arbeid, og at de heller ikke evaluerer sikkerhetskulturen i bedriftene som fører tilsyn med. Det finnes ikke lovgivning i vegsektoren som krever sikkerhetsstyringssystemer eller sikkerhetskultur. Det må imidlertid nevnes at Transportstyrelsens evaluering av lovgivningen for vegsektoren indikerer at disse reglene til en viss grad kan rettferdiggjøre fokus på sikkerhetskultur i tilsyn.

Kjernekraft. Sikkerhetskulturbegrepet fikk relativt lite oppmerksomhet i svensk kjernekraft fram til begynnelsen av 2000-tallet. To hendelser; den første i Barsebäck i 2003 og den andre i Forsmark i 2006 medførte et økt fokus på sikkerhetskultur. Intervjupersonene fra kjernekraft hadde et sterkt fokus på sikkerhetskultur, som også er reflektert i kravene til styringssystemer i kjernekraft (IAEA Safety Requirement GS-R-3). Da intervjuene ble gjennomført (2017), ble det nevnt at sikkerhetskultur snart ville bli dekket i et separat lovverk. Strålsikkerhetsmyndigheten hadde også gjennomført en intern evaluering av egen sikkerhetskultur, for å klargjøre hvordan deres egen sikkerhetskultur kan påvirke sikkerhetskulturen i bedriftene de fører tilsyn med. Når de fører tilsyn med sikkerhetskultur hos lisensinnehavere (bedrifter), ser myndighetsinspektørene innen kjernekraft etter indikatorer på «underliggende mønstre», som de definerer som kultur. Denne informasjonen blir lagret i en database, som etter hvert består av en omfattende samling av observasjoner og indikatorer fra bedriftene de fører tilsyn med. Myndighetenes inspektører besøker lisenshaverne relativt ofte, og de må rapportere sine observasjoner og erfaringer i en felles database. På denne måten kan myndighetene få et omfattende bilde av sikkerhetskultur hos lisenshaverne som de fører tilsyn med. Informantene fra kjernekraft meddelte at de har et positivt forhold til lisenshaverne som de fører tilsyn med.

Sikkerhetskultur som ledelsesstrategi blant bedrifter

Undersøkelsen viser at bedriftene i hver sektor sine fokus på, og bruk av sikkerhetskulturbegrepet i sitt sikkerhetsarbeid stort sett synes å være relatert til; 1) regelverket innenfor hver sektor (SMS-krav), i tillegg til at 2) regulerende myndigheter fokuserer på sikkerhetskultur i sine tilsyn og 3) tradisjonene for sikkerhetsledelse innenfor de respektive sektorene. Videre viser erfaringene fra sjø og veg betydningen av 4) krav fra tredjeparter, som transportkjøpere, forsikringsselskaper og classeselskaper. Vegsektoren illustrerer også betydningen av 5) bedriftenes egne strategier knyttet til SMS og sikkerhetskulturutvikling.

Alle bedriftene innen luftfart jobbet aktivt med utvikling av sikkerhetskultur, og understreket betydningen av å utvikle en informert, rapporterende, rettferdig og lærende kultur. Bedriftsinformantene i sjøfart arbeider generelt med ISM-koden, og de fokuserte stort sett ikke direkte på sikkerhetskultur, selv om de nevnte at ISM-koden indirekte fokuserer på sikkerhetskultur gjennom SMS-kravene. I tillegg, arbeider jernbaneselskapene også indirekte med sikkerhetskultur gjennom sine sikkerhetsstyringssystemer, men de bruker i stor grad ikke begrepet.

Bedriftsinformantene i vegsektoren bruker ikke sikkerhetskonseptet systematisk. På grunn av manglende krav til sikkerhetsstyringssystemer i vegsektoren, finner vi at det er andre aktører enn de regulerende myndighetene som arbeider for å opprettholde en standard til sikkerhetsstyringssystemer og sikkerhetskulturnivå enn det det juridiske regelverket legger opp til. Busseierforeningen har for eksempel utviklet en rekke sikkerhetspolisier for sektoren, og transportkjøpere (stat, fylke og kommuner) stiller krav til sikkerhetsstyringssystemer i langsiktige kontrakter med busselskaper. Gitt de manglende juridiske kravene til sikkerhetsstyringssystemer og sikkerhetskultur i sektoren, ser det ut til at den interne variasjonen mellom bedrifter i dette henseendet er stor.

Tabell S.2 illustrerer sikkerhetskulturbegrepets relevans blant myndigheter og bedrifter i de studerte sektorene, med fokus på om de fokuserer på sikkerhetskultur (SK), hvordan dette fokuset er legitimert, hvordan sikkerhetskultur defineres og evalueres, forholdet mellom myndigheter og selskaper i sektoren, og potensialet for å fokusere mer på sikkerhetskultur i sektorene, basert på de intervjuedes synspunkter og våre analyser.

Tabell S.2. Sikkerhetskulturbegrepets relevans i de studerte sektorene. (Myn.=myndigheter, Bed.= bedrifter, SK-fokus= sikkerhetskulturfokus, SMS=sikkerhetsstyringssystemer, Def.=definisjon, IAEA= International Atomic Energy Association, ERA=European Rail Association).

Sektor	Nivå	SK-fokus	Legitimering	Def./Evaluering	Forhold: Myn-Bed	Potensial
Kjernekraft	Myn.	Ja	SMS-regler	Underliggende mønstre. IAEA	Positivt	Positivt. Snart lovkrav
Luftfart	Myn.	Ja/«test»	SMS-regler & strategien til Transportstyrelsen	7 tema/28-punkter	Positivt	Positivt
	Bed.	Ja	SMS-regler	Rapporterende, rettferdig, lærende	Positivt	Systematisk innsats
Sjøfart	Myn.	Ikke direkte	ISM-fokus	«Living system»	Positivt	Innen ISM?
	Bed.	Nei/i liten grad	ISM-fokus	Not applicable	Blandet	Fornøyd med ISM?
Jernbane	Myn.	Ja	SMS-regler & strategien til Transportstyrelsen	Transportstyrelsen & ERA	Positivt	Positivt
	Bed.	Ikke direkte	Utfordringer?	Ikke relevant	Blandet	Noen utfordringer
Veg	Myn.	Nei	Like konkurransevilkår	Ikke relevant	Godt/tidligere anstrengt?	Vanskelig?
	Bed.	Heterogent	Transportkjøpere og bransjeorganisasjoner	Ikke relevant	Godt/rigid tidligere?	Bransjeorganisasjoner

Forholdet mellom tilsynsmyndighetene og bedriftene

De intervjuede i luftfart rapporterte om et godt forhold mellom tilsynsmyndighetene og bedriftene. Bedriftsinformantene i luftfart sa at deres forhold til Transportstyrelsen er bra, og at det bidrar til å øke sikkerhetsnivået. De sa at de informerer Transportstyrelsen tidlig og åpent når de planlegger noe, og at de får relevant informasjon om nye ting i god tid. I sjøfart er mange av tilsynene delegert til klasseselskaper og rederiene som forholder seg til flere ulike flaggstater og havnestater. De intervjuedes erfaringer med Transportstyrelsen var blandet, men det bør nevnes at de intervjuede generelt hadde registrert sine fartøy i utenlandske flaggstater. Bedriftsinformantene i jernbanesektoren nevnte store endringer i sektoren de siste årene da vi diskutert deres forhold til regulerende myndigheter, for eksempel deregulering, konkurranse og nye organisatoriske endringer (for eksempel oppsplitting av store statseide selskaper til små private selskaper). Bedriftsinformantene i jernbanen sine erfaringer med Transportstyrelsen var også blandet. I vegsektoren nevnte noen av myndighetsinformantene at Transportstyrelsen tidligere hadde et litt vanskelig forhold til transportbedrifter og bransjeorganisasjoner, men at dette heldigvis er forbedret. Bedriftsinformantene i vegsektoren mente generelt at forholdet til regulerende myndighetene var bra. Noen av dem nevnte at tilsynene med kjøre- og hviletid kunne være mer fleksible, og argumenterte for en mer funksjonsbasert tilnærming på dette området. Til slutt var bedriftsinformantene også bekymret for at det de oppfattet som manglende ressurser hos politiet kunne påvirke håndhevelsen av trafikkreglene negativt.

Spørsmål for fremtidig forskning

Er det mulig å gi generelle råd om utvikling av sikkerhetskultur?

I tråd med tidligere forskning indikerer den foreliggende studien at hver transportsektor er unik, og at sektorene er ulike når det gjelder lovgivning, sentrale aktører, teknologier og historie etc. I tråd med dette, ser vi at sektorens arbeid med sikkerhet er tilpasset disse kontekstene, og at transportsektorene er svært forskjellige når det gjelder deres fokus på arbeidsrelaterte faktorer som sikkerhetskultur og sikkerhetsstyringssystemer. Våre diskusjoner med myndighetsinformantene viser at det er viktig å huske at også bedriftene er unike, med forskjellige historier, ledelse, organisasjonsstrukturer, tradisjoner og kulturer. Hver bedrift har sine egne måter å løse ting på (for eksempel hvordan de forholder seg til juridiske krav), de har ulike styrker og svakheter, og myndighetsinformantene understreket at de derfor skal ha mulighet til å kunne gjøre ting på sin egen måte.

Med bakgrunn i dette, diskuterer vi hva de fire ulike transportsektoren faktisk har til felles. Vi konkluderer med at de ulike transportsektoren er involvert i de samme grunnleggende aktivitetene, de forholder seg til de samme negative bivirkningene knyttet til deres grunnleggende aktiviteter, og de står overfor de samme organisatoriske utfordringene når de prøver å unngå disse bivirkningene. Noen av sektorene har klart kommet på et meget høyt nivå i dette henseendet. Dette er et godt argument for å studere sektorene sammen, og undersøke hva sektorene som i liten grad fokuserer på organisatorisk sikkerhetsstyring kan lære av de med de mest utviklede tilnærmingene til dette.

I forlengelsen av denne diskusjonen drøfter vi også om det er mulig å beskrive universelle trekk ved sikkerhetskulturintervensjoner som gjelder for alle bedrifter i alle transportsektorer. Vi konkluderer i tråd med Nævestad, Hesjevoll & Phillips (2018), som gjennomgår sikkerhetskulturintervensjoner i veg-, sjø-, luft- og jernbaneselskaper. De argumenterer for at, selv om sikkerhetskulturintervensjonene er svært forskjellige, avhengig

av sektorene og bedriftene de implementeres i, har de gjerne fire felles grunnleggende elementer:

- 1) Utnevne en ansvarlig person
- 2) Institusjonalisere felles diskusjoner og risikovurderinger av risiko i arbeidet
- 3) Implementere og monitorer tiltak, og basert på disse diskusjonene
- 4) Sørge for effektiv kommunikasjon om sikkerhetsspørsmål i organisasjonen

Selv om det ikke er mulig å gi generell rådgivning om utvikling av sikkerhetskultur, siden hver sektor og bedrift er unik, kan tilsynsmyndigheter ta utgangspunkt i disse fire hovedelementene når de utvikler råd til bedriftene i sin sektor.

Basert på vår drøfting av forholdet mellom sikkerhetsstyringssystemer og sikkerhetskultur i luftfart, maritim sektor og jernbane, diskuterer vi om en god sikkerhetskultur er det samme som vellykket implementering av sikkerhetsstyringssystemer. Vi konkluderer med at det er vanskelig å aspekter ved sikkerhetskultur (for eksempel rapporterende og rettfærdig kultur) fra aspekter ved sikkerhetsstyringssystemer (rapporteringssystem). Tidligere forskning indikerer at mange av de viktigste aspektene ved sikkerhetskultur og sikkerhetsstyringssystemer er like. Det gjelder for eksempel ledelsesforpliktelse til sikkerhet. Dette er interessant, fordi det indikerer hvor tett sammenvevd formelle (struktur) og uformelle (kultur) aspekter ved sikkerhet er. Det kan derfor være vanskelig å si hva som kommer først, og dernest hvordan man skal påvirke sikkerhetsnivået i en gitt transportsektor. På bakgrunn av dette, ser det ut til at de fire nøkkelementene som vi beskriver ovenfor kanskje også gjelder for vellykket implementering av sikkerhetsstyringssystemer.

Organisatorisk modenhet, tillit og selv-regulering

Forskning skiller mellom to tilnærminger til tilsyn; en «regelbasert tilnærming», som spesifiserer hva selskaper skal gjøre, og en «funksjonsbasert tilnærming», som angir målet for bedrifter og lar dem velge metoder for å oppnå sikkerhet selv. Selv om de fleste regulerende myndigheter blander disse tilnærmingene, fastslår Grote (2012) at tilsynsmyndigheter i løpet av de siste årene har beveget seg bort fra den «regelbaserte» og mer i retning av den «funksjonsbaserte» tilnærmingen. Dette medfører gjerne økt selvregulering, og tilsynsmyndighetenes rolle går dermed mer over til å gi råd og veiledning enn å fokusere på overholdelse av regler. Et viktig tema som ble nevnt av flere myndighetsinformanter, er at funksjonsbasert tilsyn, som involverer en høy grad av selvregulering av selskapene, krever at bedriftene har et høyt modenhetsnivå. Selvregulering som involverer internrevisjoner utført på en tilfredsstillende måte, er avhengig av et høyt nivå av tillit, kunnskap og felles mål mellom myndigheter og bedrifter. Noen av myndighetsinformantene ga eksempler på dette; mens de seriøse selskapene pekte på egne feil og svakheter, rapporterte de mindre seriøse selskapene ikke avvik. I stedet svarte de i samsvar med hva de trodde at myndighetene «ville høre». Dette illustrerer betydningen av tillit mellom myndigheter og bedrifter i en funksjonsbasert tilnærming som involverer en høy grad av selvregulering.

Dersom vi går videre med dette paradokset, er det interessant å merke seg at en av de vanligste måtene å vurdere organisatorisk modenhet på er gjennom målinger av sikkerhetskultur. Det er paradoksalt at det ser ut til at bedrifter allerede må ha nådd et visst sikkerhetskulturnivå for å ha nytte av tilsynsmyndigheters tiltak for å bedre deres sikkerhetskultur. Basert på myndighetsinformantenes syn, vil bedrifter med dårlig sikkerhetskultur sannsynligvis ikke ha nytte av tilsynsmyndigheters tiltak for å forbedre

sikkerhetskultur. Disse vil kanskje forvente, og ha mer nytte av en regelbasert tilnærming. Dette er interessant og bør undersøkes i fremtidig forskning.

Flere av de intervjuede mente at organisatorisk modenhet utvikler seg gjennom gradvis gjennomføring av tiltak rettet mot å utvikle organisatorisk sikkerhetsstyring. Det ser ut til at nivået på organisatorisk modenhet og dermed tillit var generelt høy i luftfart og lavere i vegsektoren. Det ser ut til at dette gir mulighet for flere veiledningsbaserte strategier og mer selvregulering i luftfart, mens flere regelbaserte strategier var vanlig i vegsektoren.

Økt fokus på sikkerhetskultur og sikkerhetsstyringssystemer i veg?

Vegsektoren har et lavere fokus på sikkerhetsstyringssystemer og sikkerhetskultur enn de andre transportsektorene. Vi diskuterer seks grunner til dette: 1) Sektorens bedriftsstruktur. Informantene i vegsektoren sa at det er lettere å fokusere på sikkerhetskultur, for eksempel i luftfart og i jernbane, hvor du har et lite antall store og modne organisasjoner, sammenlignet med vegsektoren, som har tusenvis av små bedrifter. 2) Tilsynsmyndighetenes kompetanse og ressurser, 3) Bedriftenes kompetanse og ressurser, 4) Bedriftenes organisatoriske modenhet, 5) Tillit mellom myndigheter og bedrifter, og 6) Hensynet til like konkurransevilkår.

Vi diskuterer også om, og hvordan tilsynsmyndighetene kan overvinne disse faktorene for å øke fokuset på sikkerhetskultur i vegsektoren. For det første foreslår vi at myndighetene skal bruke tilnærmingen i Sikkerhetsstigen i sitt arbeid med de små vegtransportbedriftene, med få ressurser og lav organisatorisk modenhet (Nævestad mfl 2017). Denne tilnærmingen tar hensyn til den store andelen av små selskaper i sektoren. For det andre, foreslår vi at tilsynsmyndighetene i hovedsak bør fokusere på sikkerhetskultur i sine tilsyn hos de større vegtrafikkselskapene. De større selskapene vil sannsynligvis ha flere ressurser og være mer organisatorisk modne. På grunn av sin størrelse, har de store bedriftene en stor andel av sjåførene i sektoren. For det tredje foreslår vi at bransjeorganisasjoner kanskje kan overta de regulerende myndighetenes veiledningsbaserte rolle i vegsektoren. I vegsektoren er det vanskelig å unngå argumentet om like konkurransevilkår, som sier at svenske transportbedrifter kan klage på at tilleggskrav (og dermed økte kostnader) rettet mot dem kan gjøre dem mer sårbare for konkurranse fra transportselskaper i andre land.

Er tilsyn med sikkerhetskultur mer subjektivt enn tilsyn av regeletterlevelse?

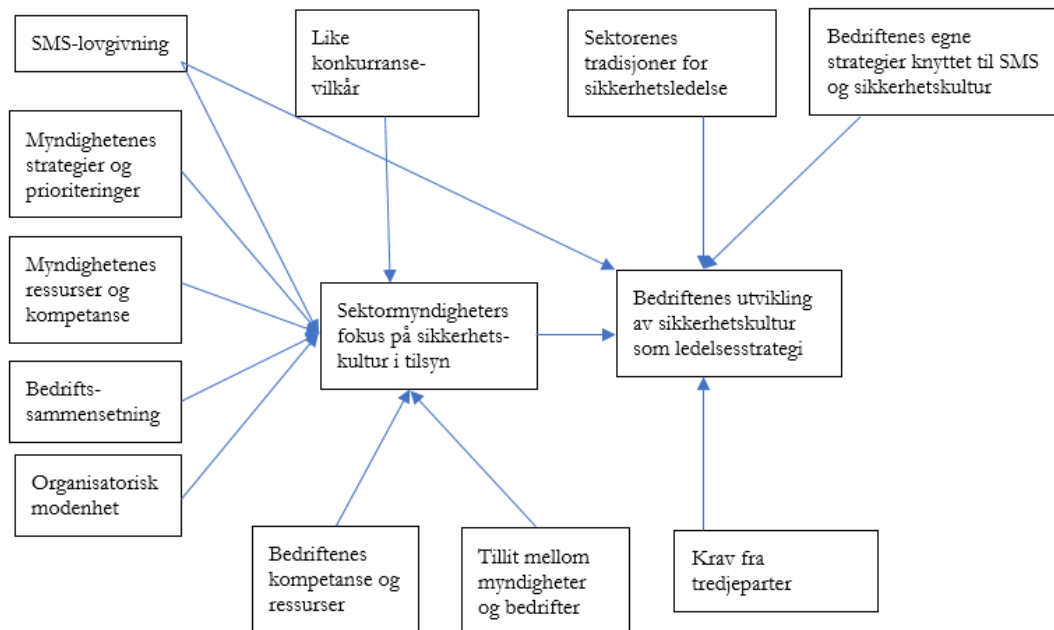
De intervjuede i flere sektorer, både fra myndigheter og bedrifter, nevnte at vurderinger av sikkerhetskultur er subjektive. Myndighetsinformanter i for eksempel jernbane var skeptiske til å føre tilsyn med sikkerhetskulturen, fordi begrepet er abstrakt, mens de uttalte at komponentene til sikkerhetsstyringssystemer er svært spesifikke, og enklere å vurdere. Andre informanter, for eksempel myndighetsinformanter fra luftfart understreket at vurderinger av sikkerhetskultur også gjøres på en systematisk måte, basert på 28-punkts sjekklisten, som oppsummerer syv temaer. Bruken av denne sjekklisten krever imidlertid mye kunnskap, og det er viktig at inspektørene som bruker sjekklisten, har en relativt lik forståelse av innholdet i hver av de 28 punktene, og hvordan man evaluerer dem. Inspektørene er derfor utdannet i sikkerhetskulturbegrepet og i bruk av sjekklisten. Likevel understreket disse informantene også at subjektive vurderinger er viktig ved bruk av sjekklisten.

Basert på intervjuene, ser det ut til at påstanden om at sikkerhetskulturvurderinger er subjektive kan bety forskjellige ting. For det første, kan subjektivitet bety at vurderinger av sikkerhetskultur (utelukkende) er basert på enkeltpersoners personlige eller subjektive syn, og dermed personlig og omdiskutert («sterk grad av subjektivitet»). For det andre kan

subjektivitet betyr at vurderinger av sikkerhetskultur krever en viss grad av personlig vurdering («mild grad av subjektivitet»). Den første tilnærmingen tilsier at sikkerhetskulturvurderinger er tilfeldige, og at en bestemt vurdering av sikkerhetskultur er «avhengig av øyet som ser». I henhold til den første oppfatningen, kan ulike personer beskrive sikkerhetskulturen i en bedrift forskjellig, og at det ikke finnes noen standarder eller kriterier som kan legges til grunn for slike vurderinger. Den andre oppfatningen indikerer at sikkerhetskulturvurderinger krever en viss grad av skjønn, men at dette ikke nødvendigvis er subjektivt i den forstand at det kan variere sterkt mellom enkeltpersoner, eller at det er vilkårlig. Snarere kan den bety at sikkerhetskulturvurderinger er utført i henhold til en kjent felles standard (for eksempel en 28-punkts sjekkliste). Slike vurderinger, med en viss grad av skjønn gjøres også i tilsynsmyndighetenes vurderinger av regeletterlevelse. Dette innebærer også en viss grad av subjektiv skjønn. På dette grunnlaget kan det derfor hevdes at myndighetsinspektørens vurderinger av sikkerhetskultur ikke nødvendigvis er mer subjektive enn andre vurderinger som de utfører i sine revisjoner.

Illustrasjon av faktorer som påvirker sikkerhetskulturbegrepets relevans

Figur S.1 illustrerer faktorer som påvirker tilsynsmyndigheters bruk av sikkerhetskulturbegrepet i tilsyn og bedrifters utvikling av sikkerhetskultur som en sikkerhetsstyringsstrategi. Sammenhengene som illustreres er basert på intervjudataene, og vi bør derfor behandle dem som hypoteser om sammenhenger, som bør undersøkes videre i fremtidig forskning.



Figur S.1 Illustrasjon av faktorer som påvirker tilsynsmyndigheters bruk av sikkerhetskulturbegrepet i tilsyn og bedrifters utvikling av sikkerhetskultur som en sikkerhetsstyringsstrategi. Figuren viser hypotetiske sammenhenger, basert på intervjudataene.

Et viktig resultat av studien er at verken tilsynsmyndigheter eller bedrifter er «prisgitt» de juridiske rammebetingelsene for sikkerhet innenfor sine sektorer. Regulerende myndigheter kan fremme et sikkerhetskulturfokus gjennom strategiske beslutninger, men bedrifter kan også velge et sterkere (eller kanskje svakere) fokus på sikkerhetskultur og sikkerhetsstyring enn det som de juridiske rammene legger opp til. Vår studie viser som nevnt at hver sektor og hvert selskap er unikt, og at tilsynsmyndigheters og bedrifters innsats for å fokusere mer på sikkerhetskultur må tilpasses disse sektorielle og organisatoriske sammenhengene. Sikkerhetskulturperspektivet må oppfattes som nyttig og konkret av sentrale aktører; det må ses som en komplementær ressurs, og gi ytterligere innsikt i hva de allerede gjør.

1 Introduction

1.1 Background

Transport accidents represent a serious public health problem. Recent data shows that 1.24 million people die each year on the world's roads and between 20 and 50 million people sustain non-fatal injuries (WHO 2013). Numerous people lose their lives annually in maritime accidents, including 24000 in the fishing sector alone (IMO 2015). In 2015, 1.739 people were killed or seriously injured in railway accidents in the EU-28. In comparison, there were in average 611 worldwide air traffic fatalities each year in the period 2006-2015. Based on these numbers, it has been argued that new approaches to safety and safety regulation should be introduced in order to contribute to increased transport safety, especially in the road sector. Safety culture has been introduced as such a perspective (cf. Ward et al 2010).

It is widely recognized that safety culture is important for safety in organizational settings in hazardous industries, and the concept is applied to an ever-increasing range of sectors and industries (Nævestad 2010a). The relationship between safety culture/climate and safety outcomes is well documented across industries and countries (Zohar 2010). Safety culture generally refers to safety relevant aspects of culture in organizations (Hale 2000; Antonsen 2009), and in this report, we specify safety culture as shared and safety relevant ways of thinking or acting that are (re)created through the joint negotiation of people in social settings (Nævestad 2010a). Safety climate represents a snapshot or manifestation of the safety culture (Flin et al 2000).

It is difficult to find directly comparable accident statistics from the different transport sectors, indicating the potential for improvement that may come about as a result of increased focus on safety culture. However, even though the technology, infrastructure and socio-cultural contexts differ, Nævestad et al (2018) found that companies in different transport domains face similar organizational challenges related to: (i) the human factors influencing operators' strengths and weaknesses; (ii) the organizational management systems developed to contain and reduce the effects of the operators' weaknesses and fully utilize their strengths; and (iii) safety culture. The safety record of international airline companies or hazardous goods hauliers suggests that they have largely succeeded in managing safety and establishing positive safety culture, while the poorer safety record of some other transport branches suggests less success. Putting varying framework conditions to one side, Nævestad et al (2018) argue that it is clear that the latter may be able to learn from approaches taken by the former.

As a consequence of the increased acceptance of safety culture as a decisive factor for organizational safety, the concept has been implemented formally by companies in several domains, including transport (Nævestad et al 2018). Additionally, regulators in different industries have attempted to account for and apply safety culture in recent years (Kongsvik & Gjørund 2016; Antonsen et al 2017). This applies to high risk sectors like the Norwegian petroleum authorities (Kringen 2009) and nuclear safety authorities (IAEA 1991, 2002, 2016). Some transport authorities have also started focusing on safety culture, e.g. North

American railroad safety authorities (Amtrak 2015; Lewis et al 2007) and the Swedish Transport Safety Agency (STA)² (2013).

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 incorporate developing 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. In order for this to happen, however, more knowledge is needed on the possibilities of introducing the safety culture perspective to the different transport sectors. Each sector will have unique legislative frameworks, histories, safety traditions, organisational models, (number of) key actors, companies etc. These factors influence both current and new approaches to safety management - and in particular the perceived need and usefulness of the latter.

Considering the implementation of safety culture strategies in transport companies, it is important to remember that different transport sectors vary widely in the focus on factors like safety culture and safety management systems (SMS) (cf. Nævestad et al 2017a). 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 (Thomas 2012).

Some transport sectors (e.g. road) are relatively new to measures focusing on organisational safety management in general, and the safety culture perspective in particular (e.g. Gregersen et al 1996; Newnam & Watson 2011). SMS fostering positive safety culture are required in aviation, in the maritime sector and in rail (Lappalainen et al 2012; Hudson 2003; Amtrak 2015). In contrast, formal SMSs for companies in the road sector are so far voluntary (e.g. ISO:39001, UK Department for Transport / HSE's Driving at Work: Managing Work-Related Road Safety). 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 (Kongsvik & Gjørund 2016; Bye et al 2016; Antonsen et al 2017). Although early studies report of promising results, they also describe social processes that seem hard to foresee and influence (Kringen 2009; Bye et al 2016).

1.2 Aims

Taking, the Swedish Transport Agency's strategy of contributing to a high safety culture in transport companies, as the point of departure, the present study examines the relevance of safety culture in Swedish professional transport. The study compares views on and use of safety culture among the regulators in the different branches of the STA (aviation, maritime, rail and road transport) and the companies that they relate to.

The aims of the study are to examine:

- 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

² There is no official acronym for the Swedish Transport Agency. Thus, the acronym STA is created solely for this report.

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*.

As noted, the study focuses on professional transport (aviation, maritime, rail and road).

1.3 The status of safety culture in different transport sectors³

The concept of safety culture has different status in the different transport sectors. The safety culture level of aviation is used as a model for improving safety culture in oil and gas (Hudson 2003) and also in other industries and sectors. Reason (1997, 1998) provides a compelling description of the key facets of safety culture, using the formal and informal aspects of incident reporting in aviation as the model. He equal's a good safety culture to an informed culture, which means that the organization collects information about both accidents and incidents, and carries out proactive counter measures. An informed culture is also a reporting culture, and a just culture, which means that there is an atmosphere of trust within an organization that encourages and rewards its employees for providing information on errors and incidents. This is the premise of a learning culture.

Based on requirements laid by the The International Maritime Organization's (IMO) International Safety Management (ISM) code (made statutory in 1998), it seems that the main safety prevention focus in the maritime sector is on structural, formal aspects of safety management systems, rather than safety culture. The ISM code was developed after several severe maritime accidents were found to be caused by human error and insufficient safety management systems. IMO's primary goal with the ISM code was to gradually create a new safety culture in the maritime industry (Kongsvik & Gjosund 2016).

The application of the organizational safety culture concept in aviation and other sectors, has influenced safety practitioners, accident investigators and researchers involved in railway safety to apply the concept to rail (Bjørnskau & Nævestad 2013). The concept has been applied in investigations of rail accidents (Hopkins 2005), studies of rail safety culture/climate (Farrington-Darby, Pickup, & Wilson 2005) and in policy statements about rail safety (HSE 2005). US railroad safety authorities have included safety culture in their regulatory repertory, through the Railroad Safety Improvement Act of 2008 (Amtrak 2015).

Compared with other transport sectors, it seems that the safety culture perspective has been applied to a little extent in the road sector. A literature review of safety management interventions that have been effective in reducing injury outcomes in heavy vehicle transport does not mention safety culture among the factors that have been found to reduce crashes/injuries (Mooren et al 2014). It is likely that this reflects a lacking implementation in the sector, rather than a lacking effect. Additionally, it seems that most national road safety authorities do not yet employ the safety culture concept systematically, despite the fact that research indicates that safety culture influences transport safety behaviour and safety outcomes in road transport organisations (cf. DfT 2004, Wills et al 2005 and Davey et al 2006).

³ This presentation is based on Nævestad et al (2018).

1.4 The Swedish Transport Agency

The Swedish Transport Agency (STA) (Transportstyrelsen) is working to achieve good accessibility, high quality, secure and environmentally aware in rail, air, sea and road transport. The STA has overall responsibility for drawing up regulations and ensuring that authorities, companies, organisations and citizens abide by them. The STA was established on the 1st of January 2009.

One of the key elements in the regulatory strategy of the STA is to contribute to a high safety culture in transport companies with permits to conduct professional transport operations (STA 2014). It is thus important for the STA that companies in all transport sectors have a good safety culture and work systematically to improve and develop safety culture.

The STA (2013) defines safety culture as:

(...) an organization's shared way of thinking and acting in relation to risk and safety, i.e. how an organization prioritizes and actually works on risks and safety in its operations.

The STA (2013) focuses on seven aspects of safety culture, e.g.

- 1) Managers' safety commitment and responsibility
- 2) Employee involvement in safety issues to create mutual trust between managers and employees
- 3) A reporting and just culture
- 4) A culture that fosters learning from your own experiences and the experiences of others.

Additionally, the STA recommends that in order to help improve safety culture, the organization should document their work in each of the four above-mentioned areas. This should happen in some form of formalized and structured safety management system. In other words, it is not enough to have formal procedures and routines in place - all relevant personnel within the organization need to know about the procedures, they must understand what they mean, why they exist, and they have to be able to act as stated in the procedures. The STA's conceptualization of safety culture underlines that the safety culture of organizations cannot be viewed separately from the safety management system. If employees lack knowledge, understanding and motivation to behave in accordance with the SMS, a discrepancy between the SMS and their safety behavior is likely to arise (STA 2013). Procedures and peoples' understanding of them influence how people actually behave.

In addition, the STA stresses that an organization is always part of a larger social context and that safety culture therefore is influenced by several external factors, such as laws/regulations, inspections, competitive conditions and costs of possible incidents and accidents.

Safety culture fits well with STA's risk-based approach to regulation and the proactive approach that system regulation involves (STA 2015). The risk-based approach involves the STA directing its attention to the areas that give the greatest benefits (i.e. the areas with the highest risk) (STA 2013, 2015). System regulation involves reviewing whether a company has a management system and whether this system ensures a correct implementation of the rules (STA 2015). This may also be referred to as an audit of companies' internal control systems.

The STA strategy of focusing on safety culture in audits was also legitimized through a rule review carried out by the STA's «Human Factors Competence Centre». This showed that the seven safety culture aspects defined by the STA were indirectly directly covered in the

legal requirements governing inspections in all the transport sectors, and that a focus on safety culture in audits was legally justified (STA 2016). This especially applies to the SMS rules in aviation, the maritime sector and rail, but also in some of the rules applying to the road sector. STA's rule review did not find connections to all seven safety culture aspects in all transport sectors. The review concludes that it is easier to justify safety culture inspections in the transport sectors with SMS requirements (i.e. all except professional road), but suggests that an SMS is indirectly required in the rules applying to professional road transport.

1.5 The nuclear industry

We also include experiences from the nuclear industry, as it is recognized to be in the forefront when it comes to safety culture regulation. It is widely recognized that the concept of organizational safety culture originates from the nuclear industry, where it originally was used by the report following the 1986 Chernobyl disaster (cf. IAEA 1991,1992). Since then, the International Atomic Energy Agency (IAEA) and the International Nuclear Safety Advisory Group (INSAG), which is an advisory group to the Director General of the International Atomic Energy Agency, has provided several requirements and guidelines on safety culture. INSAG defines safety culture as:

“That assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance. (INSAG 1991).”

The IAEA Safety Requirement GS-R-3 (IAEA 2006), which may be adopted by IAEA member states, is directly linked to safety culture. This standard requires nuclear organizations to implement management systems which promote and support a strong safety culture by for instance reinforcing a learning and questioning attitude at all levels of the organization and providing the means by which the organization continually seeks to improve its safety culture. (IAEA 2006: 6). Furthermore, the standard provides five characteristics of a strong safety culture (IAEA 2009, 2016):

- Safety is a clearly recognized value
- Leadership for safety is clear
- Safety is integrated into all activities
- Safety is learning driven
- Accountability for safety is clear

The IAEA provides several different tools and training to both regulators and organisations in Member States to increase their understanding of safety culture and how to improve safety culture. First, the Independent Safety Culture Assessment (ISCA) is based on data from questionnaires, interviews, focus groups, document reviews and observations. Second, the Safety Culture Continuous Improvement Process (SCCIP), includes a three-day senior management workshop to strengthen safety culture leadership skills, self-assessment training and continuous improvement training. Third, the IAEA provides guidelines with examples of good safety culture management practices (IAEA 1997). Fourth, the IAEA provides a practical guideline for auditing safety culture: Safety Culture Oversight Process (SCOP) (IAEA 2013).

1.6 Structure of the report

In order to provide a theoretical and conceptual background to the presentation of the empirical data from the different transport sectors and nuclear sector, the report next reviews previous research on organizational safety culture and its relevance to the management and regulation of safety in professional transport (Chapter 2). After briefly describing the interview method (Chapter 3), the above aims are achieved by presenting our findings according to sectors studies: nuclear, aviation, maritime, rail and road (Chapter 4-8). We end by considering the strengths and weaknesses of our approach, and discussing the significance of our findings for the management and regulation of safety in transport companies (Chapter 9).

2 Previous research

In this chapter, we review previous research on organizational safety culture, its relevance as a regulatory concept for authorities and developing good safety culture as a management strategy for companies. This previous research relates to the first and second aims of the study, and it provides a backdrop for the presentation of the empirical data in Chapter 4-8, and our discussion of the empirical data in light of previous research in Chapter 9.

2.1 Organisational safety culture

The concept of (organizational) safety culture is usually traced to the 1986 Chernobyl disaster, which led to a shift of focus in the investigations and studies of safety in organizations. Several major accident investigations subsequently identified safety culture as a major contributing factor (Cullen 1990; NASA 2003). Organizational safety culture can be defined as «safety relevant aspects of culture in organizations» (Hale 2000; Antonsen 2009; Nævestad 2010a). Although these aspects may refer to a range of different cultural phenomena (e.g. behavioural patterns, norms, values), most studies define safety culture as shared and safety relevant ways of thinking or acting that are (re)created through the joint negotiation of people in social settings (Nævestad, 2010a).

Research on culture in organizations is often subsumed under two approaches: the functionalist and the interpretive approach (Glendon & Stanton 2000).⁴ Functionalist and interpretive scholars differ in their understanding of what safety culture is, their understanding of how safety culture should be measured, and their views on the manageability of safety culture (Nævestad 2010a). The functionalist approach views culture as a critical variable (Smircich 1983) influencing certain outcomes: safety, reliability and so forth. Interpretive researchers, on the other hand, conceive of culture as a root metaphor (Smircich 1983) for the organization, approach organizations as if they were cultures.

These approaches give rise to different views on how to measure safety culture. It has been argued that the functionalist approach upholds a reified notion of culture, presupposing that it is an entity that one can measure and then evaluate the effects of (Antonsen 2009). Interpretive scholars, on the other hand, do not view organizational culture as a distinctive entity within the organization, but as an approach to the organization; as an aspect of all organizational phenomena. The former approach often tends to study safety culture quantitatively, as safety climate, while the latter approach tends to use qualitative methods. Quantitative studies focus on identifying the key aspects of safety culture and their relations to safety outcomes. Quantitative studies also focus on developing and validating scales for

⁴ These approaches can be referred to as ideal types (Weber 1997): analytical simplifications that do not exist in their pure form in reality. It is evident that the situation in the research field of safety culture is more complex than this ideal typical outline indicates. Although such simplifications are required to distinguish some of the major differences in research on safety culture, it is important to remember that not all safety culture scholars are explicit about their orientation (i.e. functionalist or interpretive). Safety culture research may be explicitly or implicitly interpretive or functionalist. It may also apply an explicitly or implicitly mixed approach (Nævestad 2010b).

measuring «shared and safety relevant ways of thinking or acting». The element of safety culture that can be measured is often referred to as safety climate. Thus, safety climate can be conceived of as «snapshots», or manifestations of safety culture (Cox & Flin 1998). We use the terms culture and climate interchangeably. Quantitative measurements of safety culture can provide leading indicators of safety and consequently offer predictive assessments that enable safety improvements without having to wait for accidents or incidents to happen (Antonsen 2009). Quantitative measurements of safety culture are necessary to compare scores over time, between organizations and to quantify the relationship between safety culture and safety outcomes.

Qualitative studies focus on how safety culture guides individuals' interpretations of actions, hazards and their identities, and motivates and legitimizes behaviours that have an impact on safety (Antonsen 2009, Nævestad, 2010a; 2010b). These studies may give us access to the «deeper» levels of safety culture; the more implicit and taken for granted basic assumptions and «tacit knowledge» (cf. Schein 2004; Haukelid 2008). Qualitative studies focus on how safety culture provides a frame of reference that guides individuals' interpretations of actions, hazards and their identities, and which motivates and legitimizes behaviours that have an impact on safety (Antonsen, 2009, Nævestad 2010a).

2.2 Safety culture as a regulatory concept for authorities

2.2.1 Rule-based and function-based regulations

Public intervention for managing and reducing risks usually takes the form of regulation, and the magnitudes, means, and methods of regulation vary (Kringen 2009). The study of risk regulation concerns, apart from the nature of the risks involved, how public policies and priorities emerge, how they are transformed into rules and policy instruments, how these are enforced and practically implemented, how regulated parties respond, and so forth (Kringen 2009).

Decisions about regulatory interventions may both be reactive (based on experience with past incidents) and proactive (based on imagined incidents that may occur). There is also a long-standing debate on the relative merits of rule-based regulation versus principle-based, or function-based regulation (Burgemeestre, Hulstijn & Tan 2009). While function-based regulations formulate norms as guidelines, leaving the exact implementation open to the subject of the norm (e.g. «drive responsibly»), rule-based regulation prescribe in detail how to behave («the speed limit is 80 km/h»). Some scholars also use the concept performance-based, or function-based regulation, which means that the regulator specifies the desired outcome (i.e. the prescribed safety level) or function, and not the means for attaining it (Lindøe, Kringen & Braut 2012). These concepts (principle-, performance- and function-based) are closely related, and they all refer to the opposite of regulation based on detailed rules (e.g. «a specific area must be secured with fences that are minimum 2 metres high»). In this study, we use the term function-based. Function-based rules may instead refer to a function (or principle) («the area must be adequately secured»), leaving it up to the companies themselves to define what «adequately secured» means, based on their own risk assessments (concluding that e.g. both fences and video surveillance are required). As a consequence of principle or function-based regulation, the regulatory role may change into a more guiding role, providing companies with examples and guidance on how to develop strategies to comply with the more generally formulated principles or functions (OECD 2002).

Organisations' self-regulation may often follow from function-based regulation, indicating that it most of the time is up to the organisations themselves to review their work on safety and whether they comply with function-based regulation. One strategy of complying with principle or function-based rules is to develop safety management systems, that may include methodologies and processes of risk assessments, internal monitoring arrangements and so forth (Kringen 2009: 6).

Organisations use internal control systems to do self-audits of their SMS or quality systems and for demonstrating compliance with environmental, health and safety laws (Andersen 1996, in Elvebakk 2015). Moreover, the implementation of safety management systems (the process for attaining safety) may also be legally required by regulators. In accordance with this, May (2007) also refers to system-based regulation, which focuses on process or system, and assesses whether systems are acceptable (Elvebakk 2015). System inspection involves reviewing whether a company has a management system and whether this system ensures a correct implementation of the rules (STA 2015).

Although most regulatory regimes comprise a mixture of rules and functions, it is argued that there is an increasing tendency to adopt function-based regulation, as the latter is more flexible and allows for more innovation when it comes to adopting best practices (OECD 2002). In accordance with this, we may also expect more self-regulation, and that regulators' focus change to a more advisory role, supervising organisations, e.g. with their internal control systems.

To sum up, it seems that we, based on the previous conceptual distinctions may conceptualize a continuum, with detailed rules (specific) in one end and function-based rules (general) in the opposite end. Thus, we refer to (detailed) rule-based and function-based regulation (general rules or principles). Additionally, we may also conceive of an advisory regulatory approach, where regulatory authorities provide organisations with help and guidance. This approach is often combined with a function-based approach, where regulators help organisations with their self-regulation, including their own efforts to develop their safety management and safety culture.

2.2.2 Experiences with safety culture as a regulatory object

Is it included in the regulatory repertory? Several regulatory authorities have as noted started focusing on safety culture, e.g. the Norwegian Petroleum Authority (PSA) (Kringen 2009) Nuclear safety authorities (IAEA 1991, 2002, 2016), North American railroad safety authorities (Amtrak 2015; Lewis et al., 2007, STA 2013) (cf. Chapter 1.3). The Norwegian PSA introduced a HSE culture provision in (2002) requiring a positive HSE culture of the companies. The IAEA Safety Requirement GS-R-3 (IAEA 2006) is, as noted, directly linked to safety culture. The standard requires nuclear organizations, in IAEA member states which have implemented it, to implement management systems which promote and support a strong safety culture. Moreover, the IAEA provides tools and training to both organizations and regulators in Member States to increase their understanding of safety culture and how to improve safety culture. The U.S. Federal Railroad Administration (FRA) has implemented voluntary programs explicitly aiming to improve safety culture in the industry. This initiative has generated several comprehensive safety culture interventions, and evaluations of these were mostly positive, although results varied between companies and sites (cf. Ranney et al 2009, 2013; Zuschlag et al 2013; Amtrak 2015). As a consequence of the Canadian Railway Safety Act, railways have since 2001 been required to implement and maintain an SMS. While the current SMS regulation (updated in 2015) does not explicitly target safety culture, related publications, including a review of the railway safety act conducted by an advisory panel and notes from the SMS working group, describes a positive safety culture both as a goal of the

SMS requirement, and as a prerequisite to fully implement it (Lewis, Côté, Lacombe, & Moser, 2007).

Why is it included? According to Kringen (2009), the Norwegian PSA introduced the HSE-culture provision partly because of the documented importance of safety culture for safety management in aviation and in the nuclear industry. The provision was introduced after a period where researchers asserted that safety levels actually were deteriorating in some areas, and Norwegian politicians stated that the Norwegian petroleum industry was in need of a «cultural effort» (Haukelid 2008). The Canadian railway safety act was reviewed in 2007 both overall (Lewis et al., 2007) and with a specific focus on SMS (SMS Aviation Safety Inc, 2007). The review indicated that although progress had been made, SMS had been implemented to varying degrees in the industry. The review also reports of a culture of mistrust within and between rail companies and the regulator, contributing to insufficient and irregular implementation of SMS (SMS Aviation Safety Inc., 2007). A recommendation of the general 2007 evaluation was that «Transport Canada, Rail Safety Directorate and the railway industry must take specific measures to attain an effective safety culture» (Lewis et al., 2007, p. 72). In response to this, an SMS working group was formed that provided the industry with additional tools to improve SMS implementation. This included: 1) Tools for self-measurement, 2) A safety culture check list, 3) Examples of best practices and 4) Guidance on how to integrate the core principles of SMS. Additionally, a 5) Definition and description of a positive safety culture was provided. One of the key missions of the IAEA is to provide high standards of nuclear safety. As part of the latter mission, the IAEA publishes safety standards. The IAEA Safety Requirement GS-R-3 (IAEA, 2006) is directly linked to safety culture, requiring nuclear organizations to implement SMS which promote and support a strong safety culture by for instance reinforcing a learning and questioning attitude at all levels of the organization.

How is it defined? The main challenge with introducing safety culture as a regulatory object is that it is abstract and ambiguous (Bye et al 2015, Kongsvik & Gjørund 2016; Antonsen et al 2017). According to Bye et al (2015), no explicit definition of HSE culture was given in the regulations or the guidelines, when the Norwegian PSA introduced HSE-culture as a regulatory object. The PSA left it up to the companies to specify what constitutes ‘a sound HSE culture’, and how to achieve it. Bye et al (2015), conclude that the HSE-culture concept legitimated a very broad range of HSE approaches in regulated companies, some of which were unexpected by the regulatory authorities. The PSA published a leaflet on HSE-culture, where they define the concept, discuss characteristics of good HSE culture and factors influencing HSE culture.

How is it assessed? In his Ph.D. dissertation, Kringen (2009) reports of challenges in the early years of the PSA’s use of the HSE-culture provision, as the concept was hard to define and operationalize in audits and in accident investigations. It was also challenging in the beginning for the predominantly technically oriented personnel in the PSA to make use of such an unfamiliar and different concept. Moreover, labelling companies with a «bad HSE-culture», e.g. after accidents was also viewed as a (too) drastic measure by the PSA in the early phase of the authority’s use of the concept. The IAEA provides tools and training to both organizations and regulators in Member States to increase their understanding of safety culture and how to improve safety culture. The Independent Safety Culture Assessment (ISCA) is based on data from questionnaires, interviews, focus groups, document reviews and observations. This data is compared with the IAEA normative framework for strong safety culture (IAEA, 2009, 2016). The IAEA provides a practical guideline for regulators on how to audit safety culture (IAEA, 2013). The Safety Culture Oversight Process (SCOP) follows six steps. First, the regulatory body must identify legal requirements related to safety culture, ensure commitment from senior management,

specifying the scope, interfaces, roles and responsibilities, and plan data gathering. Second, an approach to safety culture oversight, producing a «safety culture picture» must be selected. Third, the regulator must engage in dialogue with licensees to ensure that the basic concepts of safety culture are shared and understood. Fourth, the regulator must collect data through for example observations, interviews, document review, questionnaires, discussions, and then analyze data. Fifth, the safety culture picture developed is presented to the licensee for discussion during a meeting, where improvement actions are agreed upon. Finally, the regulator plans further analysis in order to understand the impact of the improvement actions on the safety culture. North American Railroad Authorities do not (yet) formally assess safety culture in their audits.

2.2.3 Regulatory strategies to influence safety culture in companies

Based on the above mentioned distinction between a rule based approach and an advisory approach, Nævestad, Hesjevoll and Ranestad's (under review) discuss 12 strategies (six rule-based and six advisory-based) that regulatory authorities can use to influence safety culture in organizations, based on a review of the early experiences from the Norwegian petroleum sector, the nuclear sector and North American Rail:

- 1) Introducing a general safety culture requirement.
- 2) Auditing safety culture (without a requirement).
- 3) Introducing specific safety cultural requirements (without a general requirement).
- 4) Facilitating changes in safety culture by introducing new rules.
- 5) Implementing culture through systems.
- 6) Using safety culture in accident investigations.

Advisory-based strategies to influence safety culture:

- 7) Providing tools for self-measurement.
- 8) Providing tools for developing a positive safety culture.
- 9) Providing guidance on the processes in which culture is (re)created.
- 10) Providing real examples of safety culture interventions.
- 11) Training of managers and employees.
- 12) Financial support as a motivational tool.

2.3 Developing good safety culture as a management strategy for companies

2.3.1 Key aspects of safety culture

Flin, Mearns, O'Connor & Bryden (2000) provide an overview of the topics most commonly included in safety climate measurements. They selected 18 studies based on a literature search. Among the criteria underlying the literature search was that the reviewed surveys had to have more than 100 respondents, and that the studies were only from the industrial sector. In the final review sample, about half of the studies were from companies in the energy / petrochemical sector. They conclude that safety climate measurements generally include six themes. The first and most popular theme is management commitment to safety. This theme was left in 72 % of the studies, and proved to be the most important topic in measurements of organizations' safety climate. This theme addresses employee perceptions of management's attitudes and behavior in relation to

safety, production and topics such as selection of employees, discipline, planning, etc. (Flin et al., 2000: 185). Senior management commitment to safety is the most studied and best-documented characteristic of a good safety culture, independent of sector (Flin et al 2000; Guldenmund 2000; Pidgeon & O'Leary 2000; DeJoy 2005). It tends to influence all other safety-related aspects of organisations, and it influences safety motivation (Newnam et al., 2008), and is directly related to safety rankings (Zohar, 2010). The second key theme that Flin et al (2000) found refers to the safety system. This theme was found in about two thirds of the 18 studies studied. The theme safety system consists of many different aspects of SMS, such as safety managers, safety committees, work permit systems, safety philosophies and safety equipment (Flin et al., 2000: 186). The third key theme identified in approximately two thirds of the 18 reviewed studies is risk, specified as perceptions of risk, attitudes to risk and safety and so on (Flin et al., 2000: 186).

2.3.2 Views on how safety culture change comes about in organisation

The varying views of interpretive and functionalist scholars on what safety culture is (see above) give rise to diverging views on the issue of cultural management. Functionalist scholars presuppose that safety culture can be changed through various managerial efforts, indicating the wanted way of doing things in organisations (e.g. Schein 2004). Schein's (2004) «six primary embedding mechanisms» that managers can use to shape culture is typical of this view:

- 1) What managers pay attention to, measure and control on a regular basis
- 2) How managers react to critical incidents and organizational crises
- 3) How managers allocate resources
- 4) Deliberate role modelling, teaching and coaching
- 5) How managers allocate rewards and status
- 6) How managers recruit, select, promote and excommunicate.

Interpretive scholars, on the other hand, argue that changing and managing safety culture is a very demanding task, as organizations comprise sub-cultures, as cultures are created and recreated through group members' interaction and negotiation over meaning (e.g. Pidgeon & O'Leary 2000). Thus, they uphold a bottom-up approach to culture change, and criticize the functionalist assertion that leaders initiate culture in organizations (Glendon & Stanton 2000).

The research on safety culture interventions generally indicate that safety culture change come about in the dynamic between «top-down» processes initiated from the management and «bottom-up» processes based in sub-groups (Olsen et al 2009). In line with this, Nævestad, Hesjevoll & Phillips (2018) conclude that the basic requirements of safety culture change seem to be to institutionalize joint discussions of work place hazards facilitated by manager commitment and employee involvement. In a systematic literature review, they identify four key elements which seem to be common in all the reviewed safety culture interventions (Nævestad, Hesjevoll & Phillips 2018):

- 1) Appointing a key person (generally a manager) to be responsible for implementing the intervention
- 2) Institutionalizing joint discussions and risk assessments of work place hazards, involving managers and employees
- 3) Implementing and monitoring measures based on these discussions and joint risk assessments, e.g. reporting systems, training and

- 4) Maintaining effective communication about safety issues in the organization, in line with Reason's (1997) depiction of an informed safety culture.

2.3.3 Safety management systems

Although work on organizational safety must address both formal and informal aspects of safety, it may be useful to think of organizational safety culture as the informal aspects of safety in organizations («how things are actually done») in order to distinguish it from the formal aspects of safety in organizations («how things should be done»), as described in procedures, routines and organizational charts etc. (Antonsen, 2009). The latter is often referred to as safety structure, or safety management systems (SMS). Just as we define safety culture as aspects of culture in organisations that are relevant to safety (Hale 2000), we define safety structure as safety-relevant aspects of organisational structure.

Organisational structure refers to the way tasks in an organisation are divided, how work flows, how this flow is coordinated and the forces and mechanisms that allow this coordination to happen (McShane & Travaglione 2003). Coordination can be achieved by: 1) informal communication, 2) formal hierarchy, involving direct control, and 3) standardization of tasks, with formal instructions, goals (standardisation of outcomes) or training (standardization of knowledge) (McShane & Travaglione 2003).

SMS typically include management policy, appointment of key safety personnel, reporting systems, hazard identification and risk mitigation, safety performance monitoring etc., (Thomas 2012). In a systematic review, Thomas (2012) finds especially two aspects of SMS (management commitment to safety and communication) to be related to safety performance. This illustrates that it may be hard in practice to discern between safety culture interventions and SMS (Nævestad, Hesjevoll & Phillips 2018).

3 Method

3.1 Interviews

We conducted 40 qualitative interviews by telephone, each lasting about 90 minutes. Three of the interviews with authority representatives in rail and road were group interviews (involving 2-3 people). We interviewed 19 representatives from the Swedish Transport Agency, working within aviation (N=6), the maritime sector (N=3), rail (N=5), and road (N=5) in order to gain knowledge on the relevance and use of safety culture in the work of the representatives from the different sectors. We also interviewed representatives from the Swedish Radiation Authority (N=2). Unfortunately, we were not able to interview any representatives from the nuclear power plants. We interviewed 19 representatives from Swedish Transport companies, from aviation (N=5), the maritime sector (N=5), rail (N=4), and road (N=5). In the road sector, we also talked to representatives of different interest organisations and business organisations with good knowledge of the situation for road transport companies. In aviation, we talked to company representatives of airlines, airports, workshops etc. All these were exposed to SMS rules⁵ and the safety culture audits of the STA. We discuss possible methodological weaknesses related to sampling and potential biases in Chapter 9.1. Table 3.1 shows the number of authority and company interviewees in each of the sectors.

Table 3.1 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

In the start of each interview we stressed that it was voluntary to participate, that the provided information is processed anonymously. We also said that we were not necessarily looking for interviewees' organizations' official views, but that interviewees «think out loud», based on their experiences, and provide us with input that we can learn from. We also stressed that we would refer to everyone we interviewed from the authorities as «government representatives», and from the companies as «company representatives», and that all interviewees would get our text describing results from the interviews for review.

We used a semi structured interview guide in the interviews with authority representatives (Appendix 1), which contained questions on the following themes: 1) the work activities of the interviewee, 2) whether they use safety culture in their work, and whether they have strategies, procedures and tools to assess safety culture, their experiences with their use of safety culture as a regulatory concept, 3) how they define safety culture, 4) their perceptions of safety culture in the companies; differences between companies, factors influencing

⁵ As we describe in the results section, there was one exception to this: one of the aviation company interviewees were not exposed to SMS rules, although his company nevertheless adhered to these rules in practice, and he also said that these rules would soon apply to his company.

safety culture, relationship between safety culture and safety performance, 5) their views and experiences on current regulatory strategies; e.g. rule-based vs. function-based, 6) their views and experiences on their current strategies to influence safety culture in organizations, and 7) pros and cons of 12 possible (future) strategies aimed at improving safety culture in the companies (cf. Nævestad et al in review).

We used a semi structured interview guide in the interviews with company representatives (Appendix 2), which contained questions on the following themes: 1) the work activities of the interviewee, 2) whether the companies use safety culture in their work, and whether they have strategies, procedures and tools to develop their safety culture, 3) which contexts the safety culture concept is used in, and their experiences with using it, 4) whether the companies of the interviewees have SMS, the extent to which the SMS is well known by the employees, and whether their actual behaviours are in line with the SMS, 5) the most risky work activities and operations that the companies are involved with, the main risk factors involved and their counter measures to reduce the impact of these risk factors, 6) the status and work on safety cultural aspects: management commitment to safety, employee involvement and trust between managers and employees, reporting culture, learning culture, 7) potential to focus more on safety culture development, 8) views on the companies' relationship with the regulating authorities: the quality of the relationship, whether the relationship with regulators leads to an increased safety level in the company, regulator focus on safety culture, and 9) their views on 12 possible (future) strategies aimed at improving safety culture in the companies (cf. Nævestad et al in review).

3.2 Analysis

The interviews were not recorded; instead we took notes during each interview. Following each interview, we wrote an extensive summary based on the themes in the interview guide and the viewpoints of each individual interviewee. When we finished all the interviews, we analysed these summaries, comparing the interviewees' comments on and opinions about the themes.

Most researchers analyse qualitative data by coding text and breaking it up into more manageable chunks (Welsh 2002). In more deductive modes of analysis, the researcher examines theory, develops hypotheses on this basis, and tests these hypotheses by means of, for instance, interviews. In inductive modes of reasoning, the researcher observes particular phenomena, infers knowledge on particular patterns from these observations, and develops hypotheses and subsequently theory. Most qualitative analyses of interview data rely on a combination of these two ideal-typical approaches, and so did we. Much of our coding started when we developed our interview guide, which largely was based on previous research, and thus more deductive. When coding our notes from each interview, we grouped individual answers into categories of viewpoints whenever several interviewees presented relatively similar views. We compared the interviewees' views on the themes in the guide and their answers to each of the questions. We did this by systematically comparing the texts and words from each interview, focusing on the extent to which the answers and viewpoints of the interviewees were different or similar. This approach to coding is more inductive, although the interview guide codes, as noted largely were based on previous research.⁶

⁶ This discussion of qualitative analysis is based on Nævestad et al 2017.

3.2.1 Quality assurance

To ensure the quality of our analysis, we submitted texts summing up the results of our analyses (i.e. the empirical chapters) to the interviewees, giving them the opportunity to comment, provide nuances and additional information and correct mistakes. This means for instance that we submitted the chapter presenting the results from the companies in aviation to all company interviewees in aviation. In this manner, interviewees were given the opportunity to see how we present their sector, and the quotes that we cite to support our presentation. We did this for each of the interviewed groups. Not all of the interviewees commented on our text, but we got several responses who had read through the texts, commenting, providing nuances and additional information. This feedback provides an important way of checking our general analyses of the situation in the sectors and the specific information that we provide.

4 Results from the nuclear sector

In the present chapter, we present empirical results for regulators in the nuclear sector, focusing on: a) whether safety culture is included in audits by regulators, b) why it is included, c) how it is defined, and d) how it is assessed. In addition, the relationship with licensees and future possibilities of safety culture as a regulatory concept is described. Unfortunately, we were not able to interview any representatives from the nuclear power plants. These companies are referred to as licensees in the text below.

4.1 Why do they focus on safety culture?

The authority interviewees in the nuclear sector said that their current focus on safety culture not is based on a legal requirement, although it will be soon (per 2017). Until then, their focus on safety culture is based on an implicit requirement; founded on the assertion that a good safety culture is a precondition of a well-functioning «defense in depth», referring to a set of e.g. technical, organizational and cultural «barriers» towards hazards. Despite the lacking of explicit legal basis for conducting safety culture audits (at the time of the interviews), the rationale for the audits is not questioned by anyone. One of the interviewees stressed that the licensees have worked systematically with safety culture for several years, and long before the implicit requirements related to safety culture came into place.

The interviewees said that they follow the safety culture definition of the International Atomic Energy Association (IAEA), and that the authority's focus on input from the IAEA has become stronger since 2003 and 2006. They stressed however that the rules and the guidelines of IAEA are not implemented automatically in Sweden. IAEA created the term Safety culture in 1986 during the investigation of the Chernobyl accident, and the issued a much-cited publication about it in 1991. Sweden was both following and participating in the development of the concept of Safety culture. e.g. through the work done by IAEA.

However, Swedish radiation authorities started to use safety culture more actively in oversights in the beginning of 2000's. There was an incident in Barsebäck in 2003, which could be traced to safety cultural weaknesses related to e.g., safety leadership, questioning attitude, not enough structure in their operational decision making etc. This was the first time the Swedish authorities used the safety culture concept in their inspections, pointing to problems. As the authority found clear deviations from requirements the regulator was by law obligated to send the case to a prosecutor for legal evaluation. However, the prosecutor did contest the authority's use of the authority's use of the safety culture concept, as the use of the concept lacked a legal basis. The IAEA has however since then produced several documents about this, held conferences etc. Then, in 2006, there was another incident, at Forsmark, which could have been very serious. This incident spurred an increased focus on safety culture. Interviewees stated that it helped the Swedish nuclear industry a lot to start focusing on safety culture. Interviewees said that after the incident in 2006, focusing on safety culture has become natural and undisputable for the industry.

The authority's existing legal focus on safety culture follows partly from the management system rules, which states that the management system should support and facilitate a good safety culture. In other industries, e.g. aviation, use the term safety management system (SMS), which is relatively synonymous. As noted, SMS typically include formal routines and measures enabling the organization to work systematically with safety, by identifying and correcting risks e.g. appointment of key safety personnel, risk assessments, safety training, safety procedures, safety performance monitoring etc. (Thomas 2012). The IAEA Safety Requirement GS-R-3 (IAEA, 2006) is directly linked to safety culture. This standard requires nuclear organizations to implement management systems which promote and support a strong safety culture by for instance reinforcing a learning and questioning attitude at all levels of the organization and providing the means by which the organization continually seeks to improve its safety culture. (IAEA, 2006: 6).

4.2 Key traits of nuclear safety culture

Interviewees noted that the licensees are clear that the management system requirements are not sufficient; licensees must go further to develop positive safety culture traits. This means to not only ensure that the required formal management system aspects are in place, but also to focus on establishing important, informal safety culture aspects. The interviewees reported that authority personnel use the whole spectrum of the IAEA safety culture aspects in their work. The International Nuclear Safety Advisory Group (INSAG), which is an advisory group to the Director General of the International Atomic Energy Agency, defines safety culture as:

That assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance. (INSAG 1991).

The above mentioned GS-R-3 standard describes five characteristics of a strong safety culture, which we will expand on in the following, based on two publications: (IAEA, 2009, 2016). The first characteristic of a strong safety culture is that "Safety is a clearly recognized value". This means e.g. that safety is a primary consideration in the allocation of resources, that a high focus on safety is demonstrated in communication and decision and that safe behaviour is supported in the organization. IAEA (2009) stresses that: "The ways that decisions are made and communicated are very important making aspects of an organization's safety culture, because decisions represent 'values in action'". The second characteristic of a strong safety culture is that "leadership for safety is clear". This means for instance that commitment to safety and involvement in safety matters is evident at all levels of management, that staff are involved in safety matters, and that there is a trustful relationship between managers and staff. The third characteristic of a strong safety culture is that "accountability for safety is clear". This means e.g. that roles, responsibilities and accountability for safety are well defined and clearly understood, that there is a high level of compliance with rules/procedures, a high level of ownership for safety, and an appropriate relationship with the regulator. The fourth characteristic of a strong safety culture is that "safety is integrated into all activities". This means for instance that it is evident that all types of safety (e.g. nuclear, radiological, environmental, physical) are considered, that an adequate level of safety is ensured in all processes and stages, that human factors and safe working conditions (time pressure, work load, stress) exist, that the quality of procedures and documentation is good, that individuals have the necessary knowledge and

understanding of the work processes. The fifth characteristic of a strong safety culture is that “safety is learning driven”. This means for instance that a questioning attitude prevails at all organizational levels, that open reporting of deviations and errors is established and supported, that internal and external assessments, including self-assessments contribute to continuous improvement, that safety performance indicators are tracked, trended, evaluated and acted upon, there is systematical development of individual competence and that external and internal assessments, including self-assessments, are used.

Apart from referring to these safety culture aspects highlighted by the IAEA, interviewees also mentioned other safety culture traits which they asserted to be important in the (Swedish) nuclear safety culture.

The first element is the recognition that it sometimes is required to do something other than the management system says. There is an overriding clause saying that the shift manager and the operator in all instances are allowed to take the reactor to its «safest state», based on their concrete judgement in the situation. This is above all else; and the shift manager cannot be punished for doing this, as long as it is justified in terms of safety. Thus, the «professional rule breaker», has an important role in the nuclear industry. The necessity of sometimes breaking the rules is based on the character of the technological system. A nuclear reactor is a complex system with many unanticipated and tight couplings. This system has the capacity to generate a series of unexpected results, often referred to as «requisite variety» (Ashby 1956), which are not necessarily described in the procedures. Operators therefore need to have a certain degree of freedom when dealing with the system, as they (hopefully) have both the local expertise to understand unanticipated interactions and the overview of the system to know how to take it to its safest state. It is important to have a management that understands this and supports this kind of behaviour. The complexity involved in nuclear safety management is especially evident in the annual maintenance outages shutdowns, where external personnel is required. In this situation, it is important to maintain control over the reactor (cold shutdown). At the same time several different actors are supposed to interact under new organizational constellations, e.g. different departments, professional groups. Then it is important to identify poor couplings between groups, in order to get an overview. As long as the reactor is running and everything is calm, the situation is less complex, but as soon as new operations start, the situation becomes more complex and dangerous.

A second important element of nuclear safety culture is individuals' self-control related to safety. The World Association of Nuclear Operators (WANO) has developed several human performance tools, and many of these have been used a lot during nuclear maintenance operations; e.g. how to do pre-job and post-job debriefings. Another crucial human performance tool is the STARC, which means Stop, Think, Act, Reflect and Communicate. This is an important concept, which is prevalent in all the minds of the nuclear facility workers; and it should be used if anything seems different, strange, unclear etc. It may be challenging to implement this line of thinking during time pressure, stress etc. but it is especially in these conditions that STARC is important, and it is important that this line of thinking and acting is natural for all personnel. Management support is crucial in this respect; that management does not punish people for stopping their work operations if they have a «bad feeling», the wrong equipment, instructions etc.

A third key cultural element is related to management; task observations, i.e. managers go out from their offices to observe the current operations and see that they are in accordance with the management system. All facilities have key performance indicators defining a certain number of such observations. Moreover, these observations are supposed to happen in a certain way; managers are educated to do this properly, and they are supposed to coach their personnel. If the managers observe and sanction something which deviates

from expectations or the management system, it is to be documented in order to learn from the experiences. An important precondition for making this happen is to free managers' time to allow them to do task observations, e.g. by analyzing how they use their time.

The fourth important element in nuclear safety culture is communication. It is important to have a clear and unambiguous communication: to speak in a controlled manner, confirm that you have heard what you have heard. Even during maintenance, there is communication between control room and maintenance. The top management's way of communicating information has also been recognized as important lately, e.g. that the same message reaches the entire organization, and that all managers have the same foundation for their work. Interviewee 1 mentioned examples of the opposite of this:

Sometimes we detect big needs for improvement. Then the authority notifies the licensee, and they make an improvement program. It [the need for improvement] can be related to poor information from management concerning why something shall be done, who it concerns, which programs it relates to etc. The result is confusion, and employees do not understand why [they should do something] (Interviewee 1).

The interviewee said that the communication under daily operations is well regulated with forums for communication and decision making. Nevertheless, communication is a key challenge during different kinds of projects.

4.3 Strong internal focus on safety culture

The interviewees from the authority also use the safety culture approach internally in their own organisation; to review their own activities. They underlined that, since they influence the safety culture of the companies that they regulate, it is important that they also focus on their own safety culture: Interviewee 1 underlined that:

Now, we also focus on our own safety culture. We influence the safety work and the safety culture of the nuclear plants, if we do the wrong prioritizations, we may influence the nuclear plants negatively (Interviewee 1).

Interviewee 1 also said that they have been going through an internal process to develop a joint recognition of how they may set the premises for safety in the nuclear plant through their work. He said that:

It has been a bit hard to gain a recognition of what it [safety culture] is to us. Many people think more about personal safety; falling in the stairs, locking doors. Instead, it is important to focus on how we may influence the licensees negatively; what it [safety culture] is to us (Interviewee 1)

Recognizing the importance of their own safety culture for the work they do to influence the safety culture of the licensees they regulate, an evaluation focusing on safety culture in the authority and the authority's work on safety culture was conducted. This was done in 2016. Interviewees stressed, however, that although they realize that they have an influence on the licensees, and deal with this influence in a very serious and thoughtful way, it is important to remember that the full responsibility for safety lies with the permit holders (i.e. the licensees).

All managers and inspectors undergo an internal safety culture education program. In this program, participants learn about the importance of the authority's own safety culture. Interviewees have also been involved in international settings, where the role, importance of and the safety culture of the regulating authority (and their understanding of it) have been underlined (e.g. Fukushima). The experience from such settings is that the role of the

authority is important for nuclear safety. The interviewees also mentioned that they base their own efforts on safety culture on the work of The Nuclear Energy Agency (NEA) of the OECD, which has established five principles describing the safety culture of an effective nuclear regulatory body. These five principles are: 1) leadership for safety, 2) individual responsibility and accountability, 3) co-operation and open communication, 4) a holistic approach, and 5) continuous improvement, learning and self-assessment (NEA 2016).

Describing their own relationship to the safety culture concept, one of the interviewees said that they have matured in their own work with safety culture. He said that they were more theoretical in the beginning, focusing on theoretical definitions, conceptual development, and the theoretical aspects of safety culture. It was noted that this is not necessarily the right way of approaching the concept, as it may be too academic and abstract. The authority's approach to safety culture has, however, gradually become more practical; focusing on the concrete licensees at hand; e.g. what kind of risks they have, what kind of behaviours they have and so on. Describing their own maturation process, they noted that they have organized workshops about safety culture and that inspectors are educated on safety culture. The focus of the education is to discuss what safety culture is, how to identify indicators and manifestations of safety culture, indicators of safety culture weaknesses etc.

4.4 Inspection methods used by the authority

Interviewees mainly conduct three types of inspections, where they also focus on safety culture. The first is the inspections (inspektioner), which first usually involve a standard pre-meeting lasting for half a day. In these meetings the authority and the companies discuss what kind of requirements they will focus on in the inspections, for how long they shall be there. Additionally, they ask for information from the management system about how they comply with requirements. They look at this documentation before they visit the organization, then they go there and stay for 3-5 days, doing interviews. In the end, they have a final meeting where they present preliminary findings and follow up of requirements. The whole process lasts for about a week. This inspection method involves a combination of document inspection focusing on the management system, and interviews to check whether the informal practice is in accordance with the formal management system description and the requirements of the authority.

The second type is review (granskning). This is an evaluation of compliance, which is primarily based on the examination of licensee documents. The inspectors also talk to licensee representatives in reviews, but they do not analyze interviews, like they do in the inspection. This method is used for instance if the licensee reports operational changes, e.g. of technical or organizational kind. The licensees have to report such changes three months in advance, and the authority decides whether an audit is required. The time the authority uses to conduct audits depends on the scope of the changes, e.g. ranging from one day to several years.

The third type is licensee surveillance «verksamhetsbevakning», which often lasts for 2-3 days. This is used as a follow-up of previous inspections and issues that are not entirely ready for inspections, e.g. if the authority needs knowledge about different aspects of the organization. It may be that the authority feels that they need more knowledge about something which is to be used as a basis for inspections, or that they have had an inspection, and the requirements are fulfilled, but that the authority may identify areas for improvement, that they want to follow up. Then they may return after half a year, or a year

to check the progression. Interviewees stressed that they never suggest improvements to the licensees. The authority may identify areas for improvement, but they never tell licensees how to improve, as that would potentially transfer the responsibility for safety from the licensee to the authority which is something that the authority actively seeks to avoid. (Authority personnel from the other sectors also stressed this.)

Additionally, the interviewees mentioned a kind of licensee inspection that they use when their trust in certain licensee is weakened. In that case, they implement a measure called «special attention», which involve that they focus strongly on a particular plant and organization. Special attentions has been issued four or five times within the Swedish nuclear industry, all of them due to a lack of trust in the licensee from the regulator.

4.5 How is safety culture assessed in the licensees?

As noted, the interviewees said that the nuclear inspection authority has matured in their approach to safety culture; from a theoretical approach to a more practical approach. Interviewees described a similar maturation process in their focus on safety culture in their audits. In the beginning, they focused more on the formal (perhaps more superficial) aspects, e.g. what the companies did to improve their safety culture, programs etc. Their current approach is more holistic, focusing on safety cultural aspects in all types of inspections, no matter what the inspection is about. It was underlined that safety culture should not be a separate object of inspection; they look for indications of safety culture and underlying patterns in all inspections, and they noted that they have developed a relatively good ability to do this.

When asked concretely what they look for when they audit safety culture, they said that this is deduced from the IAEA guideline, e.g. management commitment for safety, visible safety management involving managers spending time in the facilities, in contact with workers on site. They also check whether safety aspects are taken care of during work, whether the organizations have a system view on safety, the relationship between the licensee and the authority, whether the organization acts proactively to prevent hazards, whether it has a long term perspective, how technical and organizational changes are handled, the quality of documentation and instructions, how fast the organization updates documentation and instructions. In addition, the inspectors check whether procedures and rules are adhered to, the manning level and whether the organisations have the required competence, whether responsibilities and roles are clear and how resources are allocated. Inspectors also evaluate whether the licensees monitor their own activities and adjust their practice or procedures if necessary. In addition, inspectors also focus on the communication and the openness in the organization, whether the organization aims at maintaining a predictable environment which facilitates safe work. In addition, inspectors also look at the general housekeeping at the facilities in their inspections.

Focusing on these different features, the inspectors try to develop an image of a pattern, attempting to identify safety cultural weaknesses, or where the organization has its strengths Scanning indicators of safety culture and evaluating whether these make up symptoms of an underlying pattern is the main method that the inspectors use when evaluating safety culture. It should also be mentioned that an inspection database is a crucial element in the authority's focus on safety culture. This database comprises all the reports and the observations from the inspectors, and forces them to evaluate whether their observations include indicators of poor or strong safety culture. Thus, recording all the safety culture elements and indicators of the licensees into this database, may help the

inspectors develop an image of an underlying pattern that may indicate a good or bad safety culture. Interviewee 1 stated that:

Merely the fact that we find something wrong doesn't mean that the safety culture is bad. It's the big patterns that are important. We cannot draw big conclusions based on small observations. This is why it is important that we collect information about safety culture in all the inspections. Then we get a very comprehensive foundation. This is a holistic approach, which is underlined in our education of inspectors. If six blind men meet an elephant for the first time, they will all describe different things. It's only when they put together the information that they can tell how the elephant looks. You need to have a lot of observations. It is the pattern, and not the symptoms we act on (Interviewee 1).

In a similar vein, Interviewee 2 also stressed that when they observe e.g. an incident, it is insufficient to use only the incident to conclude about safety culture; they must look for several indicators of underlying patterns. Their database with information about the respective companies is very important in that respect; building a comprehensive collection of observations and indicators. Inspectors from the authority are relatively often visiting the companies, and after each visit, they must record their observations and experiences. Interviewee 2 said that this helps them focus strongly on developing a database of information. Thus, they tell their inspectors:

Can you observe these things when you are out there and return them to us, so we can develop an overall picture? We educate our inspectors, and we have an inspection database. When inspectors register something in the database, they must decide whether it has relevance for safety culture. When they make an inspection report for instance, before it is approved they must copy each of the different evaluation elements, and for each copied element, they must decide which area in the licensee it is relevant for, and if it has anything to do with safety culture, and whether it is positive or negative. Sometimes, inspectors may have a hunch that they have found something relevant for safety culture, but they may be unsure about how it is relevant. Then more people will look at it afterwards to decide. This is done annually. This is done for nuclear plants. They [the inspectors] have methods, the necessary vocabulary and intuition that they can use to discuss what culture is and what it is not. This is often concretized in some specific things, e.g. safety assessments, operating clearances related to different components etc. We often ask whether there are more examples of the same type, whether it is serious enough, how they have arrived at specific conclusions etc. We may often have a continuous dialogue. (Interviewee 2).

Based on the interviewees' reference to safety culture as «underlying patterns» and Schein's (2004) analytical separation of organizational culture into basic underlying assumptions and more superficial levels (artefacts, like slogans, visions), the interviewer asked whether the inspectors sometimes find that the patterns (the underlying values) are opposite to what the licensee representative actually say. Interviewee 2 answered that such discrepancies between cultural levels is what they do not want to see. This interviewee also said that:

Explicit values and all that are the ground premises, but you have to go under the surface to see the actual culture... you have to find the pattern, to arrive at an understanding that «this is what they do». (Interviewee 2).

This interviewee also said that:

(...) If someone returns home [to the authority] with a gut feeling, then we ask «what is this about?». We have an inquiring attitude....(Interviewee 2).

This quote illustrates how the authority inspectors form and discuss their analyses of safety culture together, by developing and drawing on a large set of data based on their observations in their contact with the licensees.

4.6 The relationship to the companies

Interviewees said that they have had a positive dialogue with the licensees through the years; they are not perceived as a «policing» authority. Consequentially, it is easier for them to inspect safety culture without a legal requirement. In other countries, a legal requirement is necessary to inspect safety culture. Thus, it is not a requirement that has brought them where they are today, with respect to their work on safety culture.

When asked whether they observe different safety cultures in different organisations, interviewee 2 answered that:

Yes, but we do not compare them, we must always evaluate them separately, they may have different ways of meeting the requirements. We always evaluate whether what they do is good enough, and that requires that we are there often. We try not to say that someone is better than others. We shall not say that someone is better than others. (Interviewee 2).

Interviewee 1 answered that:

Yes, we observe different safety cultures in the different companies. It is like different personalities. They all live up to the requirements and the required level, but we see different approaches: some focus more on production and time schedules, and are strictly hierarchal, while others are more informal etc. In that case, lines of responsibility may be surpassed etc. They all have different weaknesses that they must address. They have their weaknesses and strengths. It is difficult to understand whether it is related to region, history etc. and different manifestations of culture. (Interviewee 1).

We also asked whether the interviewees observe a relationship between safety culture and other safety indicators (e.g. incidents). Both interviewees answered yes, but they noted that the relationship is complex. The number of reported incidents is for instance contingent on several different things. However, when applying a system perspective, they see that several things are related. They have an annual radiation safety evaluation which includes 17 themes (e.g. technical, organisational) that all licensees are evaluated against, and it seems that scores on these themes are related to safety culture scores.

Interviewee 1 also said that some safety cultural weaknesses are worse for safety performance than other. Focus on production is for instance a bad point of departure, but the strength with such a culture is that they are good at systematic planning etc. Thus, it is important to identify specific weaknesses and work with them. National safety culture became for instance a theme after Fukushima, but it is wrong to label an entire national culture, rather, it is important to remember that you have different cultural strengths and weaknesses at both the national and the regional level.

Additionally, interviewees said that they are required to be very specific when they describe weaknesses, and that they would be reluctant to say that an entire organization has a poor safety culture. Instead of referring to a general «poor safety culture», they will point to the specific weaknesses. Interviewee 1 said that:

We are reluctant as authorities to put labels on licensees. It's a bit similar to the situation where aviation authorities say that a type of aircraft is dangerous - when can

you say that it's safe again? The licensees understand what we mean ...[when we give our specific feedback] (Interviewee 1).

We also asked interviewees whether they give specific feedback to the companies, describing how they should work with their safety cultures. Interviewee 1 said that:

No, we point out weaknesses, and then we want them to describe how they plan to improve, e.g. by means of an action program. Then we will review it. In that case we can say that: «we believe in that, and we believe in that...». We want the organization itself to say how to improve. There are many ways to get better, they have to choose the method themselves. They are the ones who have the full responsibility for improving. We are very careful to avoid telling them how to work. (Interviewee 1).

The same interviewee said that around the time where the authority increased its focus on safety culture, they organized a safety culture seminar, where all companies were invited to describe how they worked with safety culture. The authority described its expectations, and goals and organized a dialogue where they discussed the problems that the organisations dealt with, what they need to work further with. The companies also discussed this between themselves, listening to each other.

We asked the interviewees whether and how they influence safety culture in the licensees, and interviewee 2 answered that:

We cannot measure their safety culture in each case, but we use a lot of information coming in over time. When we influence the safety culture most is when we see a pattern in their behavior, e.g. how they use conservative decision-making, then we can influence them. (...) when we see a trend, we ask them to investigate the causes. We do it [influence] through our inspections, when we show what's [we believe is] important. (Interviewee 2).

When we asked interviewees which factors they believe contribute to a positive safety culture in the companies, what they believe is important, they especially pointed to top management commitment to safety.

4.7 Future alternatives for safety culture as a regulatory concept

We asked respondents about possible alternative regulatory strategies that can be used to influence safety culture in companies, e.g. whether they think it is a good idea to implement a «safety culture requirement». As mentioned, they said (per 2017) that such a requirement will be introduced in their industry soon, when it will be legally required that the management system shall facilitate and support a good safety culture (cf. GS-R-3). Several countries have already implemented this requirement. This will also apply to other sectors dealing with radiation, e.g. hospitals and mines.

We also asked interviewees what they think about the idea of using the safety culture concept in accident investigations. In line with what they said about how they assess safety culture in organisations; identifying underlying patterns through many observations, interviewee 2 answered that:

It depends on how you do investigations; if you go so deep in the investigation that you are able to discover systematic path choices [then it is ok]. It is not sure that you can do that in all investigations. In our case, we will have to look at several different events to be able to say that something is related to safety culture. In the case of Fukushima [we did that], we looked at several events and a long chain of events over a long period. I think we may see certain [safety culture] aspects in one event, but I

would not say that one event shows «that you have a poor safety culture». We could have said that «we see this [i.e. a negative safety culture trait] in this event, and we have also seen it in the previous events» (Interviewee 2)

We also asked interviewees about advisory-based strategies, e.g. providing tools for self-evaluations and learning. They said that it is already required that the companies perform self-measurements to learn, as a part of their continual monitoring and improvement efforts, specified in the management system rules. They said that have been looking at what the licensees are doing when it comes to safety culture for about ten years or so. Moreover, some of the licensees also conduct regular and comprehensive surveys to map their safety culture. It was mentioned that the licensees have become quite good at this. Interviewees also mentioned that the authority considers it very important not to request such internal evaluations unless it is necessary, as these can contain sensitive information. One of the interviewees mentioned an example where the police had requested a licensee to submit such an internal evaluation after a police report. External parties like e.g. the media may easily draw wrong conclusions based on such material, and if they are granted access, it becomes more difficult to conduct such open evaluations.

We also asked interviewees about the advisory-based regulation strategies, e.g. giving advice, providing information, training, examples of good practice etc. When we asked whether they provide real and concrete examples of safety culture measures in licensees. They answered that they do not highlight one licensee, nor do they say that something is good or bad. The licensees are not compared. If one licensee presents something, then the other licensees are also allowed to present. They have the responsibility to carry out this work. Interviewee 1 said that: «If we say ‘do like them’, then we have told them what to do». As noted, the authority refrains from doing this, as different solutions may work for different licensees, and because if they specify exactly what the licensees should do, then the authority may become accountable..

We also asked interviewees about the advisory-based strategies regulation strategy of education of managers and employees, and they answered that they use this strategy, especially when they deal with new people or organisations. It was mentioned that because of this education, «everybody knows what safety culture is about». They have also organized seminars with the licensees, and encouraged discussions between the licensees. They also commission research about safety culture, and when they have enough research results, they arrange a seminar to discuss the results. In these settings, the authority talks and the companies talk, discussing themes that both parties are interested in.

4.8 Summing up

In Sweden little attention was given to nuclear safety culture until the beginning of 2000's. There was an incident in Barsebäck in 2003, which could be traced to safety cultural weaknesses, and this was the first time the Swedish authorities used the safety culture concept in their inspections, pointing to problems. In 2006, there was another incident, at Forsmark, which could have been very serious. This incident spurred an increased focus on safety culture. Interviewees said that after the incident in 2006, focusing on safety culture has become natural and undisputable for the industry.

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), but which per 2017 soon would be covered in separate legislation. They have also gone through a review of their own safety culture, to clarify how it may affect their influence on the safety cultures of the licensees.

Apart from referring to the five characteristics of a strong safety culture underlined by the IAEA: 1) Safety is a clearly recognized value, 2) Leadership for safety is clear, 3) Safety is integrated into all activities, 4) Safety is learning driven, and 5) Accountability for safety is clear. Interviewees mentioned four additional safety culture traits which also are important in (Swedish) nuclear safety culture. The first element is the recognition that it is sometimes required to do something other than the management system says. The second element of nuclear safety culture is individuals' self-control related to safety. The third cultural element is related to management; Task observations, which means that managers go out from their offices to observe the current operations; see that they are in accordance with the management system. The fourth element in nuclear safety culture is clear and unambiguous communication.

Assessing safety culture at the licensees, the authority inspectors in the nuclear industry look for indicators of underlying patterns. They maintain a database with information about the respective licensee 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 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. Interviewees noted that the licensees are clear that the management system requirements are not sufficient; they go further to develop positive safety culture traits. This means to not only ensure that the required formal management system aspects are in place, but also to focus on establishing important, informal safety culture aspects.

5 Results from aviation

In this chapter, we first present findings from regulatory authorities, and second from companies.

5.1 Results from the regulatory authorities

5.1.1 The role of safety culture in function-based regulation

Interviewees from the aviation authority use the safety culture concept actively in their work, although their use to some extent is dependent on their work activities. It seems that the more technically oriented inspectors use the concept less than the other interviewees in their work, although they also were very familiar with its importance in their organization. Consequentially, it also seems that the more technically oriented inspectors had a less well-developed conception of safety culture, compared with the inspectors who were oriented towards SMS and organizational aspects.

Interviewees stressed that the safety culture concept was used during inspections, in seminars with company representatives, in other communication with the companies, and on authority webpages providing information to the companies regarding SMS and safety culture. It is, however, important to note that the safety culture audits in aviation not are fully implemented at the time of the interviews (2017).

Different types of inspections were mentioned by the interviewees. There is for instance the audit of the SMS and the related processes. Additionally, there is the inspections of different activities, e.g. air transport operation activities (OPS), and ground activities like e.g. fueling, loading and education. Generally, interviewees said that the companies that they regulate have several different permits for engaging in different activities. Inspections are related to these different permits, and they may target different levels and parts of the organization (e.g. the management, departments). Thus, a company may often be subjected to 7-8 inspections each year. Safety culture is often assessed in relation to the inspections targeting the SMS.

Inspectors from aviation reported positive experience with safety culture as a regulatory concept, stating that it fits well with a transition from a rule-based to a more principle and advisory based approach to safety regulation. Interviewee 3 noted that the legislation that they base their audits on is much more function-based than it used to be:

The rules were much more detailed previously. Now the companies have more opportunities to adapt to the existing conditions. They found it hard at first, but then they started to appreciate the possibility to adapt. Previously, what they did was either right or wrong. Now there is more dialogue, and we evaluate their answers and provide our thoughts; creating a positive dialogue between authorities and companies. We never say what they should do, we help them interpreting the rules. We have the same goal, and we say things to get them in the right direction. Good communication from us is important and a [i.e. their] will to do right. (Interviewee 3).

Interviewees also stated, however, that detailed rule-based regulation is necessary in several areas, for instance when it comes to the design of physical infrastructure, technical maintenance of equipment and so on. Thus, a combination of the two approaches to safety regulation is necessary.

An important issue that was mentioned by several of the 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.

5.1.2 Why do they focus on safety culture?

Some interviewees stressed that they started using the safety culture concept systematically in 2011, but it seems that the systematic use of the concept was not initiated at the same time in all operational areas related to aviation in the STA. Interviewees also said that the concept is not mentioned directly in the legislation that they base their inspections on. Rather, the legislation describing the required key elements of SMS (reporting, just and learning culture) describe the key aspects of safety culture (e.g. EU 1321-2014 part 145 Airworthiness). These SMS requirements apply generally to different areas of aviation, e.g. airports and airlines. Interviewees said that the focus on safety culture in inspections also is the result of a central STA decision. Focusing on safety culture in the inspections is a key strategy for the STA, which is laid down in central documents, defining safety culture and describing its key elements. These documents describe both strategy and procedures. The decision to focus on safety culture in the inspections was based on an assumption that this would provide a valuable perspective, supplementing the existing regulatory strategy. Interviewee said that: «We wanted new indicators in 2011 to spur additional improvement», and «We wanted to focus on the individual [organisations] furthest out in the system, as these also are key to safety».

The decision to focus on safety culture in the inspections, and launching the safety culture focus as an important inspection strategy, was also based on a consideration of how this could be justified in light of the existing legislation in the sectors. The STA as a regulatory authority can only make demands that are in line with the EU-rules. Human factors experts in the STA therefore reviewed the legal basis for the inspections in each sector, to consider whether these rules justified a focus on safety culture. In the case of the aviation sector, it was found that STA conceptualization of safety culture in a 28-point checklist summed up all the different SMS requirements relating to different aspects of safety culture. In the EU-rules these aspects are referred to as «ability to detect hazards», «reporting culture» «learning culture» and so on (EU for 965/2012). The aspects of safety culture are reflected in the SMS requirements, and they are quite similar to the safety culture aspects described by James Reason (1997).

Interviewees said that as they have started focusing on safety culture, the STA's human factors competence centre is crucial, providing information about safety culture in the organization and educating the inspectors in how to use the concept in their inspections. Additionally, the increased focus on safety culture does not only require training internally in the STA, it also requires training of company representatives.

5.1.3 How is safety culture assessed in the companies?

We asked the interviewees how they understand and define safety culture. They either referred directly to a 28-point safety culture checklist that they use to audit safety culture, or aspects of safety culture evaluated in this checklist. It is important to note that the use of

the 28-point checklist was not fully implemented in the aviation branch of STA at the time of the interviews; its use was only tested within some of the sections within aviation.

The 28-point safety culture checklist comprises seven main themes, each measured by means of four questions. The seven themes are: 1) reporting culture, 2) just culture, 3) learning culture, 4) managers' and employees' safety commitment, 5) internal and external communication, 6) the organisations' resources, competence and qualifications for doing their safety work and 7) the organization's systematic work with safety.

In their audits the inspectors also use a separate 24-point checklist comprising six themes to assess the SMS, focusing on whether: 1) the SMS is adapted to the size complexity and character of the organization, 2) the management responsibility is clearly defined, 3) the organisation's system for compliance monitoring is used in the daily work, 4) internal SMS-revisions are conducted, 5) the organization is able to identify deviances, detect risks and implement counter measures, and 6) the organization is translating its safety policy into daily work.

Scores on the checklists are ascribed a color code (green, yellow and red), and companies get oral feedback, describing the share of green, yellow and red scores that the safety culture inspection resulted in. One of the interviewees stated that this would come in written form by the end of 2017, but as noted it is important to remember that the focus on safety culture in the aviation branch of STA still was at a «test stage» with limited implementation at the time of the interviews. The color codes reflect the «potential for improvement» on each question, based on the assessment of the inspector.

The 28-point safety culture checklist is filled out at the end of each SMS audit, typically lasting a couple of days involving e.g. two inspectors. The checklist is described in a nearly 60-page document. One of the interviewees said that such inspections occur at least once every second year, but that inspectors may visit the companies annually in case of red and yellow results. Interviewee 7 provided an example of how they assess safety culture:

When we inspect «just culture» in an organization, we start with the highest responsible, e.g. the accountable manager and go through the quality systems, the type of reports he has, and what he has done with them. We also participate in certain meeting forums. Additionally, we talk to the quality manager, we go through their internal audits and check the measures they have implemented to correct their own observed non-conformities. This lasts for about five hours. Then we talk with the management about the quality system, before we conduct the same audits that they have done themselves. These are random samples, but we check whether we get the same results as they did. Sometimes, we get totally different results. This may indicate flaws in their system. All organizations have a procedure manual, so before we visit their organization, we know how it is supposed to work. When we visit them, we check whether this corresponds with reality. (Interviewee 7).

Another inspector said that they also consider the rate of reported incidents per flights, also considering type of flights. If the rate is too low, it may indicate a low safety culture level. He said that, in such cases, they ask the companies themselves what they think may be the explanation; if they seem uninterested, they follow them up, to examine whether this is related to reporting culture or other things; they may for instance have changed the type or number of flights.

The use of the checklist is aided by the inspectors' subjective assessments. Words like «gut-feeling» were used several times. 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. Interestingly,

interviewees said that they previously also developed a certain «gut feeling», or a subjective impression of «how things are actually done» in the regulated organizations, but that they had no place to record, assess or validate this information.

Interviewee 3 described the interaction between the checklist and the overall impression of the inspector. When the inspectors use the checklist, it is supposed to sum up their overall impression of the state of the safety culture aspects in the organization, based on their examination of key SMS documents, observation and interviews with key personnel.

The SMS describes a role: the flight safety coordinator. This role involves working proactively with safety culture. Inspecting how they have implemented this requirement and how they work proactively with safety culture is difficult. We therefore interview some of the personnel during inspections to evaluate to what extent the concept is implemented (...). A discrepancy between the answers of managers and employees, may indicate a «paper culture». Additionally, the inspectors use a checklist with 28 questions, which the inspectors evaluate subjectively; there are no objective rules for using this checklist. The result is a percentage describing the distribution of the colors of the answers. The annual goal is to have 90 % green scores in the checklist. There are currently not any rules on how to report deviances from the points on the checklist, so the companies get oral information that the inspectors have found areas of improvement. They may also get it in writing, and we will implement routines for this by the end of the year [2017]. This is not an «audit», as it is not based on a rule; it is only a subjective evaluation. But it works well this way, and we make annual overviews of the results (Interviewee 3).

This quote illustrates that the use of safety culture as a regulatory concept is quite new in this sector; there are few rules and that the regulators were developing guidelines and routines for how to use culture as a regulatory concept at the time of the interviews. Given the new status of the safety culture concept as a regulatory tool, interviewees stressed the importance of safety culture education in STA and in the companies. The regulators are regularly trained internally, and it is also required that key company personnel are trained. This occurs e.g. in seminars arranged by the STA. It was stated that it is important with such training, as it may contribute to a shared understanding of what safety culture is between the regulators and the companies. Several interviewees saw this is an important premise of a positive dialogue.

Discussing the nature of safety culture as a regulatory concept in the end of the interview, the interviewer mentioned to several of the interviewees that the safety culture concept is known to be a relatively abstract social construct that lends itself to several different definitions and uses. To illustrate, they explained a case where they had concluded that the safety culture of a company had several flaws and needed to be improved. The management in the company rejected this description and contended that their safety culture was very good. Such a case provides an ultimate test of the tools that the STA use to assess safety culture in the company: how «real» or valid the result is, and how can it be justified when there is a lot of subjective judgment involved?

Following up the issue of the abstract character of the safety culture concept, two interviewees especially mentioned the challenge of academizing the safety culture concept too much. They stated that although they know that the definition and measurement of the concept is debated by scholars, it is important not to make the concept too abstract, both internally and externally while communicating with the companies. It is therefore important to be as concrete and specific as possible, focusing on the specific aspects that make up the safety culture concept.

5.1.4 The relationship to the companies

Interviewees generally reported a good relationship with the companies, although exceptions were mentioned. When asked whether the companies find the authority's safety culture assessments useful, and whether they work with the results, an interviewee said that this is required of the companies, and that they must translate the results into concrete activities. They said, however, that companies generally found their safety culture assessments useful. Again, it is important to recall that the focus on safety culture in the aviation branch of STA still was at a «test stage», with limited implementation at the time of the interviews.

Interviewees said, however, that some companies are better than others, depending on the resources; the big companies have more resources. It is therefore easier for them, and they find it very interesting to compare themselves with the mean scores, to see where they are better. It was also mentioned that the new written feedback will provide the companies with an even better platform for translating the STA's assessment into practical action.

We asked whether interviewees see differences between companies' safety cultures, and all answered yes. They reported of relatively big differences, which become evident in audits. Some companies have distinct air safety cultures, with managers clearly backing safety messages, while others have weaker cultures, although they may have strong technical requirements applying to their aircrafts. It was mentioned that some companies may lose their permits temporarily if they have insufficient systems for internal audits, or fail to report errors and incidents.

We also asked whether interviewees see a relationship between safety cultures and safety performance (incidents, accidents) in the companies. All reported that they see, and/or assume such a relationship, but that it may be complex and difficult to document; measures of exposure must be included, in addition to types of activities and reporting effects. If the regulator receives too few reports from the companies, it may indicate a poor safety culture, e.g. the absence of a learning culture, or employees who are afraid to report.

We asked interviewees which factors they believe contribute to a positive safety culture in the companies, and all respondents answered top management commitment to safety.

We also asked interviewees about how they perceive the effects of their own efforts to improve company safety culture and safety through their regulatory activities. One of the interviewees said that they have a perception that their work leads to improvements, and said that there are several good examples. They see that the companies working proactively with these issues improve all the time, based on their assessments and feedback.

When discussing how the regulators perceive their role vis-à-vis the companies, the interviewees mentioned the importance of stressing that the responsibility for safety lies within the companies. One perceived danger with the advisory-based approach, which involves giving advice to the companies, is that the regulating authority might be blamed in case of accidents:

After accidents they [the Accident Investigation Board] also look at our role. The responsibility is always with the organisations, we are very concerned with not being consultants for the organisations, we must not be a part of what they do, we must not assume the responsibility for their process. (Interviewee 7).

All interviewees were not equally worried about this. Moreover, another concern mentioned in this respect is that it is difficult to give a general advice to all companies, as their contexts, histories and personnel etc. are different.

5.1.5 Future possibilities of safety culture as a regulatory concept

Interviewees were asked about possible ways to further improve their work with safety culture in the companies.

Introducing a general safety culture requirement. First, we discussed the possibility of making a good safety culture an explicit legal requirement. Interviewees mentioned that it after all is indirectly required through the legal SMS-requirements, but some mentioned that it could be a good idea to also include safety culture in the legal text to have an even better legal basis for the safety culture inspections.

Auditing safety culture (without a requirement). Interviewees also said that auditing safety culture without a legal provision, as they do today, is a viable strategy. The safety culture aspects they look at are required through the SMS-requirement, and they have a systematic checklist for assessing these aspects.

Implementing culture through safety management systems. Their main strategy for regulating safety culture is through implementing a positive safety culture through systems, as their SMS requirements concern the key aspects of safety culture.

Using safety culture in accident investigations. The STA do not conduct their own accident investigations, as they may be subject to such investigation, as part of the «causal chain» influencing aviation safety. Interviewees said that the accident investigation board are supposed to examine the safety culture of companies involved in accidents, and that they therefore may use the safety culture concept in accident investigations. It has, however, not been referred to many times in such investigations. One of the interviewees stressed the importance of being concrete in such instances, referring to (inadequate) aspects of safety culture instead of an inadequate safety culture in general.

We also discussed advisory-based strategies to influence safety culture:

Providing tools for self-measurement. All the interviewees were positive to the idea of providing the companies with tools for measuring their own safety cultures. They were also positive to the idea of providing tools for developing a positive safety culture, perhaps introducing self-development as a continuation of self-measurement. They said that they currently do not employ these strategies.

Providing real examples of safety culture interventions and guidance on the processes in which culture is (re)created. Interviewees said that they currently provide real examples of safety culture interventions in companies, and information about how safety culture is developed in companies. This is done through seminars with the companies, web information, direct letters, formalized e-mails and so on. They also mentioned that their inspectors serve as sparring partners for the companies engaging in educative dialogues to provide good example of companies that succeed in their safety work, describing the methods that they use. The interviewee who mentioned this said that these roles can be combined. It was also mentioned that the inspectors are wary not to be held responsible for accidents, but that this primarily applies to inspectors involved in rule-based inspections. It was mentioned that regulators should avoid providing concrete examples in rule-based inspections, to avoid being held responsible in cases of accidents and incidents. Not providing concrete examples is, however, difficult when you conduct advisory-based strategies regulation.

Training of managers and employees. The authority currently provides training of managers and employees. One challenge that was mentioned related to requiring a good safety culture by law, is that the authorities and companies may have different views on how to assess the safety culture in a company. It is hard to settle such discussions, as safety culture is a social construct. For that reason, one of the interviewees stressed the importance of developing common understanding between the parties, and a common basis for assessment of culture. Interviewees say that they use educational and informational measures for this

purpose, e.g. seminars, which may be an important way of fostering management commitment and understanding for safety culture in the companies. Additionally, they said that they also approve the companies' designated person responsible for safety, and that the concern for safety culture may be included in their judgments related to who is suitable for such a role. It was however mentioned that in the end, it is important to remember that peoples' and companies' responses to safety culture training is contingent on their willingness to «take in the message».

Financial support as a motivational tool. A couple of interviewees also mentioned that financial support as a motivational tool may be a possible strategy to facilitate a good safety culture. They said that companies now pay an annual fee to the authority, which is supposed to cover the work involved in auditing their certificates. However, in an imaginable future, it is possible to conceive of companies that are organisationally mature enough to conduct full self-regulation and only report results of their internal audits to the authority. Such organisations could be motivated by a reduction in their annual fee paid to the STA, as the regulatory work required is lower in their case. This is, however, dependent on a high level of organizational maturity and a high level of trust between the parties.

5.2 Results from the companies

5.2.1 Strong focus on SMS and safety culture

The company interviewees work in different organisations involved in aviation activities: airports, airlines, workshops etc. The two former organization types answer to relatively comprehensive international and national safety legislation. The interviewee from the latter said that they have safety management systems (SMS) in place, although this was not required legally at the time of the interviews. Thus, all organisations of the interviewees have formal SMS in place to facilitate reporting of incidents and learning, and they focus strongly on employee training to ensure that all personnel understand the significance of safety culture, and what it is.

All of the interviewees in aviation underlined that they focus on safety culture in their organisations. This is to a considerable extent a result of the SMS requirement in aviation. These requirements do not directly refer to safety culture, but they do refer to the elements of safety culture, e.g. reporting, just and learning culture. As a consequence, interviewees indicated that these cultural aspects (i.e. the safety cultural aspects described in the SMS regulations) were deeply ingrained in their organisations. It must be noted however that Interviewee 11 said that they had started to use the safety culture concept two years ago, and that there were a lot of questions in his organization in the beginning, querying what safety culture actually is. Moreover, Interviewee 12 said that they did not use the concept in their daily work. Instead, the organization of Interviewee 12 referred to the safety culture elements described in the SMS regulations.

5.2.2 The role of the safety management systems

All of the interviewees in aviation agreed that their focus on safety culture, or the key elements of safety culture (e.g. reporting, just and learning culture), to a great extent is a result of the SMS requirement in aviation. SMS typically includes management policy, appointment of key safety personnel, reporting systems, hazard identification and risk mitigation, safety performance monitoring etc. (Thomas 2012).

Interviewees outlined how their SMSs describe the different roles in their organisations, the competence required to hold these roles and the key activities that the roles involve. It was mentioned that competence is an important aspect of SMS. All of the interviewees mentioned education of personnel as a crucial strategy to develop SMS and safety culture in their organisation. Interviewee 9 mentioned that they consider personality traits in their hiring interviews, and that employees undergo extensive internal theoretical and practical education after employment. They have a matrix describing the knowledge required for each position, and each requirement is matched by an internal education program. Interviewees also mentioned that they sometimes organize campaigns, where certain issues are highlighted.

When describing the most important aspect of their SMS, Interviewee 10 pointed, however, to the reporting system, and it seems that other interviewees agreed. This illustrates the tightly interwoven relationship between SMS and safety culture; while the SMS provides the infrastructure or the medium for incident reporting, the safety culture concerns whether incidents are reported and the atmosphere facilitating (or impeding) it. Another key SMS aspect, which also is related to safety culture is the continuous improvement process, which means that the organisations continuously collect data on their performance (e.g. reported incidents, flight data). These data are regularly analysed in the organization, focusing on current trends and risk factors. One of the interviewees said for instance that he heads a management team which meets each week to discuss non-conformities, reported incidents and observes key safety indicators. In each meeting, they agree on solutions, and designate personnel responsible for their implementation. In many cases, the implementation responsibility is also delegated to employees in the relevant departments.

External and internal audits are important elements in the organisations' continuous improvement processes. The above mentioned management group also discusses non-conformities from external audits and agree on corrective actions in the weekly meetings. The interviewee mentioned that they are subject to at least two audits each month, and that about the half of the audits are conducted by their customers, while the other half is conducted by regulating authorities. Customers often audit when cooperation is initiated, and then sporadically. Authority audits are more regular, based on the duration of the different permits. These range from one to three years. Additionally, they have at least 10 internal audits each year, which are conducted by their own internal audit department. Moreover, the company's external contractors and subcontractors are also audited.

We also asked interviewees whether the employees know the SMS, and whether their actual behaviour is in accordance with the SMS. Interviewee 11 mentioned that all employees know that it exists, but that their familiarity with all the routines varies. He said that it is a challenge to find a way to communicate this to all employees, and that it is easier with the managers, as they are «forced» to use the SMS routines in their work. He also said that they have developed a new system which could increase SMS familiarity among employees:

When we publish information (e.g. about new procedures), EASA requires that the receiver (i.e. the personnel) shall understand and accept it. The same applies when changes are made to the procedures. (...). When new routines are introduced, employees must sign that they have read them. (Interviewer 11).

This interviewee also said that they also give a person on each shift a special responsibility to ensure that all procedures and routines are adhered to. He noted that it is important that the routines become second nature. Interviewee 10 also noted that to ensure that this happens, it is important that the regulatory authorities develop procedures that are easy to understand and use, underlining the importance of good procedures for a well-functioning SMS and a positive safety culture.

5.2.3 Management commitment to safety

Interviewees underlined the importance of management commitment to safety for a well-functioning SMS and a good safety culture. Interviewee 10, who is a manager himself, said that:

It takes several years to build a good aviation safety culture, and it can be destroyed in one day - if I give the wrong signals. (Interviewee 10).

When asked whether he believes that the management always focuses on safety, and whether conflicting signals sometimes are communicated, Interviewee 11 said:

‘Safety first’ is written everywhere, but we nevertheless end up in situations where we cannot prioritize safety immediately because we lack the money. In such cases, it is challenging to communicate properly with the employees. We have the same challenges with larger corporate decisions. (Interviewee 11).

Interviewee 10 underlined the importance of educating the managers and owners in issues related to aviation safety, stating that it is important that the managers understand the premises of aviation safety.

5.2.4 Openness, trust, and reporting culture

Describing the most important aspect of (their) safety culture, most of the interviewees pointed to an open, non-punitive environment which facilitates trust, reporting of incidents and subsequently learning. Interviewee 10 stressed the importance of a transparent organization, which means that:

(...) everything is open; that you are confident in your role and you dare reporting both what went wrong and what went well...it is just as important that you analyse why things go well. And it is just as important that everybody understands that they depend on each other, and support each other if necessary; that a colleague repeats a question; ask one more time. This is openness and transparency; that people trust their intuition and their feelings; and if something doesn't feel right; that they dare saying it (...) (Interviewee 10).

Interviewee 1 said that they have worked with maintaining an informed, reporting, just and learning culture for a very long time, but they have not referred to it as safety culture until now. He said that it is ok for employees to make mistakes, as long as they report them: the company wants to know why he did what he did to prevent it from happening again; the scapegoat mentality is gone. Interviewee 11 elaborated further on this, as he said that the attitude in their company is that no one makes mistakes willfully; that would be sabotage. Thus, it is the responsibility of the organisation to find the cause of the mistake and remove it. Interviewee 13 related the non-punitive just aviation culture to the Scandinavian culture, which involves less explicit hierarchies between managers and employees, more trust and openness. He said that even though everybody respects the role of the captain in the cockpit, they are not afraid to have their say in safety matters. Thus, it seems that national culture also may facilitate a reporting environment. Interviewee 11 made a similar comment, telling an anecdote from an Asian country with less openness and trust between managers and employees. In this case discussions over non-conformities were very serious, as they could lead to reductions in the salaries of people involved. The company of Interviewee 9 has a wage bonus system aiming at increasing the number of reports of incidents that could lead to personal injuries, and they get several thousand reports each

year in an organisation with 2000 people. He said, however, that the reporting rate was low in the beginning.

5.2.5 Employee involvement as a basis of a learning culture

Interviewees underlined that employee involvement is a crucial element in developing a well-functioning SMS and a good safety culture. Interviewee 10 said that:

(...) it is very important that you create a working environment where the employees feel trust and involvement; that they are involved, that they perceive that 'we are the ones who can influence aviation safety'; that they have a personal responsibility for aviation safety. (Interviewee 10).

Describing how to develop foster such feelings of involvement and personal responsibility, Interviewee 10 said that:

(...)employees are involved in evaluations of non-conformities; they record and evaluate them. We have quality people (i.e. working with the quality system) in each department, and the responsibility for this is to a large extent delegated to the employees. Our mantra is: quality is everybody, it is not [the top manager], but everybody else (Interviewee 10).

We asked Interviewee 3 whether he experiences that management involves employees sufficiently in safety issues, taking advantage of their expertise. He said that employees are regularly involved in the planning of work activities and in evaluation of reported incidents. Each shift in the organisation has designated improvement groups meeting each month. The improvement groups engage in relatively free discussions of different safety related issues, e.g. what happened? Did the routines work as planned etc.? They engage in active discussions. There is also a central improvement group, convening each quarter. And each shift has an improvement manager, which brings relevant issues further from his own shift to the groups. This is part of a lean production philosophy. Additionally, the organization arranges weekly meetings with employees to plan and discuss what has happened the current week and what will happen next week. Similar meetings are arranged on a monthly basis. Each month, the results of the incident report analyses are presented, where groups are shown what the analyses have shown, and what the organisation plans to do, based on the analyses. Finally, other communication channels between managers and employees were also mentioned, e.g. managers in meetings, intranet, weekly information letters, message boards and information magazines.

5.2.6 The relationship with the regulating authorities

When asked about their views on the quality of the relationship with the regulating authorities all of the interviewees mentioned that they believe that this relationship 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.

Interviewee 10 mentioned, however, that some of the STA inspectors focus too much on the formal documentation. He said that in some cases, it is difficult to understand how to fulfil the requirements of EASA, suggesting that the STA could be clearer about this. He said, however, that the STA inspectors were very concerned about not acting as consultants, but that this had changed somewhat lately. When asked whether their contact with the regulating authorities has contributed to maintaining or increasing the safety level of his company, he said that:

Yes, it is important, they have a bigger role than they understand themselves. Their way of answering us, and showing that they also have an openness, transparency and open dialogue, it has evolved in recent years (...) (Interviewee 10).

Interviewee 11 described their relationship with the STA as a very positive dialogue. He said that the STA is very good at receiving their comments, and that they do not act as a «policing authority» that they have to hide things from, instead they help the companies. An interviewee also mentioned positive experiences with the STA's evaluation of their safety cultures and their SMS. Interviewee 12 said that the contact with the regulating authorities (i.e. not just the STA) is better when it comes to safety than with security. In the former case, the laws are international, the authority is more proactive and there is less classified information.

5.2.7 Views on potential future strategies to regulate safety culture

We asked the interviewees in the aviation sector to consider the relevance of twelve regulatory strategies to facilitate safety culture. The first is the introduction of a legal requirement for good safety culture in companies. Interviewee 9 said that this is currently not directly required in the rules, but that the regulating authority nevertheless presuppose (and believe) that they have a good safety culture. The second strategy is to audit safety culture, and Interviewee 9 also said that regulating authorities currently ask several questions about their safety culture when they audit their SMS. Interviewee 11 mentioned that these strategies give clear indications of the authority's priority, but that it is important that the authority does not become a «policing authority». Instead it is important that the authority disseminates good ideas to help the companies.

The final rule-based strategy we suggested was to use the safety culture concept in accident investigations, and Interviewee 10 reminded us of the complexity involved, stating that an accident may happen although the company has a good safety culture. Interviewee 11 said that they use the safety culture concept in when they conduct causal analyses in accident investigations. He said that personnel involved in accidents may have adhered to all the rules, but perhaps their attitudes or common sense failed. This could provide indications of safety culture.

We also asked interviewees about advisory-based strategies, e.g. whether they would like the regulating authorities to provide tools for self-assessment of safety culture. Interviewee 9 answered that he thinks that there is a wish in the sector for such assistance. Interviewee 10 said that this may be more complex in large organisations than in small organisations.

Additionally, we asked about the regulatory strategy of providing companies tools for self-development. Interviewee 10 said that:

Yes, the STA could contribute more; give good examples on how to work on different things. They see a lot, [but] they are a bit afraid of that [i.e. providing examples]. The examples would not need to be related to a specific organisations; it could be more general info, e.g. 'how can you foster motivation in an organization?' 'How can you get better on safety culture?' This information can be uncoupled [from concrete organisations] (Interviewee 10).

We also asked about the regulatory strategy of providing companies with real examples of safety culture measures in other companies. Interviewee 9 said that he thought that this would be quite powerful. Interviewee 10 mentioned that there should be more learning between organisations, and that the STA could have contributed to this. He mentioned an STA magazine describing how companies work, but he would like to see more of this, perhaps also from other sectors (e.g. maritime). Interviewee 11 found this strategy positive, envisioning the possibility to learn from good examples and role models.

We also asked interviewees what they thought about the regulatory strategy of providing managers and employees with safety culture training. They found this to be a very important strategy. As mentioned they also focus heavily on internal safety culture education. Interviewee 10 mentioned that such education could make the STA more into an organization disseminating experiences. Interviewee 11 thought however, that this strategy would not be relevant enough for the authority, as its activities are more related to rules and regulations.

5.3 Summing up

The focus on safety culture in the aviation branch of STA was still at a «test stage» with limited implementation at the time of the interviews. Thus, it is important to note that the safety culture audits in aviation was not fully implemented in the branch at the current stage, and that our description is based on interviewees who were part of the «limited implementation». Later (in January 2018), we heard that the safety culture audits in aviation had been suspended (we do not know for how long). At the time of the interviews (2017), however, interviewees said that they use the safety culture concept systematically in audits, where they fill out a 28-point checklist at the end of SMS audits. They said that the safety culture concept also is used in other communication with the companies, e.g. in seminars with company representatives, on webpages and in other communication with the companies. A review from the STA's «Human Factors Competence Centre» showed that safety culture was indirectly covered in the sectors' SMS requirements, and thus that a focus on safety culture in audits was legally justified.

When asked how they define safety culture, interviewees in aviation referred to the 28-point safety culture checklist that they use to audit safety culture, and/or the seven safety culture aspects evaluated in this checklist (e.g. reporting culture, just culture, learning culture, managers' and employees' safety commitment). Authority interviewees in aviation assess safety culture, using the 28-point checklist (they also use a 24-point SMS checklist). Each of the points are ascribed a color code, reflecting the «potential for improvement» on each question, based on the assessment of the inspector.

Authority interviewees in aviation generally reported a good relationship with the companies, although exceptions were mentioned. They said that companies generally found their safety culture assessments useful. All the company interviewees in aviation mentioned that they believe that the relationship to the authorities is good, and that it contributes to increasing their safety level. Company interviewees underlined that their contact with the STA was dialogue-based, open and transparent. They appreciated this greatly, stressing that the STA has «a bigger role than they understand themselves». They also reported of positive experiences with the authorities' assessments of their safety cultures.

All of the companies in aviation worked actively with safety culture development, stressing the importance of maintaining informed, reporting, just and learning cultures. We reviewed the status of the different safety culture aspects in the companies of the studied sectors, based on the assertions of the interviewees: management commitment to safety, employee involvement, reporting and just culture, learning culture. Based on the interviewees reports, it seems that these key safety cultural aspects are very well developed in aviation. This seems to reflect a relatively successful SMS implementation in aviation.

6 Results from the maritime sector

6.1 Results from authorities

6.1.1 Safety culture in rule-based regulation

The authority interviewees from the maritime sector are involved in inspections and audits related to all kinds of international and national certificates and Swedish provisions on smaller vessels. The larger the vessels, the more legal requirements there tend to be. Relevant set of rules are ISM, Solas, Marpol and national requirements for smaller vessels. Much of the audits (e.g. related to the ISM-code, which is relevant for safety culture) are transferred to the classification societies. Thus, the interviewees role is both to conduct their own audits of the national fleet and to do random sample controls of e.g. ISM-audits carried out by the classification societies. Interviewee 15a said that they have gone through a change; from regulation of vessels to regulation of classification societies. He also said that the regulation of classification societies may involve inspections of vessels after the classification society inspections (to compare), visits to the offices of the classification societies etc. Interviewees asserted that the safety consequences of the delegation of the ISM audits are none or positive, suggesting that the classification societies are as competent as themselves: They have the same education, the same background, the same routines, and it is a bit random whether people end up in the authority or the classification society. A possible draw back with delegating the ISM audits is however that the classification societies are vulnerable in the sense that they can be replaced by their customers in the competition with other classification societies. This could hypothetically influence their level of strictness.

The STA inspectors use systematic checklists for the different types of audits and inspections, and record the results in a computer-based system, before the vessels receive a new certificate. They look for instance at technical equipment, physical design, class certificates, special certificates, insurance, manuals. When auditing the safety organization of the shipping companies, ISM and the working environment, they look at manuals, talk to crew members and examine whether the safety organization is well functioning.

The interviewees from the maritime sector are primarily involved in rule-based regulation. Interviewee 15b stated that:

We are mostly involved in rule-based [regulation]...we have no direct experiences with the goal-based. It is easier with rules in a big organization, and it is hard to make assessments in a goal-based system. We [the sector] are not quite mature enough for that, but it is dependent on the objects; in the industry, most want exact rules describing what they are supposed to do. They do not «think outside the box». We do not reward those who have done something better [than the rules], we check whether the rules are complied with. (Interviewee 15b).

Safety culture seems less relevant in rule-based regulation. When asked whether they use safety culture in their work, interviewee 14 and 15b answered usually not, or not directly. Interviewee 15a answered that he used the safety culture concept in his work, although he contended that the safety culture concept is largely not used in the maritime sector; instead people in the sector refer to the ISM code when talking about the informal (and formal)

aspects of maritime safety. Interviewees also stressed that they do not have a strategy or procedures related to safety culture. They said however that they talk about good and bad operators (and good and bad flag states), and that this is related to safety culture. When asked whether they see different safety cultures in the companies, interviewee 15b said that:

Everybody knows who has a good and a bad safety culture, but we do not use the concept directly, the inspectors know where they have to spend longer time; there is an informal evaluation of the shipping companies and the vessels that we are in contact with, even though we do not use the [safety culture] concept. (Interviewee 15b).

When asked about the basis for these assessments, Interviewee 15b answered «gut feeling» and the «overall impression». Interviewee 15a said that:

You perceive the line of thinking as soon as you are on the vessel; whether they «think safety» (...) you see it when you talk with people on board. You see it if anyone has stated scrimping, and barely get by. In the Nordic countries and the Baltic Sea, we often see very good vessels of high quality, reflecting a high national level (Interviewee 15a).

In line with this, Interviewee 15b and 15a said that it is evident in port state controls, for instance, that some flag states have poorer standard and safety culture. The Nordic countries for instance, have a very high standard. Tankers and chemical vessels also have a high standard, because of the vetting process of the oil companies.

Although the authority mainly performed rule-based regulation at the time of the interviews, Interviewee 15a noted that they were currently preparing a large project focusing on the national fleet, where the authority would switch from rule-based to function-based regulation (in April 2018). This applies to the national fleet, that the STA still was responsible for regulating, largely consisting of smaller passenger vessels. This change will involve a large increase in the shipping companies' possibilities and responsibilities. It involves increased possibilities in the sense that if companies do not want to adhere to a specific legal requirement, they may provide reasons for this, and present an alternative. Interviewee 15a said that this may be accepted by the STA, if the reasoning is good. It involves increased responsibilities, as shipping companies themselves must define how to adhere to legal requirements, e.g. defining safe manning level themselves. Moreover, in this system the STA will only conduct point inspections, when they suspect violations. This means that the shipping companies must find a method for self-regulation (e.g. annual self-inspections), if they do not already do this. This requires a high level of resources, competence and judgement from the shipping companies. Accordingly, Interviewee 15a said that the smaller shipping companies are a bit uncomfortable with this responsibility, while the larger shipping companies (with 20-25 vessels in their fleet) are eager for this change to come, asking for it to happen. The smaller companies, on the other hand are content with the rule-based approach, and the idea of rule-based inspections of hull and equipment, following the principle of the detailed vehicle inspections in the road sector, which conclude that «it is guaranteed that you can drive for another year».

6.1.2 The SMS-requirements of the ISM code concern safety culture

Although they did not use the safety culture concept, interviewees agreed that many of the SMS-requirements of the ISM code concern safety culture. Interviewees answered, as noted, that they do not have any strategies or procedures related to safety culture, although they indirectly focus on this in their ISM-code audits. When asked about strategies or procedures related to safety culture, Interviewee 15b stated:

Not directly, but we examine whether they have a safety policy, which includes safety and environment, and then we examine whether they live up to that policy in their ISM manual, or the safety manual; that is the basis of a good safety culture. (...) The most important thing is that they continuously work with improving their safety work, a good effort on improvement means a good safety culture. The opposite of this is to use ISM as a «dead document». It is important to learn from incidents, both your own and from other vessels, and to develop routines and procedures based on this. (Interviewee 15b).

In accordance with this, Interviewee 14 gave the following ISM-based definition of safety culture:

That you are conscious about the risks on board, and work towards eliminating the risks in a systematic manner. And that you work towards the goal of improving as much as possible when it comes to safety; you take no risk and work as safely as possible. (Interviewee 14)

The interviewer also asked Interviewee 14 whether he thought that the ISM code had influenced the safety culture within the maritime sector. Interviewee 14 replied yes; that it has involved a more systematic way of working on safety. He said that the ISM code does not mention safety culture at all, but that it is implicit that the code shall contribute to a better safety culture. He also said that all of the points in the ISM-checklist, in addition to the other examinations, give a picture of the safety culture. Interviewee 15a also said that there has been a marked improvement in the shipping companies' safety work since the ISM code was introduced, focusing on ownership and management. He also mentioned the Scandinavian Star fire in 1990 to illustrate how difficult it previously could be to define vessel ownership, stating that this is completely different now.

The interviewees from the maritime sector said that they do not have procedures or tools to evaluate safety culture.⁷ The interviewees said that they do, however, have the checklist for the «safety organisation», which shows how the vessels work with their SMS is a «living system»; whether they have received incident reports, implemented changes and so on. This is the equivalent to safety culture, which usually refers to the informal aspects of safety, while the formal aspects refer to routines, roles, procedures etc. (i.e. the SMS). Instead of discerning between formal aspects (SMS) and informal aspects (safety culture), the ISM code includes the informal aspects in the SMS, focusing on whether the SMS is a «living system», i.e. the extent to which it is known and used in the daily work. It is important to note, however, that when assessing whether the SMS is a «living system» they do not evaluate whether the safety culture is good, or ascribe it certain scores; they evaluate whether the vessels comply with the requirements of the ISM code. As interviewee 15b stated:

It would be difficult to evaluate the safety culture on the vessel or in the shipping company; that would be a subjective assessment. That makes it difficult, but it should be possible to evaluate it. We don't hear much from the shipping companies that do well...we know that some [shipping companies] have a poor safety culture, but we cannot punish them for that. (Interviewee 15b).

⁷ 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. It seems that the maritime branch in STA formally also should have used the same 28-point checklist for safety culture as interviewees in aviation. What seems to be a lacking focus on this could, however, be due to a delayed implementation process, delayed communication etc. in the maritime branch. It could also be due to a wish to rather stick to the ISM-code inspections, as expressed by the interviewees. These suggestions are, however, mere speculation, and this should therefore be examined further in future research.

6.1.3 No-blame culture

One of the interviewees stressed the importance of maintaining a «no-blame» culture on board. He stated that this follows from the ISM-code's focus on reporting, and that they therefore assess whether vessels have a no-blame culture in the audits. He also said that this is part of their inspection strategy, but that it is not explicit or written in any document, although it is implicitly acknowledged that this is an issue that they should focus on. He said this is important, as they cannot expect people to report incidents or suggest safety improvements if they are afraid to be blamed for an incident. Interviewee 14 said that:

We try to facilitate a «No-blame» culture on board. It should perhaps be an explicit requirement in the legislation. In order to get a picture of whether there is a no-blame culture, we look at the number of incident reports and what has happened with them, and we talk with people on board. A blame culture comes from the management and the shipping company; that you punish or in other words make people who commit a mistake feel that they are not wanted. (...) When we audit the shipping companies, we focus on this, and look for indications of a no-blame culture on board. The shipping companies say that it helps to report of incidents of blame culture, but it is difficult to change a culture very fast; it is a long-term project. (Interviewee 14).

As noted above, Interviewee 15a had a clear conception of safety cultural differences between flag states and national groups. These differences largely concern the prevalence and preconditions of a «no-blame» culture:

Yes, we see cultural differences related to e.g. no-blame and reporting. In Norway, Sweden and Denmark, people are «allowed to make mistakes». In 1996, when we introduced the ISM-code, seafarers in Eastern Europe did not dare to admit mistakes. In the Nordic countries, it is perceived as positive to report [mistakes, safety issues etc.]. (...) In this respect we are better off in the Nordic countries, as we dare to ask questions; «I will not be fired if I ask a question» (Interviewee 15a).

This interviewee said that how these issues are handled are related to the national cultures of each country, and that it may be possible to spread this relatively open Nordic no-blame culture to other maritime countries through IMO's member state audit scheme and follow up, based on IMO's Triple «I» code.⁸

6.1.4 The relationship to the companies

Interviewee 15a said that he perceived the relationship between the shipping companies and Swedish authorities to be good. He said, however, that shipping companies may perceive the authority regulation to be expensive, and that they therefore may choose (other flag states and) classification societies instead.

As noted above, the maritime section of the Swedish Transport Agency has gone through some changes in recent years. First, the different transport sectors have merged into one national authority. Second, the activities of the maritime branch have decreased, as many of the inspections have been taken over by the classification societies. Along with this

⁸ The Triple I code refers IMO Instruments Implementation code. This code is based on the fact that although IMO member nations may agree to make IMO conventions part of their own national law and enforce them like any other law, they may lack the expertise, experience and resources necessary to do this properly. Thus, the purpose of the Triple I code is to ensure effective and consistent global implementation and enforcement of IMO instruments concerning maritime safety and security and the protection of the marine environment. Cf: <http://www.imo.org/en/OurWork/Safety/Implementation/Pages/ImplementationOfIMOIstruments.aspx>

development, the number of employees in the maritime section has decreased. Interviewee 15a pointed to the first change as a weakness, compared to other countries. Other countries, with separate national maritime authorities, acquire a higher focus on the maritime sector. In well-developed maritime states, this involves a joint maritime regulatory strategy in line with IMO's Triple «I» code, shared and adhered to by all relevant bodies (e.g. accident investigation board, coast guard, authorities responsible for developing national rules). Swedish maritime authorities lack, however, such a strategy. Interviewee 15a noted that such a strategy could have involved an explicit focus on safety culture in the maritime sector.

As noted above interviewees said that they see differences between companies' safety cultures, but that they do not necessarily use the concept. Interviewee 14 said that his perception of vessels' safety cultures is based on the number of nonconformities he finds in his audits on board, combined with crew members' reactions when he writes reports; e.g. some may not understand why he asks for a lot of documentation that they find unnecessary.

When asked whether the ISM based SMS in shipping companies and vessels are different, respondents replied yes; that some are very easy to understand, while others are very difficult to understand. The latter are often managed from the top. The SMS's which are based on employee involvement, allowing employees to influence and improve the systems often generate more interest and ISM-ownership, reducing the chance of people taking short cuts, or that they only follow the manual and fail to think for themselves.

We also asked whether interviewees see a relationship between safety culture and safety performance (incidents, accidents) in the companies. Interviewees answered that they see such systematic differences. In addition to the mentioned country difference, it was mentioned that tank and chemical vessels, because of the vetting process of the oil companies.

We asked interviewees which factors they believe contribute to a positive safety culture in the companies, and interviewees underlined the importance of managers, stating that bad safety culture in the management «trickles down» in the organization. The same applies to the shipping companies; when they show lacking understanding of the authorities' requirements and requests to improve safety, it influences people on board. New employees are also negatively influenced by lacking commitment to safety when they come on board a vessel. Interviewees also stressed that they may see big differences between vessels in the same shipping company, depending on vessel management and crew attitudes.

6.1.5 Future alternatives for safety culture as a regulatory concept

Interviewees were asked whether they would like to focus more on safety culture in their audits, and whether the regulating authority should have an explicit focus on this. It seems that one of the interviewees in the maritime sector missed the extra dimension that a focus on safety culture (and function-based approach) could give the regulatory authority:

We have been very focused on legislation and rules, but you cannot have rules for everything, when «the rules end» you need to appeal to «something higher», and safety culture should be the normal thing to focus on in that respect. (Interviewee 15).

Interviewee 14 also said that he would like to facilitate measures to improve and develop safety culture in the companies. He said, however, that a challenge with this is that they then may risk entering the domain of consultants, but that it would be good nevertheless. He said that their role is not to be advisors or consultants, but to point out things that are

wrong, and that only consultants give advice. Interestingly, it seems that this assertion follows from their focus on rule-based regulation, which largely involves to identify non-conformities. Their main reason for being skeptical to giving direct advice is that they could be held accountable for accidents, if they have suggested concrete actions (which have led to accidents).

Nevertheless, interviewees also found it positive to also provide their opinions on relevant issues, when they were asked by crew members on vessels. Moreover, they also found it interesting to work more explicitly with safety culture (which would involve a turn towards a more function-and advisory based approach). They found a requirement of positive safety culture in companies to be a good idea, although it could be difficult to define it, and assessments of safety culture would involve subjective judgements. Additionally, they also found safety culture inspections to be a good idea. As in the case of the SMS, interviewees stressed the importance of employee involvement and that the management and employees have a unified understanding of what safety culture is. If so, the chances that safety culture may lead to continuous improvement and ownership is greater. Interviewee 15a underlined that the most important strategy that the STA should use when approaching the shipping companies is to be active and explain why rules are the way they are. He stressed that involvement of the companies is key; and that they get a totally different understanding if they are involved in the process (e.g. of rule development and implementation). When they are involved, they understand that the rules are not just something that the authorities have made up. Further stressing the importance of involving the companies, Interviewee 15a said that:

It is important that we meet each other, e.g. in meetings for leading officers or in industry meetings. It is important that we are there to discuss, e.g. in the maritime schools, in the shipping company meetings, to discuss, when new rules are introduced, why they are like they are, the background. [It is important] that we not just take on a policing role, but that we explain why things are the way they are (Interviewee 15a).

When asked, they also found that providing companies with tools for self-evaluation of safety culture to be a good idea, as it would provide them with a possibility to measure progress, provided that such tools are formalized. It was noted though that it is a problem that incidents are underreported in the accident statistics, as people are afraid to contribute negatively to statistics and progress reports. Thus, the fact that people may be afraid to contribute negatively to the results is a challenge with organisational self-evaluation of safety culture. Interviewee 15b said that they hold that a high level of non-conformities is an indication of a good safety culture, but that this is interpreted differently in other countries. It was also mentioned that providing tools for self-development of safety culture and learning is a good idea, as knowledge about this is a prerequisite for improvement. They also found providing real examples of good safety culture measures to be a good idea, and said that they have good experiences with providing concrete feedback to the vessels and shipping companies, saying e.g. that their ideas are good. Interviewee 15a stressed however that it is important to remember that shipping companies and vessels are different; they have their own histories, structures, cultures etc., and it may be difficult to give general advice. One interviewee mentioned that in his experience, vessel members appreciate feedback from the shipping companies, as it indicates interest and the vessel members are «seen». It was mentioned that shipping companies generally could give more feedback to the vessels. Finally, Interviewee 15b also stressed that there currently are several possibilities and tools for shipping to learn. He referred, for instance, to an anonymous Swedish database created 15b years ago, where shipping companies can report ISM-deficiencies. Other companies can learn from this system, seeing what kind of

deficiencies shipping companies have experienced and what they have done to avoid them in the future. Moreover, he also mentioned that shipping companies may learn from IMO reports of different issues.

6.2 Results from the companies

6.2.1 Safety culture follows from successful implementation of the ISM code

The interviewees work in different shipping organisations, and are largely employed as managers with responsibility for safety, often employed as designated person ashore (DPA). According to the ISM code, every shipping company has a requirement for SMS, and also a responsible DPA who has a direct link to the top management. All of the interviewees said that they have management systems, as this is required by the ISM code. Such SMSs are formalized descriptions of how to work with risk, and they typically include safety policy, safety roles and responsibilities, procedures for risk analysis, conducted risk analyzes, actions taken based on risk analyzes, procedures, training, reporting systems, checklists etc. Interviewee 16 said that the ISM code is one of the most well-regulated documents, but he underlined that it only tells companies what to achieve and not how to do it. He also mentioned that shipping companies transporting oil have additional SMS requirements, stemming from the oil companies, the «Tanker Management and Self-Assessment» (TMSA).

The position of the ISM code in the maritime sector indicates that the main way of working with safety in this sector has been the system approach. Accordingly, interviewees' main view on the relationship between SMS and safety culture was that safety culture follows from successful ISM code system implementation. In line with this, Interviewee 19 said that:

Safety culture is that you have a system that is so well implemented that you actually live by it and do not need to go to the bookshelf to find out what to do, everyone is comfortable with it, it sits in everyone's backbone. (...) We have our own system based on how we think we should act. It is implemented as mix of mandatory laws and demands of the industry. The whole concept comes out as safety culture, and we try to implement that, visit vessels and make sure they are implementing procedures etc. (...) I don't think we have written «safety culture» anywhere, we have written the «safety system», but the culture will develop if you have a good system. (Interviewee 19).

In line with this, Interviewee 20 said that:

Safety culture is integral with SMS, and it comes from ISM that we use in the shipping industry. It must come from the top of the company and down to the employees. From the perspective that all employees have a responsibility for safety culture in the working environment etc., and we have guidelines and pamphlets. I have employed a captain who supports the crew on this so they can understand what safety culture is in context of the SMS, and at end of the day it's not about paper it's about discussions and social interaction. (Interviewee 20).

Interviewee 18 stated that:

The SMS is a tool to achieve an effective and good safety culture. Safety culture is the way things related to safety are performed in a company. In our company, I would

say that we focus on both and that the SMS is a part of the safety culture. (Interviewee 18).

Interviewee 18 also underlined that the ISM code sets out the requirement for shipping companies to have in place a safety management system, but that it does not stipulate the method for achieving satisfactory safety performance. Moreover, as the ISM code does not focus directly on safety culture, the audits carried out by port state and flag state authorities do not focus on safety culture:

When port states themselves inspect, they don't use «safety culture» term. But when there is a serious deficiency, an «ISM deficiency», it's like failing kindergarten. You should not have those failures since they are basic problems. So they do not deal explicitly with safety culture, and you also have the problem: how do you measure safety culture? E.g. poor maintenance of equipment, which they point out, but getting behind the reasons for this on a short term inspection is difficult. (Interviewee 16).

This further illustrates that ISM is the primary focus in the maritime industry. Thus, perhaps the maritime industry's focus on safety culture is relatively new, as indicated by Interviewee 16 «Companies are beginning to see the several benefits of investing in safety culture, it improves the company in many ways; good for business.»

6.2.2 Safety culture is used in a general and abstract way

As a consequence of the maritime sector interviewees' primary focus on the SMS and secondary focus on safety culture, their understanding of the safety culture concept was perhaps more general than it is in e.g. aviation. Some interviewees were somewhat uncertain as to whether the ISM code, their SMS and procedures actually mention safety culture. One interviewee said that they did, but that it is a recent development. Interviewee 18 said that their SMS explicitly mentions safety culture. Others said that they did not think so. Accordingly, it also seems that the extent to which the safety culture concept actually is used in the work places of the interviewees varied. In many cases, interviewees used the wording of the ISM-code, as indicated by Interviewee 19. When the interviewer asked whether they use the term «safety culture» in his work place, he indicated that they talk about the ISM concepts, which are related to safety culture:

Maybe what we talk about is not so different, it's probably just related to the wording in the ISM code. (Interviewee 19).

Additionally, interviewees in the maritime sector had a slightly higher tendency to problematize how to measure and define safety culture. Interviewee 16 said for instance that:

It works well, but the term is vague. What is culture? We know what safety is. People need their own explanation, but the important thing is in safety culture the individual should be the promoter themselves. (Interviewee 16).

Accordingly, Interviewee 20 said that:

We talk about it in an abstract way, rather than use the term and explain what it means. It's better to simplify the wording to the crew. Crew are on different levels. You must come down to the lowest level. They are the ones often in the frontline when something happens. So if they understand and have good safety culture, you have gone a long way. (Interviewee 20).

6.2.3 Employee involvement and SMS-ownership

Employee involvement is a key process in developing both a good safety culture and a well-functioning SMS. We asked interviewees whether they experience that management involves employees sufficiently in safety issues and take advantage of their expertise. Interviewee 16 answered that most of their on-shore operatives are ex-seafarers, and that they have crew input when they build ships and take on new contracts, that they meet their crews at conferences frequently, to pick up on points of view. He said however, that, there is potential that is unharnessed. This is also evident, if we compare with the extensive employee involvement that we saw in some of the companies of the interviewees in aviation (cf. Interviewee 5). Interviewee 20 said that his company involves employees through training, conferences ashore, intranet, hands-on training on board, also binders and things like that, which stand by side of computer. Additionally, people send in ideas by computer through SMS. He also said that:

There are safety meetings on shore, where we go through all the nominated changes in the system coming from crew and captain's review. After we have an acceptance of something asking for change, we then inform about the change and act on it. People have to give a receipt that they have a read a new message from us on this. (Interviewee 20).

All of the interviewees focused strongly on employee involvement. A main reason seems to be that they have quite comprehensive SMS and procedures, and that a general challenge related to SMS is the extent to which they are known by the employees, and whether the crew feels ownership to the SMS. All of the interviewees talked about the importance of a «living system» which is «at the backbone» of crew members, which is used in the daily work, and not just a document on a shelf. Several solutions were mentioned as to how this could be attained. Making the system «user-friendly» was a recurring theme. Interviewee 18 said:

We have a very living system, where people onboard are involved in improvements. We have a group with people on board, we check proposed measures and ideas with them as much as possible before changing anything. There are so many written instructions these days, so we do what we can do get people onboard and embrace the SMS. Shipping generally should have more focus on this, on how to make safety procedures user-friendly. In addition to the above mentioned groups with people onboard we have SMS meetings on board every month, where we pick out particular SMS issues that crew identify onboard e.g. bridge management, and the whole crew attends these meetings. Also new routines are brought up at committees. We have bridge audits, where any new requirements brought up. And also in safety bulletins we bring up SMS changes, also at the seminars ashore. When we are on board at least once every 6 months, and on many occasions, we can bring up safety issues. (Interviewee 18).

The company of Interviewee 20 had adapted the SMS to a smart phone app:

The stationary computer is not so popular any more so we are building a situation with an app on the phone so each crew member can view the SMS from home, and at work you can do a risk analysis on it. We must simplify everything today. It's important if you want safety culture and interest from the crew. In the last 20 years, shipping companies have made things too complicated. (Interviewee 20).

This digitalized SMS, attainable by means of a smart phone application could be a central way of facilitating employee involvement. Interviewee 16 said they also were planning to make the SMS digital to increase employee ownership and use. Currently, the SMS was on

the bridge in manuals. We asked whether employees know the SMS and whether their actual behaviors are in line with the formal SMS descriptions. Interviewee 17 said that:

I would say all crew know about SMS, but they are not equally familiar with it at all levels. We are working to get ABs and other ranks to be more involved. Mostly captains [are involved in SMS] at the moment. We try to give more info, education, safety awareness training, and we are making a new folder with procedures. (Interviewee 17).

This answer, stating that the SMS is more known among captains and other people with managerial functions was not uncommon among the interviewees.

6.2.4 The role of the captain in SMS and safety culture implementation

Interviewees stressed that senior management commitment is important for SMS and safety culture implementation in the maritime sector. Interviewee 20 underlined that:

When CEO and top management have it on the agenda, then mid management of course understand that this is very important. We are ... employees, so of course there is always some manager who does not understand. I have direct access to the board and the CEO. This is good, because if mid management says we have to make safety cuts I can go to the CEO, if I want. Of course it is not easy for top management to understand the whole situation about safety and safety culture. Normally top management are not sailors, they are from other environments. They don't work with technical staff etc. It's a learning process for many of them also. (Interviewee 20).

Interviewee 18 said:

Our safety attitude has always been there. It comes from the owners and senior management, from the top. They have always focused on the people in the company. This is key for success in this area. You must have people with you to gain the goals, embracing the idea of positive safety culture. It should further be noted that we implement our policies together with people ashore and onboard, this gives strength and meaning to all involved. (Interviewee 18).

Working with SMS and safety culture implementation is, however, a bit special in the maritime sector compared with other sectors, as the shipping companies mainly relate to the captains on the vessels, unless when they have large on-shore seminars for crew members. Hence, most of the vessel contact go through the captain. Vessels are to a large extent isolated communities, and thus it is the role of the captain to implement and take further the shipping companies' plans and intentions for SMS and safety culture implementation on board. When we discussed employee involvement with Interviewee 17, he said that:

We are striving for a just culture. «We» means me in the office and people on the vessels, mostly safety or ISM related. Mostly, in maybe 90 % of the cases, it is the captain we talk to about this. But when I visit the vessel I try to talk with everyone. But it is the captain who should implement safety culture on board. (Interviewee 17).

Interviewee 20 said that:

According to the rules it's the master who has total responsibility on board, so we support them. We can put up an agenda and questionnaire this is what the company wants from you as the master. They have the responsibility to invite us on board to do HR training. (Interviewee 20).

Interviewee 19 underlined that they provide the captains with a large discretionary space:

We try to have as little «you must do like this» documents as possible. In our line of work, much depends on the situation. If we started making concrete procedures it would conflict with reality. We put things more to the discretion of the master. We do this more than in other parts of the industry. We have many procedures, don't get me wrong, but we try not to specify in detail, we leave room for responsibility. We want it safe, but you can be flexible with risk assessments so that you consider different situations. (Interviewee 19).

6.2.5 Measures to develop an open, no-blame, reporting culture

The important role of the captain on-board the vessels indicates a cultural challenge that was noted by some of the interviewees. These mentioned that the maritime industry is traditional, that the hierarchies on board the vessels have been strong and that this could provide a challenge to developing open safety culture, where safety issues are communicated freely, independent of rank. When we discussed employee involvement and informal and formal managers on board, Interviewee 20 (from passenger transport) said that:

(...)if you look back at the history, the captain had his own saloon, he was God on board, then it was engineers, then the catering dept. But these must work together. But still today you can hear deck/engine officers saying these catering officers are not real officers. Ok they may not have the most formal qualifications, but they have more people, more challenges, often a different culture, so that is a challenge in a way. Ultimately, the guy cleaning the cabin is just as important as the captain, for safety. (Interviewee 20).

Interviewee 17 also indicated that the traditional hierarchical maritime culture may be at odds with the open communication that a good safety culture should involve:

I was at a conference, and there was something interesting there showing the culture is to answer the superiors, not ask them. What we are trying to do is get it to be ok for junior officers to ask the captain. It is something to account for especially when you have mixed crew on board the vessels. But constant care and time, get the top level to understand it, then you can apply it more. (Interviewee 17).

All interviewees said that they aimed to develop open, no-blame, reporting cultures on board the vessels operated by their shipping companies.

Technology and procedures, most companies have taken this quite far. You can build away risks [with technology], and procedures are quite good; you can tell people 'you should do it like this'. But culture means how all this works in practice, it is about people realizing the power within themselves to say stop etc., say to a pilot 'this is not safe', this is paramount, the procedures after all stand on a very vague platform. What we are working on at the moment is safety culture – it devolves from the mindset of the person of the top of the chain. And he can undermine safety by not being seen to prioritize it in several ways. (...) For me this is where each person has a responsibility for themselves and others, understands that safety has a purpose from a personal point of view, where it reflects on that person, the crew onboard, but also at home i.e. must be responsible for families etc. (Interviewee 16).

Interviewees' views on the quality of open, just and reporting culture in their companies were, however varying. Interviewee 17 was concerned about the quality of the reporting system on the vessels. He had the perception that the reporting system for near misses, accidents, and improvement was not being used the way it should be. This assertion was based on visits to vessels and secondhand information. He said that the reason for the

improvement potential of the reporting system was that it is only the captain who is responsible for it working and that the captain is not responsible for the computer. He said that the captain may use a lot of time to fill in a report, and that more training and more focus will help, partly attributing it to a traditional attitude in shipping:

I don't think captains are afraid of reporting, but shipping is still quite traditional, «this is the way we have always done it» etc. (Interviewee 16).

Interviewee 16 said that they train the crew individually, on how to use the incident reporting system.

They can use the safety representative, and then there is the safety officer who is responsible for safety. It is my belief that the crew down to low level who have the tools they need for this and understand how to do it. Whether they report everything can depend on reaction to reports on individual ships, but I don't know. There is no one in the organization that feels they will be cornered for their reporting. I have trained the safety representatives myself. (Interviewee 16).

Interviewee 18 reported of positive development in their reporting culture:

We have increased the reporting a lot, especially of near misses and suggestions for improvement. The crews get feedback on this by shared experiences, and they see we try to improve in all areas, they see the advantages of doing this. Systems must be kept user-friendly so it's not too much for busy officers and crew. IMO, customers etc. need to think about this in relation to other reporting needs. (Interviewee 18).

Interviewee 19 also stressed the importance of the informal discussions and open dialogue, stating that «(...) the discussion, the most informal channels, are the most important.» The purpose of the reporting systems is to provide the companies of the interviewees with data that can be used for learning and improvement. Interviewee 19 provides an illustration of this:

We have a system that all reports when they are processed and finished; we have visits [to crews] once a month to go through them. If there are too many, we pick out the most relevant. If there are 10 for the whole fleet, we go through them all, if 20-30 then we pick out most relevant. We go through them at the meetings. If there is something relevant, a good suggestion, we have a dialogue to modify a routine or update a RA or adapt local RA, it all depends on what the issue is. Most is we find a new way of doing it, someone might give a tip, explain how they do it etc. We tried something else where people put up pictures and tips, but it's better done via the reporting system. If it's relevant enough we capture it in the office and alter routines and so on as described. (Interviewee 19).

6.2.6 The relationship with the regulating authorities

The maritime industry is truly international, and one of the indications of this is that shipping companies may register their vessels in any flag state. Each flag state is required to carry out inspections of vessels in accordance with IMO rules, although these inspections often are delegated to class societies. Additionally, interviewees' vessels travel to different countries, where they are exposed to different port state controls. Interviewees therefore relate to many different flag states and port states, and their experiences with these vary. Interviewee 20 said that:

(...)we are on the market on different countries, we see the difference among different state controls. Crew are treated different, variation in ideas about the same legislation. So that is why we try to minimize authority inspection on board. If we have a Swedish flag, then a recognized body can come aboard can perform all the

different authority's inspections at once, so we get the same interpretation of the regulations, so we know how to handle it. Every country wants the same info but some add on more than is needed. It's complicated, and all shipping nations have complained. We should have one system, not several. Its ok with regulations and inspection, but when you get overloaded and different opinion of same regulation and different knowledge depending on where you are in Europe then it's crazy for someone trying to do business. (Interviewee 20).

It seems that this view was relatively representative of the interviewees in the maritime sector. Interviewee 19 mentioned that:

I mean in some countries there is (...) port state control should come on board and check all is in order, but in some countries they are there to find something and they always find something - they lose trust from the crew. That's hard to work with, and if you argue/discuss with them then there will be more and more problems. In some places that's the problem - they don't have a dialogue with the vessels. They just like finding things and have a (punishment) mindset. In some countries, you can discuss, come up with a solution, and so someone inspecting the vessel can be a good thing. I don't know if there is control of the authorities doing these inspection – that is maybe an idea. (Interviewee 19).

Interviewee 16 and 18 also stressed the important role of the transport buyers, stating that these often may require more than flag states:

Being the kind of shipping company that we are, you have so many requirements from your customers, it doesn't matter which flag you have the buyers in a way make it easier to fulfil the requirements. (Interviewee 18)

This illustrates that interviewees' vessels are subjected to a range of different audits from different parties, in addition to their own internal audits:

We as a company do safety inspections on board, then port authorities, class societies, oil companies and also flag states do safety inspections on board. Then there is the occasional post-port state control, on behalf a terminal owner or manager. (Interviewee 20).

Interviewee 18 also mentioned that:

For us I don't think flag has made difference to safety, but for a company where there is no focus on safety, then there could be a difference. [Scandinavian country] flag states are better, because they push more and expect more. (Interviewee 18)

Additionally, the interviewees experiences with the Swedish Transport Authority varied, although it should be noted that interviewees generally had registered their vessels in foreign flag states. One of the interviewees reported good experiences from meetings that Swedish Authorities' arranged together with the Swedish ship owners' association. It was mentioned that this was very important, as it makes it easier to contact them after and address things. Another interviewee was not content with Swedish authorities, stating that Swedish maritime authorities:

(...) lack a plan of how to get into a dialogue with the ship owner now that they have delegated the surveys to others. They just turn up as an anonymous mass if we have an accident. They should come much earlier, be more proactive, flexible in the forefront. Danish authorities have done good things here that STA might learn from. Even in cases of companies without Swedish vessels. The STA are exposed to competition by all other agencies, so they should focus on their customers. (...) The STA have tried to implement internal control. (...) they tend to trust people too much on who will audit to give a good internal control (Interviewee 19).

6.2.7 Views on potential future strategies to regulate safety culture

We asked the interviewees in the maritime sector to consider the relevance of twelve regulatory strategies to facilitate safety culture. Interviewee 16 stated, however, that before regulatory authorities start considering such strategies, they should perhaps take one step back first, and:

(...) collect knowledge about where companies are today. Workshops would help more than a simple measurement tool. I find it hard to know how to make safety culture rules e.g. if you do not have safety culture, you cannot be approved. If they would invite for discussion on workshops it would engage companies (...) You have to install the willingness to know first. The transport agency has a problem to be positive at the same time as enforcing the rules. Maybe it's better to use an outside company or partner to create something with the STA. It takes a long time to reach the level of trust required. (Interviewee 16).

Interviewee 19 also argued in the same manner, suggesting that:

(...) to start with what I've been missing is let's just have a breakfast seminar and discuss what we can do better. Most people live close to STA, it would be a good start. The class societies are doing it frequently already. (Interviewee 19).

The first regulatory strategy to promote safety culture that we discussed is the introduction of a legal requirement for good safety culture in companies. Interviewee 16 mentioned the challenge of measuring safety culture, stating that:

(...)the ones who don't want to do it cannot be punished (if you can't measure it). It's hard. You can see it from incidents etc., that's probably the only way». (Interviewee 16).

Interviewee 19 also disagreed with this strategy, stating:

Basically no. The authorities should demand you have a system that is doable and possible to work after. We would have to make a clear definition of what is a culture, but culture is in the eye of the beholder. Let's instead get the authority to guide the company towards a good proactive work on safety and the culture will come by itself. The culture comes if you are walking the talk. If you don't do this your system may as well be a bookshelf. (Interviewee 19).

Interviewee 18 also agreed with this view, underlining that soft skills already are covered by the ISM code. This assertion is in line with the culture-follows-from-system argument that we discussed in section 6.2.1. This argument was also used when we discussed the second strategy, which is to audit safety culture, and:

It's very hard to measure, but if they – and they do- inspect effective use and understanding of the system...and they are doing this...they have already been doing this since 1995! (Interviewee 19).

Safety culture refers to informal aspects of safety, as opposed to formal aspects, which refer to SMS. This interviewee finds that the legislation already covers safety cultural aspects indirectly, by focusing on «effective use and understanding of the system», which refer to the informal aspects of the SMS. This is an interesting assertion that could be followed up in future research. It could for instance be argued that safety culture is more than use of the SMS, as the former also includes management commitment to safety, employee involvement. On the other hand, it could be argued that these aspects are covered by the SMS and that it is easier to measure and assess SMS use than safety culture. When discussing strategy 1 (safety culture requirement) and 2 (safety culture audits) with Interviewee 20, he said that:

When you say demand [for safety culture], I have to laugh. The authorities don't know how many systems and regulations we have. As I say, safety culture is about how you behave. This is not a good idea. (...) they already have inspections. We don't need more. Internal audits and external audits cover this. It would be wording and nothing else. I have been on board more than 30 years. If they come in with a new system from the flag states, the crew will get furious, they will say this is more corporate bullshit. (Interviewee 20).

Instead of introducing new safety culture requirements, Interviewee 20 argued in favour of improving the ISM code:

There is a lot of discussion already about ISM in IMO, class societies already had this kind of SMS, and then it happened in the industry. I think we should improve the ISM code within IMO, we don't need new systems. Even new terrorist measures need to go through the ISM code. We just have enough regulations and there has been a lot of change recently. (Interviewee 20).

The final rule-based strategy we suggested was to use the safety culture concept in accident investigations. Interviewee 16 thought of this as a good idea, provided that safety culture is explained a bit more. The same applies to Interviewee 17 and 18. The former said that it would improve safety, if the term «safety culture» started to be more frequent topic up for discussion. Interviewee 19 found that the investigations already conclude if SMS are implemented and working or not, and that safety culture therefore is indirectly covered in investigations. Interviewee 20 answered that this strategy is very important, and interesting to have in accident reports: «what kind of culture has brought up the situation».

We also asked interviewees about advisory-based strategies, e.g. whether they would like the regulating authorities to provide tools for self-assessment of safety culture. Interviewee 16 mentioned that UK's Maritime safety authority (MSA) already has a good evaluation tool for that, where you can assess the safety culture in your own company. Interviewee 17 suggested that this is a good idea, if it is done anonymously, and if crew members see measures being implemented, based on the results. Interviewee 20 said that:

It's already covered by us. It could be an idea, but you have to define what is safety culture. When you define it, you find that it's everything that happens on board, in the board room, are we thinking about safety when we sitting here, when we make investments etc. It sits in your backbone. (Interviewee 20).

Additionally, we asked about the regulatory strategies of providing companies tools for self-development, and knowledge about how safety culture develops. Interviewee 17 stressed that it may be impossible to get a generic how-to-do on safety culture, because every person and every situation is different. Interviewee 18 agreed.

We also asked about the regulatory strategy of providing companies with real examples of safety culture measures in other companies. One of the interviewees said that even though they share knowledge between ourselves already, this would be good. Interviewee 17 agreed. The same did Interviewee 19, who underlined the importance of dialogue between the authorities and the companies, stating that

It's not just pointing fingers, it's discussions. If they find something that is good about a ship owner, they have no channel now which they can use to spread the word with other ship owners! (Interviewee 19).

Interviewee 18 said that it is good to share experiences, and get tips on how to improve safety culture, and that everything can improve.

We also asked interviewees what they thought about the regulatory strategy of providing managers and employees with safety culture training. Interviewee 19 said that this could be an idea, but he said that it would be very resource demanding in large companies. It would

depend on computer-based training, in a class room. Moreover, he also said that there is not much time to use for training they, are exhausted often and need their free time. Finally, Interviewee 16 stated that perhaps transport buyers could be a relevant party to motivate shipping companies to focus more on safety culture:

A complementary training program would help, but this is an area hard to sell, what is the pay off, what enforcement does it address etc.? But it is important, if you get the buyers of transport to say this is one of the things you have to be knowledgeable of, be certified in, that would give the industry willingness to go there. (Interviewee 16).

6.3 Summing up

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 to auditing safety culture. Although they did not use the safety culture concept, interviewees agreed that many of the SMS-requirements of the ISM code concern safety culture.

Authority interviewees in the maritime sector do not formally assess safety culture in their inspections. They said however that they talk about good and bad operators, and that this is related to safety culture. When asked whether they see different safety cultures in the companies, one of the interviewees said that: «Everybody knows who has a good and a bad safety culture». Such impressions and assessments are made informally e.g. in ISM inspections, based on «gut feeling» and the «overall impression».

Many of the SMS-requirements of the ISM code indirectly concern safety culture. One of the interviewees stressed the importance of maintaining a «no-blame» culture on board. He stated that this follows from the ISM-code's focus on reporting, and that they therefore assess whether vessels have a no-blame culture in the audits. He also said that this is an implicit part of their inspection strategy. The inspectors in the maritime sector, lack however the systematic safety culture checklist of the kind that the aviation inspector use, and thus they do not have a systematic way of analysing their «gut feeling» about safety culture.

Discussing the lack of focus on safety culture, it important to note that the safety culture checklist that we described in the aviation chapter is based on a safety culture definition and model that in principle applies to the entire STA (i.e. all transport sectors). Moreover, 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. Those interviewed in the maritime sector may not have been very familiar with this, either because they were unaware of existing safety culture activities in their sector, or because this definition/model has not been applied to the maritime sector in practice yet. We lean towards the latter interpretation, as interviewees had a good overview of activities, and several years of experience.

Although authority interviewees from the maritime sector do not have procedures or tools to evaluate safety culture, they have the checklist for the «safety organisation». This shows how the vessels work with their SMS, and whether it is a «living system»; whether they have received incident reports, implemented changes and so on. It is important to note, however, that they do not evaluate whether the safety culture is good, or ascribe it certain scores; they evaluate whether the vessels comply with the requirements of the ISM code.

Company interviewees in the maritime sector relate to many different flag states and port states, and their experiences with these vary. Interviewees experiences with the Swedish Transport Agency were mixed, although it should be noted that interviewees generally had

registered their vessels in foreign flag states. While one of the interviewees reported of good experiences with Swedish Authorities, another interviewee was not content, stating that the STA «lacks a plan of how to get into a dialogue with the ship owner now that they have delegated the surveys to others», and that authorities should be more proactive.

Although they did not use the safety culture concept, company interviewees in the maritime sector agreed that many of the SMS-requirements of the ISM code concern safety culture. The safety culture aspects were relatively well developed in the maritime sector, but here it seems that there is a risk of a discrepancy between the formal ISM-code aspects on the vessels and the actual safety practice of the crew members (i.e. safety culture). We discussed «ISM-ownership» as a central safety cultural issue in the maritime sector, noting that this is a way of increasing SMS familiarity and ensuring that work practice is in accordance with SMS.

7 Results from rail

7.1 Results from authorities

7.1.1 Rule-based regulation developing into advisory-based regulation

The interviews from the rail sector indicates that this sector primarily relies on rule-based regulation, but that it is gradually starting to employ a function-based and advisory-based perspective, and regulatory focus on safety culture. Interviewees stated, however, that although advisory-based strategies have become more prevalent, some areas will always need rule-based strategies, e.g. those related to technical equipment and specifications. It is also important to note that the rules governing their audits focus on SMS, and not directly safety culture. Nevertheless, the key aspects of the SMS requirement and the SMS audits indirectly concern safety culture. Additionally, most of the interviewees also focus on safety culture in their inspections, based on a strategic STA decision, followed by a review of the rules governing their audits which concluded that these rules legitimize focusing on safety culture in the audits.

All but one of the interviewees said that they systematically use the safety culture concept in their work, that they seek to evaluate safety culture in their inspections, and that they talk a lot about it. It was also mentioned that safety culture has been a hot topic in the seminars hosted by the Swedish Transport Administration (Trafikverket) in the recent five years, and that SMS was the previous hot topic. One of the interviewees even said that they perceive improving the safety culture of the rail companies as one of their most important tasks; included in the general goal of facilitating better performing organizations.

One interviewee stated however that they did not use the safety culture concept in his place of work, and that they did not have a strategy related to safety culture, although he stressed that the content of the SMS approach is very similar to the safety culture concept. Defining safety culture, he pointed to a learning culture, a just culture and a reporting culture.

Interviewees mentioned that they have started to focus more on safety culture partly as a response to an initiative from the STA centrally. Explaining the background of their focus on safety culture, some interviewees recalled a visit from the human factors competence centre of STA. The visiting human factors expert requested to see the most important document, governing their audits. He looked for questions relevant to safety culture, and then he started a discussion with the inspectors concerning the document, its content and how it is interpreted and used in the audits. He went through 10 points with the inspectors. Thus, when asked whether they have strategies related to safety culture, one of the interviewees replied «the rules», referring to this examination which found that the rules governing the rail SMS inspections concern key safety culture aspects like a reporting and learning culture, although safety culture not is mentioned in these rules.

Interviewees also mentioned that the safety culture of a key unit in their organization recently had been evaluated by the STA's Human factors competence centre. It seems that this also contributed to raising their awareness and knowledge about safety culture, especially their knowledge of the key aspects that safety culture is comprised of. Interviewees stated that they were going to use this evaluation report to learn more about safety culture.

Discussing the mix of rule-based versus principle and advisory based regulatory strategies, interviewees mentioned the importance of the maturity level of the companies, suggesting that they employ a more rule-based strategy when working with companies that they know have a poor safety culture.⁹ These companies are defined based on a risk-model, considering speed, the complexity of the traffic, incidents, and previously identified non-conformities. Based on this risk-based regulation model, companies are inspected annually or biannually.

Describing the safety culture level of the rail sector, one of the interviewees stated that the safety culture level overall is good; employees are not afraid to report incidents, the culture is relatively just, the safety commitment is high, and has historically been high. The safety cultural maturity was also discussed with other interviewees. When they were asked about the prevalence of a reporting and just culture in rail, one of them said that:

It is a bit individual-based; when someone is involved in an incident the response is directed at the individual; e.g. «he needs more training». The sector is not quite mature, there is not enough focus on the system. There are quite big differences between companies, but there may be too little focus on the role of the management. We are good when it comes to investigating technical failures, but we are a bit weaker on the soft [aspects of safety]. The companies have no behavioural scientists in their investigations. They do not focus on organizational failures in such investigations. (Interviewee 23).

Another interviewee said that the challenge related to safety culture in the railway sector is the use of many subcontractors which may impede a learning culture. There are over 500 actors involved in the railway sector: 370 involved in infrastructure, 100 operators using the tracks, and tens of actors involved in tram and metro transport.

It was, however, noted that the documentation systems are good and that the owner of the infrastructure in any case is responsible for safety, as it is impossible to delegate away this responsibility.

7.1.2 The legal basis of the inspections is SMS

Although most of the rail interviewees stated that they relatively recently have started to focus on safety culture in their audits, it is important to note that the rules governing their audits focus on SMS, and not directly safety culture:

We can relate all non-conformities related to safety culture to our already existing legal requirements, although there may possibly be some exceptions. We have the safety directive from 2004, and a new directive now, stating that «by means of SMS, infrastructure shall promote a safety culture». This point is about reporting, and this directive will be implemented in 2019. It applies to all EU countries, including Norway, and it is based on Article 9 in EU directive 2016-798. (Interviewee 23).

Thus, we see that interviewees underlined that SMS is the legal concept that their audits are based on, but they stated that it would not harm to also introduce safety culture in their legal documents (as it will in 2019). Their SMS inspections concern the key aspects of safety culture, and it can therefore be argued that these inspections also focus on safety culture. Interviewee 21 said for instance that:

Many of the SMS requirements match the content of safety culture. There are requirements for reporting, monitoring activities, examine non-conformities, have a

⁹ It seems that this was based on a safety culture maturity model based on the European Railway Agency (ERA 2013), which in turn was based on Fleming (2000).

management commitment for safety, and horizontal and vertical communication in the company. This is very close to safety culture. Safety management and risk management are described in the EU-legislation for the rail sector; the SMS rules for rail. These are also included in a Swedish provision. (Interviewee 21).

When asked whether they would like to explicitly focus on safety culture, and not just indirectly, Interviewee 21 stated that:

We use the term safety management, as this is the concept which is used in the legislation. Most of it is quite similar, it is just different words that are used to describe same. Much of the themes in the safety culture report about the Swedish Transport Administration [Trafikverket] would fall under SMS in the legislation. It is just another concept, but it is the same thing. It is not necessarily easier to use legal concepts related to safety management, it is just as easy to refer to safety culture, but it is easier and more correct to use concepts related to safety management, as we often must refer to the legal text. (Interviewee 21).

One interviewee said that the most important aspect of SMS is structure and a systematic approach: you know which documents that apply, have clear roles, follow up and monitor activities and the organization.

When discussing whether the rail sector should implement a separate legal requirement for a good safety culture in the companies, interviewee 23 said that:

This would not add very much, as this already is covered in the existing bits [SMS components]; the concept is like an umbrella. The STA states on its website that the safety culture must be evaluated in audits, and then we require corrective actions, although we do not have resources to evaluate their corrective actions. (Interviewee 23).

Discussing the relationship between safety culture and SMS, Interviewee 22 said that:

Safety culture is more abstract and not as concrete as safety management. Safety management is easier to control. Safety culture is what is not in the documents. It is what you may read between the lines in interviews with employees in a company. Much is the same, but I experience that safety culture is more than what is written. (Interviewee 22).

One of the interviewees said that the most prevalent type of audit that he is involved in is related to the issue of transport permits to new companies. When asked how often companies lose their permit because of insufficient safety management, the interviewee stated that this happens sometimes each year. In the small companies, non-conformities are often related to economy. In the bigger companies, non-conformities are often related to e.g. failure to document or follow up rules, failure to comply with competence requirements.

7.1.3 The assessment of safety culture in audits

As noted, most of the interviewees also said that they focus on safety culture in their inspections, and that they try to evaluate it. This largely occurs indirectly, during SMS inspections. They said that they still are looking for tools that they can use to evaluate safety culture in their (SMS) inspections.

Yes, we talk a lot about it...we try to find an instrument to measure this in the companies, now it is more like a gut feeling; we look for a tool to get it down on paper (Interviewee 23).

Interviewees 22-25 were aware of the STA's official definition of safety culture. They said that this definition, with its seven aspects of safety culture, previously used to be implicit in

their SMS audits, and that they currently try to focus on these safety culture aspects in their audits. This definition is included in strategy documents and manuals describing how to perform audits. Interviewee 22 said that:

We have a model to help us prioritize audits, and then we weigh companies according to different risk factors, and this includes the different aspects of safety culture: reporting, just, learning culture, safety commitment, resources and systematic work. We have used this. We measure the companies based on information from the [human factors] competence center, which write a bit more on each aspect of safety culture. We score them on a scale from 1 to 3 (good-bad). We used to have a scale from 1 to 5, but we found it difficult to calibrate and get a uniform evaluation depending on the inspector, so we added more risk factors, and reduced the scale. This was perceived as better. (Interviewee 22).

Interviewees said that they also have used other safety culture models in their audits (i.e. other than the STA model) for instance the European Railway Agency's (2013) «safety culture maturity model» depicted as a ladder «approach» (which in turn is based on Fleming 2000). Interviewee 24 said that:

We have been trying a bit, we have a [maturity] ladder with different steps to examine whether it is possible to measure the management's responsibility to implement an SMS, for the employees to learn how important safety is. This may lead to more safety thinking and personnel commitment, and then the operative personnel see the use, we have used the maturity ladder in a handful audits. (Interviewee 24).

This maturity model has indicators of maturity for different safety culture aspects. It is important to note that the STA checklist for safety culture also measures «safety culture maturity», as its scores are based on the potential for improvement in each specific area. Thus, assessing safety culture maturity is a central aspect of the safety culture assessment that the interviewees in the rail sector perform:

We focus on indicators of maturity; they give indications of how mature they are. This is based on an overall assessment...a gut feeling. We still look for good criteria to be able to clarify ourselves: «what is good enough?». We must set some criteria to establish a unified level of assessment. We work to develop uniform assessments between inspectors in the audits. (interviewee 25).

As an example, it was mentioned that the CEO of a rail company wanted to personally talk to everybody who had passed stop signals. This may be an example of an operationalization of «manager commitment to safety».

It was mentioned that it is a problem with the different models, originating from different agencies, to find out what to focus on, and that they were uncertain as to whether they should use all of it, or just something.

At the same time, it is important to remember that one interviewee said that he did not evaluate safety culture in his audits, or say that he had strategies on this governing his work. Thus, interview results indicate that the process of evaluating safety culture in the rail sector still is in its early stages and that it does not yet seem to have been implemented from the top level in this sector.

7.1.4 The relationship to the companies

As noted above interviewees said that they see differences between companies' safety cultures, indicating different levels of maturity, especially related to the aspects of reporting and learning culture. Some interviewees mentioned, however, that it may be a big problem to make the companies understand the relevance of safety culture for themselves; that it is

a pedagogical challenge to make them understand that this is not something that they have to do only to «please the authorities». Thus, it seems that organizations' maturity level is crucial in this respect. One interviewee also mentioned that he thought that the safety culture level was higher among the transport companies using the track, compared to the infrastructure provider. The latter group is quite diverse, and it includes all kinds of different actors (Mostly the Swedish Transport Administration (Trafikverket) with 78 %, but also municipalities, private industries and museums). Actors which have their own safety personnel often have a more positive safety culture.

Moreover, Interviewee 22 stated that it is important to adapt their strategies and approach to the type of company that they relate to. When relating to the small companies, for instance, he often takes on a more advisory and less rule-based approach:

We have different strategies, based on who the counterpart is. We try to supervise and inform the smaller companies more than to manage based on rules. They have the same rules as the larger companies, but I find that we take on a somewhat different role towards them. We have arrived at this approach through discussions, but it is not documented in a strategy. We have started to conduct information meetings for the smaller companies throughout the country, where they can ask us questions. It is done to provide them with more support. (Interviewee 22).

When asked about their experiences with using the safety culture concept in audits, interviewee 22 said that these experiences were both good and bad; it is positive to create a dialogue with the companies, but if they were to sanction the companies they would need something more concrete.

We also asked whether interviewees see a relationship between safety cultures and safety performance (incidents, accidents) in the companies. They agreed that there is such a relationship, although the number of accidents fortunately is low in the sector. This makes it however difficult to document such a relationship, especially since a high number of reported incidents may indicate a high safety culture level. Interviewees also suggested that safety performance could be interpreted as maturity level and personnel's' attitudes to learning.

We asked interviewees which factors they believe contribute to a positive safety culture in the companies, and interviewees underlined the importance of managers' signals of the importance of safety, especially related to goal conflicts. In such instances, it is important that the management is clear about the importance of safety over other priorities, and make sure to involve all personnel in this message. Good communication in the companies was also mentioned as a key factor.

7.1.5 Future potential of safety culture as a regulatory concept

Interviewees were asked about possible rule-based and advisory-based strategies that they can apply in further attempts to improve the safety culture of the companies. As noted, all of them were positive to work further with the safety culture concept, although they used it to different extents. Moreover, all of them also seemed to believe that the future would involve a more systematic focus on safety culture. They also saw it as their mandate to work with safety culture. When asked whether it is a good idea to include safety culture as a legal concept governing their audits, they said that it is a good idea, although they also said that their legal audit base already focuses on the content of safety culture through the SMS-requirements. It was also noted that it after all is easier to refer to a legal safety culture provision when conducting audits of safety culture. They also noted that it could be useful to focus on safety culture in accident investigations, but that this activity has been

transferred to the Accident Investigation Board, as the regulating authority also may be subject to investigation.

When asked about more advisory-based strategies, e.g. providing the companies with tools for self-evaluations of their safety culture, interviewees stated that they did this in 2005-2006, but that it did not work out as planned. The reason is related to trust and to the maturity level of the companies: 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», and not in accordance with their own level of compliance. An interviewee suggested that only the big and well-performing companies may benefit from such an approach.

Interviewees said that training of managers and employees in the safety culture concept may be a good idea, although it is important that the authority does not take on too much responsibility for this. The rationale for this was that it is important not to be too concrete, «specifying what the companies should do», as this may lead to legal responsibility in case of accidents.

The same argument was used when interviewees were asked whether it is a good idea to provide real «good examples» of «best practice» describing how companies work with safety culture. Interviewee 22, said that they «could do more» when it comes to influencing the safety culture of companies, but he also pointed to a general dilemma related to taking on a more advisory role.

Additionally, one of the interviewees stressed that it is important to remember that companies are different, depending on their size, history, personnel etc., and that solutions that may work for one company not necessarily are transferrable to other companies. Moreover, one interviewee said that they have considered publishing information about companies' non-conformities as a source of learning for other companies, but the legal department of the authority stated that they should abstain from this, as it could influence competition. If a transport buyer sees such information, they may choose another company, and they may lack the competence to determine the seriousness of the non-conformity. It was concluded that it is difficult to balance such considerations.

7.2 Results from companies

7.2.1 Little explicit use of the safety culture concept

We interviewed four people in the rail sector; three of them were working in safety related managerial positions in rail companies, while a fourth had vast experience with the sector working in a business organization. Interviewees in the rail sector all had a clear understanding of what the safety culture concept means, but they generally asserted that the concept seldom was directly used in their companies, especially not by employees in the «sharp end», e.g. train drivers, shunters. When asked about whether the safety culture term is used in his place of work, Interviewee 26 said, for instance, that:

The term is used, yes. Not in everyday talk, but it is a known subject. Don't think train drivers talk about it, but they have an idea about what it means. (Interviewee 26).

One interviewee said that he searched for the term «safety culture» in the company documents before the interview, and got one hit, describing just treatment of personnel who have made mistakes. He said, however that they would use the concept more in conversations, talking e.g. about how to develop a reporting culture, using aviation as an

example. Similarly, Interviewee 27 said that management may talk about safety culture, but not the train drivers:

[I use the safety culture concept] As a counselor but not as a driver (as I am sometimes). It is not the term that is a problem. We think of it at a high level in the company, but we are bad at taking it down to those who are out on the railroad. (Interviewee 27).

Interviewees underlined that they focus on the essence or the key aspects of safety culture, although the wording that they use is different. Interviewee 29 said that they nevertheless talk about safety culture indirectly in the company, although they do not use the concept:

I believe that we are talking about safety culture, although we use [other] common concepts instead of «safety culture», but we have an understanding of it. I can't say that we talk specifically about it (Interviewee 29).

When asked what safety culture means, Interviewee 27 said for instance that:

It means that all roles at all levels know about the risks associated with what they are doing, what to do to avoid it, what they need to do to contribute to a safe work environment, and to take into account the role of other actors. (Interviewee 27).

This understanding of safety culture is very similar to some of the key elements of SMS; clearly defined roles, risk assessments and countermeasures. We will elaborate on that below. Additionally, interviewees also stressed that tradition is important in the rail sector, and that they have a strong safety tradition in railways:

Tradition is very important. There is a big safety tradition in railways and it is important, but it must be supported by new activities and new work, and that is a challenge. There is an understanding of «safety first», it applies in the production organs, but probably not throughout all branches of the organization. (Interviewee 26).

7.2.2 All companies have safety management systems

We also asked interviewees whether their companies have any strategies or procedures related to safety culture. They generally answered no, but in line with interviewees from air and sea, one of them mentioned that their SMS focus on e.g. reporting and learning:

We do not have a specific document on safety culture, but we have our safety policy that says things about reporting and learning from it, and to choose a safer way where there is a choice between a more and less safe way. (Interviewee 26).

This illustrates that the rail sector to some extent also have SMS features (and requirements) indirectly concerning safety culture.

All interviewees said that their companies have safety management systems, and this is required by law of all rail companies in Sweden and in other EU and EEA countries. Interviewee 29 noted, however, that the regulatory authorities in the Scandinavian countries have different interpretations of these requirements. Based on what the interviewees told about their experiences with their own SMS, it seems that the quality of these systems varied. Interviewee 29 said for instance that his company has a long tradition for SMS, which also is positive for safety culture. Additionally, one of the interviewees said that he believed that the SMS of small companies largely were of poorer quality than those of larger companies. Likewise, Interviewee 27 reported positive experiences with their SMS. When we asked about the most important strategy that the company used to control hazards, Interviewee 27 answered: training, routines, procedures, risk assessments and technology. All factors except the latter are key aspects of SMS.

7.2.3 Management commitment to safety

Interviewees' views were mixed when discussing management commitment to safety. Most of them said that management did not always indicate that safety is more important than economy, stating e.g. «If you ask them, they would say so, but in action they would show otherwise». In a similar vein, Interviewee 27 said that management may say that safety comes first, but that this is more at the policy level. At the practical level, the «money decides». This interviewee also said that they had few examples of employees being rewarded for choosing safety over efficiency in their company. Interviewee 28 said:

I can't imagine any management high up ever saying profit is more important than safety, but we can tell at times they try to maximize time efficiency, which can in our opinion lead to less safety. When you get more stress or less downtime in your schedule, it threatens the safety mindset. But it is the nature of the private business. It's not done with purpose, to maximize profit over safety, but it's a natural conflict of sorts. (Interviewee 28).

Interviewee 29 reported of a different situation in their company, stating that there had been important changes in his company, favouring safety:

Changes have occurred over the past 15 years, [which indicate] an improvement in this: 'safety before punctuality'. The Board of Directors has also stated this. Fifteen years ago, it was not so clearly signaled. Now you talk about it at all levels of management. (Interviewee 29).

7.2.4 Employee involvement

We also asked whether interviewees think that there is a high level of trust between managers and employees, and views were also mixed on this issue. Interviewee 26 said that the level of trust to the nearest boss is good, but that the main office is too distant. Interviewee 27 said that the level of trust could be better, and that it perhaps is different in state-owned companies. Interviewee 29 noted that the level of trust between managers and employees generally is good, but that it may vary depending on the departments.

Interviewees were asked whether they assert that management always involve employees sufficiently in safety questions. Interviewee 26 answered «to a certain extent, but not enough». He said that they use the following channels to communicate with the employees: presentations 2-3 times a year, local meetings that are held annually, a paper that comes out 3-4 times each year, where they write about safety, accidents and near misses, describing openly (but anonymously) and in detail what happened and what caused it. Interviewee 27 said that:

Management involves employees who are intermediaries in the organization, for example the training center manager, the head of the vehicle, the head of production, but not the drivers. Because of this, management does not see how it really is. (Interviewee 27).

This interviewee also said that it is a problem that much of the safety relevant experiences of the train drivers are not registered or incorporated in their SMS (e.g. «Synergi», which is a system for reporting of accidents and near-misses).

SMS-involvement is a crucial aspect of employee involvement. When we asked interviewees whether employees were familiar with the SMS and used it in their daily work practice, interviewees generally acknowledged that this is a challenge, and their views were mixed. Interviewee 27 said that the train drivers are not familiar with the documentation in the SMS, although they are familiar with how things should be done in the company.

For example, we have documents stating that personnel should be trained, have knowledge tests; we have nice documentation about this, but when I go out and talk to people, and ask practical questions, they know how it is done, but they do not know what's going on in the documentation. (Interviewee 27).

This view indicates a certain discrepancy between the formal (SMS-documentation) aspects of safety and the informal aspects (e.g. safety culture, work practice). Discussing this, interviewee 26 held that «Staff knows a bit about SMS» and that they inform by education about the SMS. Interviewee 29 contended that SMS-familiarity had increased substantially in recent years. Interviewee 28 held the view that level of SMS familiarity among employees was relatively good in the rail companies.

One of the companies had a group-based safety behavior observation scheme, which also provides an example of a possible way of involving employees in safety work:

We are trying to work with safety behavior, and have a project with a consultant [which means that employees] observe their self and their colleagues in their local groups, and by their own actions develop a safer system. They focus on a theme, get it right, and then go on to the next theme. In some places it goes well, in others it does not. Staff engagement is the main reason why things go well, if staff get interested in things going better, then they see results. They see a connection between what they do and the results. (Interviewee 26).

The most important aspect of employee involvement in the companies of the interviewees is, however, related to (lacking) follow up of their reports of incidents and safety issues. We expand on this below.

7.2.5 Reporting and learning culture

All companies have reporting systems that are used actively by the employees, although interviewees indicated different reporting rates in their companies. Interviewee 26 asserted that they have a high level of reporting of serious incidents in his organization, but he emphasized that reporting of near misses and safety issues was too low:

Reporting of accidents and serious incidents – we have a high level of reporting. Seldom that such [accidents and serious incidents] events are not reported, but when it comes to near misses, and when things are not the way they should be [e.g. latent conditions] – such reporting probably happens less than it should. People think if I report the latter, nothing will be done. (Interviewee 26).

Interviewee 27 said that the reporting level was too low in the company. When asked about the reporting rate in the company, Interviewee 27 said:

In far too little extent. I know how it is for the train drivers, I know that many train drivers do not get feedback about what they report (.) This means that they stop reporting some things. (...) it's a good reporting culture, but poor feedback culture [i.e. train drivers do not get feedback about what has been reported]. This is due to the fact that they [the company] do not have routines for it, do not have personnel /resource for it. (Interviewee 27).

This illustrates a general challenge highlighted by all interviewees: Employees reporting incidents or safety issues seldom see the results of their reports, e.g. corrective measures implemented, feedback on statistics etc. Interviewees asserted that this could be negative to employees' motivation for reporting, and subsequently hamper a high reporting level.

Interviewee 29 said that:

We have a problem with feedback, we are not skilled enough. If a train driver reports something to the nearest boss, it may not be reported further, or feedback may not

be given to the train drivers. It is probably the most serious issues that are reported to the greatest extent now, minor problems are not always reported enough because of lacking feedback (Interviewee 29).

It seems that a consequence of lacking feedback on reports is that safety issues and near misses and incidents are not reported. All interviewees said that their companies register reported incidents and safety statistics in «Synergi». There still seems, however, to be a considerable potential for organisational learning in the rail companies of the interviewees, by also including the less serious incidents and the safety issues.

Interviewee 26 also mentioned that it is likely that the way they report may impede a high reporting rate in his company:

It has also to do with the way we report. Traditionally paper and pen, we have moved to e-reports, but it isn't easier, it can be complicated as well. This may put people off reporting. And if it's not possible to report on the spot...you have to report when you have finished for the day, or come to a place when you have to log on to a computer. [That puts people off reporting] (Interviewee 26).

Another interviewee said that train drivers may access the reporting system (Synergi) on iPads, but that it nevertheless is only used to report major incidents.

To sum up, interviewees mentioned four factors that may negatively affect the reporting level in their organisations: 1) nothing happens (with e.g. latent conditions), 2) employees do not see results, 3) it may be complicated, and 4) it is not possible to report on the spot.

7.2.6 The relationship with the regulatory authorities

Some of the interviewees 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). This was also mentioned as a backdrop to explaining the safety focus in the sector. Interviewee 26 said for instance that:

It is a big change to a railway from the railway of yesterday. [A big change happened] in Sweden in 1988 and in Europe in 2004! When you had the former organisations cut up in pieces more to get a profit from the railway...before that it was safety first thinking...that was a change of focus. People who became executives [carried with them] the tradition [of safety from before the changes], but today they come from another world, they think it's like driving trucks on the road, people can operate independently of the rest of the system as long as they follow the rules of the authorities. (Interviewee 26).

Interviewee 29 noted that as the sector had been split up in many different units, there is no longer anyone maintaining a central overview of the system:

A concern with my many years of perspective is that management of the entire rail system does not necessarily work better now than before. No one has a function to manage the entire system anymore. Changes in traffic, outsourcing, etc. have made this worse. It is bad for the interfaces between e.g. the train brakes and the signal system, we need to manage the various parts of the railway in a systemic perspective. (Interviewee 29).

Discussing their relationship with regulating authorities, interviewees were generally more satisfied with Danish regulating authorities than with Swedish authorities:

(...) we believe that the Danish authority is at the best level. The Swedish Transport Agency manage quite badly. They have too few resources for inspection. There are too few inspections in our business. The Norwegian authority is a bit in between;

quite detailed, and can take a long time. The Swedish Transport Agency could learn something from the others. (Interviewee 29).

In accordance with this view, interviewee 27 said that their company had very good contact with inspecting authorities in all countries except Sweden:

[We have] Very good contact with inspecting authorities in all countries except Sweden. In Sweden, there are many companies operating, and [there is] a complicated infrastructure (e.g. shifting trains that are private and not belonging to the national network). It is difficult for the Transport Agency to face this complexity with relatively small resources, for example, to check that all operators are acting rightly towards the infrastructure. (Interviewee 27).

Both interviewee 27 and 29 referred to the lacking resources of the STA to explain their relationship. Interviewee 1 said that their company would like more visits from the STA:

Communication is good. (...) We see big differences with respect to authorities. I think we don't have enough contact, it's too seldom. In Sweden we suffer from our history, authorities visit our smaller, newer colleagues [more often] than they do us (they think it's ok with us), but we need visits too. We need the authorities to support us. (Interviewee 26).

7.2.7 Views on potential future strategies to regulate safety culture

To sum up, interviewees said that they focus little on safety culture and do largely not use the concept. They generally said that regulatory authorities also tend to lack focus on safety culture, nor the legislation governing their operations. Interviewee 29 said that regulating authorities mention safety culture, but that there is no material which directly supports this. We asked interviewees whether they think that they would have had a stronger safety culture focus if safety culture had been requested by the legislation, and/or the regulating authorities, e.g. by introducing a legal «safety culture requirement» Interviewee 26 underlined that such a focus nevertheless must come from within the organization:

Tricky question, what is...I'm not sure more regulation does the trick, this has to come from inside if it's going to work otherwise it is like pretending, it has to grow [from inside the organization]. I think we are on the way. (...) it has to come from inside the company, from the employees, we must make it easy for them to think and act in this way. It will be never finished; it will go on forever. (Interviewee 26).

Interviewees were positive to measures increasing the focus on safety in the sector, but they were generally a bit skeptical to introduce new regulations focusing on safety culture based on the argument that the STA has too few resources for inspections today. We also asked interviewees what they thought about the rule-based regulatory strategy of auditing safety culture. Interviewee 26 found this to be a more promising strategy, asserting that it is realistic and that it would not necessarily be very resource demanding. The same applies to Interviewee 27, but both Interviewee 27 and 28 were a bit skeptical about the possibilities of measuring safety culture:

First, we need to determine what safety culture is: should it be ISO-certification or what, certain routines maybe? This is the tough nut to crack. If you can do this, then it would be possible to do inspections. How do you specify what safety culture is, and what do you need to do to reach safety culture status; this must come before inspections are possible. (Interviewee 28).

When asked about the regulatory strategy of using the safety culture concept in accident investigations, interviewee 26 said that this would be very good, but that the concept would have to be clarified for people who do not think «in this way». Interviewee 27 was

uncertain as to whether focusing on safety would lead to increased safety after the investigations. Interviewee 28 asserted that the safety culture aspect was covered in accident investigations by using other terms. Interviewee 29 argued that they probably lack the resources, education and quality in their internal investigation teams to do this.

Interviewees were also asked about advisory-based strategies, and Interviewee 26 found that providing companies with the opportunity for self-assessment was a good idea. Interviewee 27 noted that this would be very resource demanding, and not necessarily lead to a higher safety level. Interviewee 29 said that providing companies with the opportunity for self-assessment and self-development would be very good measures for small companies.

When asked about the regulatory strategy of providing knowledge about how safety culture is created and recreated, Interviewee 26 said that it is important that regulators are careful when considering such strategies, as they have to be compatible with the actions the companies themselves take: «If we are on the right path by ourselves, we don't want something to [interfere with or] destroy that.» Interviewee 27 mentioned that this could lead to increased safety, that it probably would not be very resource demanding and that it also would be realistic. Interviewee 28 was also skeptical to the level of resources required for this. Interviewee 29 asserted that the STA perhaps was too far from the companies to understand their reality, and suggested that the train operator union would be better suited for this task.

We also asked about the strategy of providing real and good examples of safety culture measures in companies. All interviewees found this to be a good idea. Interviewee 26 stated that «If we take SMS and safety culture, there isn't much difference between these two.» Interviewee 27 found this to be a very good idea. Interviewee 26 also said that they draw on experiences from other sectors in their safety work, e.g. in their efforts to improve their reporting systems:

We often talk about the air business as a good example of reporting and so on when we do our campaigns to get reporting done. We have had meetings with people from air, and afterwards have visited the chemical industries and talked to them.... And this was the way we got to the project about getting people to handle safety on their own a bit. Airlines are good at reporting, handling reports. Chemical industry is a little more like us in terms of risk levels and the risk of...it's possible that a person makes mistakes that nobody else can see and it's important we get to that person in some way. (Interviewee 26).

The final regulatory strategy that we discussed with the interviewees was providing education about safety culture to managers and employees in the rail companies. Interviewee 26 said that this could help, but he thought that it could be difficult to achieve, as the authority inspectors are very busy, and that time spent on inspections etc. would be more needed than training. Interviewee 27 was positive to this strategy, but noted that it should not be used if it would be costly. Interviewee 28 was skeptical to all the measures because of the resources required, but noted that this measure: «(...) is most important because in that you can really focus on what is important and how to do it in this workplace.»

7.3 Summing up

Results indicate a considerable contrast between the authority's and the companies' awareness of safety culture. All but one of the authority interviewees in the rail sector said that they systematically use the safety culture concept 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. In connection with this, a review from the STA's «Human Factors Competence Centre» showed that safety culture was indirectly covered in the sector's SMS requirements, and that a focus on safety culture in audits was legally justified.

Most authority interviewees in rail were aware of the STA's official definition of safety culture, with its seven aspects of safety culture. They said that it previously used to be implicit in their SMS audits, and that they currently try to focus on these safety culture aspects in their audits. This definition is included in strategy documents and manuals describing how to perform audits. They said that they focus on safety culture in their inspections, and that they try to evaluate it, e.g. in the model which is to help them prioritize audits, weighing companies according to different risk factors, including the different aspects of safety culture (reporting culture, just culture, learning culture, safety commitment, resources and systematic work.) They use a scale from 1 to 3 (good-bad). They said that they still are looking for tools that they can use to evaluate safety culture in their (SMS) inspections, and that they also have used other safety culture model in their audits, e.g. the European Railway Agency's «safety culture maturity model» (ERA 2013), based on Fleming (2000).

Authority interviewees said that they see differences between companies' safety cultures, indicating different levels of maturity, especially related to the aspects of reporting and learning culture. Some mentioned, however, that it may be a big challenge to make the companies understand the relevance of safety culture for themselves.

Company interviewees 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). One of them worried that that as the sector had been split up in many different units, there is no longer anyone maintaining a central overview of the system. Discussing their relationship with regulating authorities, interviewees were generally more satisfied with Danish regulating authorities than with Swedish authorities. One of the interviewees complained about infrequent visits from the authority.

The rail companies mainly work with safety culture indirectly, by maintaining their SMS, but they do largely not use the concept. Like the maritime sector, the rail sector also had potential challenges related to employee involvement, indicated by the fact that interviewees asserted that employees who reported incidents seldom saw the results of their reports, and that this could impede their will to report, and subsequently impede the reporting culture in the company.

8 Results from the road sector

8.1 Results from the authority

8.1.1 Risk-based inspections based on police reports

It is important to emphasize that the results here apply to the regulation of professional road traffic, and that they cannot automatically be transferred to other road traffic inspection areas, such as e.g. the inspection of training, vehicles or infrastructure. The STA regulation of professional road traffic has special conditions, e.g. as it primarily involves desktop inspections, which does not apply to other inspection areas.

The authority interviewees in the road sector are involved in rule-based inspections of professional goods and passenger transport. The EU-provision 1071/2009 regulates passenger transport (bus, taxi), which describes companies' credibility related to economy and safety, equal conditions of competition, ensuring that they are not unsafe in traffic and that the companies have a person who is responsible for traffic safety. Additionally, there are EU-rules governing the «social dimension», e.g. the common European rules on drivers' hours, and a good work situation. Interviewees are involved in regulation related to the transport permits of companies, and when transport companies apply for transport permits, they must document that they fulfil these criteria.

Interviewees conduct risk-based regulation. This work is to a great extent dependent on police reports on driver violations in the companies. Interviewee 30 said that:

We are dependent on the work of the police, and they have gotten far less resources in the recent, which negatively influences our work. We should have had indications from other sources to in order to create a picture of what we should focus on.

(Interviewee 30).

Interviewees in the road sector conduct most of their regulatory tasks from their offices. They do not conduct their own roadside inspections, and depend therefore on police-reports with information about drivers and companies involved in traffic offenses. Interviewees have experienced a decrease in police reports in recent years. Some of them suggested that this could be to reduced police resources, while others were less certain. The former interviewees argued in favour of increased resources to the police.

In the goods transport sector, the risk-based selection of companies is based on police reports on repeated violations by the drivers in companies, e.g. relating to the driver's hours legislations, poor technical vehicle condition, poorly secured cargo, other criminal offences, problems related to debt collectors, sexual offences and violence offences. Based on these reports, interviewees make an assessment to consider whether there is reason to believe that the companies violate the principle of safeguarding traffic safety. Interviewee 34 described how they apply their risk-based inspection strategy:

In the case of inspection with driver's hours compliance, we gather data files from goods and bus transport to check compliance with the rules. We supplement this with information from police road side controls, tips from the public, and as a result of this, a risk value is ascribed to the company. Based on this risk value, we require documentation from the company. The companies' risk scores reflect the number of

certain kinds of violations, previous controls, the number of vehicles. (Interviewee 34).

Based on the risk values ascribed to the companies by regulators based on different sources of information, regulators contact the companies to get information about how they work with safety management. Then it is up to the company to describe how they have worked with the problem, and what they to do improve the situation. One of the interviewees said that:

We try to open up for safety thinking in the goods sector; we follow up the goods transporters to see how the companies follow up safety, procedures, drivers' competence and so on. If companies can describe and show how they work with safety culture, even though they previously have been involved in many violations; they may get the opportunity to fix their own systems to keep their transport permit. (Interviewee 30).

Interviewees said, however, that they do not have a systematic way or method of approaching the companies that they audit. What they do seem to be dependent on the character and content of the violations:

The assessment of the safety work that companies must provide is dependent on what the violations are, and there is made an assessment each time. This work should be more systematic, there is a lot of uncertainty now, as separate judgments are done, instead of systematic and uniform judgments across companies. (Interviewee 31).

In addition, they also noted that they lack a clear strategy for doing follow-up checks of whether the companies actually had done what they said that they were going to do, to avoid losing their transport permits.

Interviewees stressed that they are currently are developing their risk assessment approach further, to improve their abilities to target companies with many violations.

Interviewees also audit companies' compliance with the rules on working hours. This is done by asking the companies to send information about their driving and working hours (i.e. not by visiting the companies). The methods and the sanctions used in these audits are less strict than the audits of driver's hours compliance.

8.1.2 Little focus on safety culture and organizational factors

The interviewees 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. Instead they use the concepts «traffic safety» in goods transport and «passenger safety» in taxi and bus transport. These concepts are derived from the legislation that the interviewees base their inspections on. When asked why they think that there is little focus on safety culture in the road sector, one of the interviewees stated that the driver's hour rules are strongly regulated in the EU-legislation, and that the STA recently took over responsibility for auditing drivers' compliance with these rules. It was also mentioned that there are thousands of small companies with less resources in the road sector. In rail and aviation, on the other hand, there is a small number of large companies, which work in a totally different manner with safety culture.

When asked about focusing more on safety culture, interviewees from the road sector underlined the importance of equal conditions for competition in all EU-countries. When asked about possibilities for increasing requirements to companies, interviewee 30 said that:

The problem is that there is a golden rim on the EU-legislation; and that we would not fulfil the requirement to neutral competition. We are supposed to facilitate neutral competition and free flow of goods across countries and mobility. Sweden is

quite strict compared to other EU-member countries, but if we are stricter than Denmark, a lot of companies will settle there instead of in Sweden. And that violates the intention of a free market according to EU-law. (Interviewee 30).

Interviewees suggested, however, that it would be interesting and useful for them to focus more on organizational safety management and safety culture, if the rules governing their audits had allowed them to do that. It was mentioned that the Swedish Work Environment Authority is responsible for auditing issues related to working environment in the road transport sector. However, as some working environment issues also may influence traffic safety, e.g. driver time pressure and stress, the STA may also focus on this in their inspections. Perhaps this may indicate an area of further cooperation to shed light on such factors.

Moreover, it was mentioned that although certification schemes for organizational safety management and safety culture, like the ISO:39001, seem promising, national authorities cannot recommend such schemes without violating the principle of equal competition between hauliers in all EU countries. When discussing differences with other sectors, interviewees noted that the legislation for aviation and the maritime sector is different; involving a stronger focus on SMS and safety culture. They also said that it is more difficult to focus on issues like this in the road sector, as there are far more small companies in the road sector compared with the other transport sectors. Interviewee 34 and 35 said, however, that it would be very interesting to focus more on the companies and organizational factors in their inspections, like they do in other transport sectors. They said, however, that it could be difficult to do this in practice, as the current legislation does not focus on this.

Discussing the culture in the sector, interviewee 35 said that there does not seem to be a strong enough culture of «saying no». Some drivers want to work a lot, especially in the beginning of the week, to be able to take the weekend off. Their managers often comply with their wishes. When authorities identify violations in their inspections of driver's hours and working hours, the managers say: «we trust the drivers». So, the companies put a lot of responsibility on the drivers; they are very independent.

8.1.3 The relationship with the companies

When asked whether they observe different safety culture in the companies, interviewee 35 said that they perceive big differences between the companies' safety cultures, e.g. based on their size and preconditions for working with safety. The bigger companies for instance often have their own personnel dedicated to safety. They also mentioned that they see differences between the cultures within organizations. When describing how they get the impression of a company's safety culture, Interviewee 35 said that:

It is hard to put the finger on it, it is a feeling, but you notice it based on the companies or the managers' commitment, and what kind of measures they implement. A lot of the companies implement many different measures, at many different levels. This is about creating new routines, educating and informing the drivers (...). But there are no checklists for the informal [i.e. culture], and we do not have a checklist for the formal either. (Interviewee 35).

This interviewee said that it would be very interesting to supplement their desk-based audits of formal safety aspects with company visits to get an impression of informal aspects of safety, to «see how it looks» in the companies. There is, however, a question of resources.

Discussing the formal and informal aspects of safety further, Interviewee 35 underlined the importance of safety culture further by saying that even though the formal papers and the

systems of companies may be in order, they may be used in the wrong way. This is an argument for also focusing on how companies actually work with safety, focusing on the informal aspects of safety which we describe as safety culture.

Some of the 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. Interviewee 30 said that:

Historically, there have been prejudices between the STA and the business associations, but it is better now. We have a department in our organization working actively to develop trust in this relationship, to give and take from each other. We are politically managed, and we may end up with following up cases that the market thinks bad of. We are more in favour of a cooperative relationship. (Interviewee 30).

This relationship was also mentioned when we discussed possible new extra requirements for organizational safety management in road sector companies. Interviewees stated that introducing new requirements could be detrimental to their relationship with the companies. It is important to note that the interviewees had somewhat different views on their relationship with the companies. An interviewee who had chosen an audit approach focusing less on sanctions did not find the relationship with the companies to be strained. It was mentioned that the companies trust the authority, report their challenges in an open and honest way, and they appreciate that they get a second chance to improve themselves. Interviewees stressed that they do not have an advisory role vis-à-vis the companies. Another interviewee, who audited driver's hours compliance said on the other hand, that he found that companies perceived the authority as strict, relating it to the fact that companies' chances of avoiding sanctions were smaller.

The issue of trust between regulators and the regulated has been a recurring theme in the interviews from all the sectors. When talking about this, interviewees contrasted their relationship with the companies to the relationship between the regulators and the regulated in the rail sector stating that:

The rail companies felt that it was useful to cooperate with the STA, without feeling that they just got an index finger and a scolding. This was appealing and inspirational for the road sector. That the companies got something from us too.

As in the other sectors, interviewees were reluctant to give too concrete advice to the companies. Interviewee 35 said that: «Sometimes they ask us what they should do, and then we answer that you should do what is best for your company, in your unique situation.» The interviewees said that many companies nevertheless implement quite similar measures, related to technology, information, training and control. Some companies have ideas that they may be unable to get down on paper; then you have to get out of them what they want to say.

Some [companies] have problems expressing it on paper; to document. Then we must find out: «what is it that they want to say?». [similarly] If they have written something, we must try to find out «what do you mean?», in addition to what they have written. This is about trying to develop their answers. A lot of time is spent on this. It is the most rewarding part of the job; to have that contact with the company. It would be interesting to visit the company also, and not just do this from behind a desk, but it requires more resources. (Interviewee 35).

This interviewee said that the most interesting part of the job is the contact with the companies, hearing how they think and resonate.

8.1.4 More focus on safety culture in the future?

When asked whether they would like to focus on safety culture in their inspections, interviewees were positive, but they mentioned several obstacles for doing so. Interviewee 30 mentioned for instance the number of companies in the road sector and that it would require too much resources:

We would like to bring it along, but it is partly not given political priority, and it is too resource demanding. We have several thousands of companies to relate to, and we do not control the vehicle park, as other transport branches do. (...) We would like to work more on road traffic safety, but the resource of the police has been reduced, and we get less reports from them than we used to. (Interviewee 30).

Interviewees also mentioned additional obstacles, like the size of the companies, the principle of equal competition in the EU, lacking political focus, views on their role as a rule-based authority, and that it is the role of the business associations to engage in activities that we previously have described as advisory-based regulation (e.g. providing information and advice.). We expand more on these factors in the following.

8.1.5 Differences with other transport sectors: Maturity level and trust

When discussing the potential for more focus on safety culture in the road sector audits, the interviewer suggested that the other transport sectors focus on SMS (and safety culture), as the laws for these sectors focus on SMS. Interviewee 30-32 agreed with this view. They also mentioned that the number of actors is lower in other sectors:

In aviation there are not as many actors as in the road sector. And there is a longer tradition with safety in these sector; the legislation says that they shall inspect vessels and not just audit from their offices like we do. (Interviewee 30).

The interviewees from the road sector are involved in rule-based regulation. In the previous sections, we have seen that function-based regulation involves a high degree of maturity and trust between the regulated and the regulator, as self-regulation is an important part of the function-based regulations. Discussing this, interviewees said that:

In the rail sector they work more with controlling the companies' controls of their own companies. I don't know if that could have work in the road sector. We have rule-compliance in focus, both with taxi and goods. We take the legislation as our point of departure. But it could perhaps be possible to get more such features into our audits, but I have not heard anyone talk like that with us. Our resources must be used in the right manner, so the companies should do more themselves. I believe it may go that way, but I do not know what it would look like.

Another interviewee said that the function-based approach in the rail sector, which to a larger extent would mean that companies shall describe for the authorities how they work with safety, is appealing.¹⁰ He said that they use features of this approach themselves, but not in a systematic manner, as the number of companies and the size of the companies make it difficult. We discussed the potential for self-regulation in the road sector, and what to do with companies who «just pretend» in a trust-based system. One of the interviewees stressed that, with their current rule-based approach:

(...) we do re-inspections, then we can issue fines in case of repeated violations. It is important to also have «sharp tools in the toolbox» [i.e. sanctions]. But I see it as a

¹⁰ It must be noted that the interviews from the rail sector indicates that although this sector has functional SMS rules, the extent of «pure» of «full» self-regulation in companies is limited, meaning that the authorities do inspect SMS implementation and use in the companies.

failure when we have to apply the sharp tools. We look at violations, then we give the companies the opportunities to do something about the observed non-conformities, and then we look for violations again. In these inspections [both the first and the second], we only look at a sample of drivers, but the measures will apply to all drivers in the company. This gives a big effect based on a little effort. (Interviewee 35).

8.1.6 The role of the business associations

Discussing the extent to which the role of the authorities involves giving advice, the interviewees from the road sector said that it is the role of the business associations to be an advisor and a consultant for the companies. Thus, it seems that the distribution of responsibilities in the road sector involves that the authorities work through a (detailed) rule-based approach, while the business associations are involved in what we in other sectors refer to as an advisory-based approach; providing information, supervising etc. This corresponds with the fact that authorities do not apply a function-based approach to the professional road sector:

The business associations work that way, by giving advice to the companies about how to work with safety to avoid falling behind. It is their role to spread knowledge to the companies. I think that we put that ball with the companies themselves, and we have a discussion about this with the business, and sit down and discuss different aspects of safety, but it is up to them how they want to solve the tasks within the confinements of the law. (Interviewee 30).

This indicates the role and the importance of the business associations in the road sector when it comes to developing new approaches, e.g. related to organizational safety management. In conclusion, the interviewees are reluctant to introduce new requirements and measures to the companies, as this would violate the principle of neutral competition, and as they would avoid straining a previously difficult relationship. Given this context, and the fact that the authorities see it as the role of the business associations to spread knowledge and give advice, it seems that introducing and implementing the safety culture perspective in road transport would fall in under the role of the business associations. Interviewees also argued along these lines when we discussed ISO:39001.

An ISO:39001 requirement to [Swedish] companies would violate the principle of equal competition across EU. And because of the resources needed, it is hard to make it a priority for companies. It could be less relevant if it were less resource demanding. We have not gotten any political indications that such safety certification is something that the companies shall have, and that we shall follow it up, but it is left to the business associations. (Interviewee 31).

8.2 Results from companies

8.2.1 Little direct use of the safety culture concept in the road sector

We interviewed five people in the road sector; one of them had vast experience with both the goods and bus transport sector after several years working in business organizations, two other interviewees worked as safety managers in bus companies, one was a manager in the goods transport sector and the fifth had vast experience with traffic safety in Sweden, including transport companies' safety work.

One interviewee said that there are about 10 000 road transport companies in Sweden, and that 700 of these are in the bus sector. He also mentioned that the haulier sector is 4-5

times bigger than bus when it comes to annual revenue. There are 4-5 very large bus companies in Sweden. There are no such large companies in the haulier sector. Thus, if we compare the number of ISO:39001 certified companies in bus and haulier transport, it is important to remember company size and the number of vehicles in the certified companies. It was noted that the traffic safety impact is bigger when a company with several thousand employees and vehicles is certified, compared to when a smaller company with fewer drivers/vehicles is certified.

Interviewees in the road sector had a clear understanding of what the safety culture concept means, but generally asserted that the concept seldom was directly used in their companies. Interviewee 36 said that the bus sector has a good safety culture, although the concept not is used. He said that they use concepts like «safety thinking» instead, which generally has the same meaning:

You don't talk about safety culture, you don't use that word, but you are working a lot with safety culture issues; You work a lot with safety thinking in the bus sector. It is a very good level in the bus sector, because you are transporting people in the buses, and you are close to the bus passengers; maybe 50 people in the bus. And the behavior of the driver is very visible to everyone: close contact, and passengers quickly notice if he radiates safety and confidence, and the customers are very capable of telling what they mean. Therefore, it is important for bus companies that it is perceived as safe to go by bus. And it is for sure, but the [passengers'] experienced risk perception is key: It is important to the enterprises, or else they exit the market. Reputation. (Interviewee 36).

The interviewees highlighted that safety is very important for bus companies, as passengers will not go by bus if they perceive it as unsafe. Bus passengers see everything that the bus drivers do. Interviewees also underlined that their companies therefore are very keen on emphasizing that their drivers are their public faces, and that they are key to passengers' risk perceptions and impressions of the companies. In line with this, Interviewee 39, from the goods transport sector, said that he believed the safety level (and requirements) to be somewhat higher in the passenger transport sector than in goods, as «it is easier to accept damaged goods than personal injuries». Discussing passenger risk perception, interviewees mentioned a recent accident in Sveg. Passengers' lacking seat belt use is a major safety concern in the companies of the interviewees, especially after this accident. Interviewee 37 said that the bus sector has been subject to increased inspections after this accident

Interviewee 37 similarly said that they do not talk about culture in his company, but that the elements of safety culture are part of the job. Interviewee 38 said that the safety culture concept is used in his organization, but probably only in management. He said, however, that drivers may talk about their safety principles, their policies and their SMS. Talking about his experiences with using the safety culture concept, Interviewee 38 said that it is a general concept, and that it is important to focus on the details and the indicators, i.e. focus on the more specific aspects of safety culture. Interviewee 39 and 40 also contended that the safety culture concept seldom is used directly in the road sector, and that people rather refer to traffic safety. Interviewee 40, contended that, compared with the other transport sectors' focus on safety culture (e.g. aviation, maritime), the safety culture level in the road sector is low.

Interviewee 38 also mentioned that his company focuses on «safety principles» and that they choose one for each month for everybody in the company to focus on. They currently focus on the safety principle «You are responsible for your safety and the safety of other people». The company uses movies and information letters to communicate with personnel about this. This is an example of an important way of working with safety culture in the

company. He referred to safety culture as the «soul of the company», involving that everybody is professional, committed to safety and proactive all the time.

8.2.2 Focus on the driver in the road sector

There is a special focus on the driver (or the transport operator) in the road sector, which is in contrast to the other transport sectors, which focus more on the organizational context surrounding the transport operator, e.g. procedures, routines and organizational training. Interviewees stressed the individual responsibility of the driver, in both goods and passenger transport:

It is the driver who has the responsibility. He sits on the bus, sees the bus and finds out and reports to traffic management. And on long journeys we make special safety checks, but the driver does this continuously every day. Special safety checks are described in protocol: fire extinguisher, emergency shutters, etc. You must check that all technical work is in place. (Interviewee 36).

Interviewee 38 also contrasted the situation in the road sector with that in rail and sea:

There are differences between the sectors with respect to safety culture. [I have] worked almost 20 years - on the rail side, the structure is clearer, and the legal space is more pronounced against the company. The same applies to the sea. The bus side is more focused on the individual bus driver's responsibility. We focus on learning from what's good in rail and taking it to bus, especially the methods of investigating accidents etc. In case of bus accidents, it becomes a police case and punishment. (Interviewee 38).

According to a Norwegian study (Elvebakk et al 2017), the special focus on the driver in the road sector is related to the legal framework in the road sector. Although professional drivers' organizational preconditions for safety are governed in the Work Environment Act in Norway, this law is seldom enforced by the police. The Road Traffic Act ascribing responsibility to the driver, is on the other hand enforced, both for private and professional drivers. In the other transport sectors, e.g. the maritime sector, the legal framework (Ship Safety Act) focuses more on the organizational context of the captain, and not his/her individual legal responsibility, as in the road sector.

8.2.3 Safety management systems varying in scope

Interviewee 38 works in a large bus company. He said that the bus company actually applies the same SMS in bus transport as they use in rail transport:

We have an SMS in rail, we have the same on the bus side, [it is] the same we have in the internal audit system. We try to have the same for bus as we have for train. Managers are supposed to be educated in this, and SMS is updated once a year. If something happens, we will issue a safety message, which says that SMS should be rewritten or changed: [it must be] updated: what has happened and how; should we change... much has focused on drivers, and if they use mobile phones. (Interviewee 38).

Interviewee 38 also mentioned that the company was certified according to ISO standards 9001 and 14001, which are quality and environment management systems. He said that the company's SMS, including the policies and the safety culture is part of the education and training of the drivers, contending that the drivers are familiar with the SMS.

The scope of the SMS in the company of Interviewee 38 seems to be exceptional in the road sector; and it is similar to those found in other transport sectors. Interviewee 37, on the other hand, stated that they do not have an SMS of a similar scope:

We do not have a safety policy, but a quality policy, which says that we shall fulfil the demands of the customers and the authorities (Interviewee 37).

Interviewee 39 from the goods sector also, said that his company does not have an SMS, but that they have routines and agreements with the drivers regarding reporting of vehicle deficiencies, parking of vehicles and how to treat special types of goods.

Discussing what SMS in bus companies typically include, Interviewee 36 said that there are a lot of traffic safety policies in a typical bus company, e.g. related to mobile phone use, crisis management:

(...) work environment policy is also (required at a certain size), common with crisis management plan: [involves routines for] contact with all, and usual with a routine to describe what has happened in case of accident or incident, and to report to the transport buyer, alcohol and drug policy ... and that you have education and info to the staff about how they behave on the roads: «understand that you are representatives for our company», «reputation», and especially much about driving and resting time, follow-up conversations. [They are] also educated with the transport buyers. (Interviewee 36).

Interviewees said that all bus companies have policies for mobile-phone use, as this is something that passenger react strongly to. Describing the safety level and safety focus in the bus sector, interviewees often referred to the passengers, and the fact that the drivers' behavior is very visible to them. This was contrasted to the situation in goods transport. One interviewee believed the bus companies' safety policies are familiar among the drivers, suggesting that the situation is better in the bus sector than in the haulier sector. As noted, Interviewee 39 from the goods sector also suggested the safety level in passenger transport to be higher than in goods transport.

8.2.4 The role of third parties for SMS implementation

Interviewee 36 underlined that the focus on safety policies in the bus sector not is a result of legal requirements or authority requests; rather it is a result of the sector's own focus, as expressed by the bus company association and the focus of transport procurers. The latter party is an important contributor to a high safety level in the sector. He said that in contrast to the short contracts in the haulier industry, the authority bus contracts last for 8-10 years:

There are a lot of safety requirements in the long contracts with the authorities, these contracts push a high level of safety thinking. (...) alcohol and drug policy, policy for really bad weather (during the winter) and road conditions. Of all the bus transport in Sweden, 80-90 % is procured by the authorities, and then the transport buyers' requirements get a considerable breakthrough. To ensure that the requirements are as reasonable as possible, they get recommendations from the sector, concerning which demands that are reasonable to make to companies in the sector from all transport buyers. (Interviewee 36).

Interviewee 36 divided all bus transport into two types: 1) booked transport and 2) line transport. The first kind is transport booked by e.g. schools and sports clubs. There is also purely commercial bus transport, but its proportion in the market is small. Each county procures line transport, with contracts lasting for 8-10 years. This transport also often gets paid according to the number of passengers in the buses, so it is also important for this line of transport to have pleased customers. It is important for them that bus transport is perceived as safe. To sum up, interviewee 36 said that:

Recommendations for safety requirements to the transport companies comes from all the associations in the public transport sector in cooperation (bus-, taxi-, train-company associations and the associations for the buyers of public transports). The

requirements are recommendations to be used when public transports are purchased. They are supposed to be a bit tougher than the companies themselves want to have; not all have policies for what to do in case of bad weather and slippery road; there is a «duty culture» to go out driving regardless of weather and conditions. (Interviewee 36).

The associations have together decided on a governing document with recommendations for 10-11 safety requirements regarding different safety policies, plans etc. to the companies. In addition to that the procurers often add additional safety requirements, e.g. to SMS, such requirements are included in the contracts. Some transport buyers may also require that the companies certify for the international ISO:39001 traffic safety standard, which applies to bus and haulier companies, taxi companies and other companies affiliated with road transport.

Moreover, insurance companies may motivate additional safety efforts in the transport companies. They give reductions in the payments to companies working actively with traffic safety. It was also mentioned that some of the insurance companies are very skilled at evaluating the safety work of the bus companies before they decide on the insurance premiums. In 2001-2003, insurance companies introduced a requirement of automatic fire extinguishing systems in the motor rooms of buses as a precondition of fire insurance. As a consequence, nearly all buses (94 %) have this, and Interviewee 36 said that the Swedish bus sector is world leading in this respect. Summing up the discussion about this, Interviewee 40 stressed that the most realistic way to increase the safety level in the road transport sector, given current legal requirements, is through transport buyer requirements. Transport buyers are in a position to require additional safety measures of the companies, and this is not in conflict with legislation or equal conditions for competition, like it would be if national authorities required more than the legislation stipulates.

8.2.5 Management commitment to safety and employee involvement

Interviewees emphasized that management commitment to safety is a crucial precondition of a high safety level. Interviewee 37 said that balancing between the consideration of safety and economy is always an important issue in transport companies. Interviewee 36 mentioned an example where a transport company had replaced all the lifts in their garages, because of a possible design failure. This resulted in a cost of SEK 7 million, but it illustrates the focus on safety over economy in a large bus company. One of the interviewees also mentioned that the key performance indicators related to safety always are first on the agenda in the monthly CEO meetings.

Interviewees were asked whether they assert that management always involve employees sufficiently in safety questions. Interviewee 37 stressed that this is the case in his company, and noted that they communicate with all drivers in driver meetings three to four times each year, and that safety issues also are discussed continuously with drivers, based on the situations at hand. Interviewee 38 added that they communicate with drivers through: e-mails from the management and the safety organization, intranet, info-screens and governing documents. Interviewee 38 also said that his company rewards positive safety behaviours through four different types of «Safety awards»: «safety hero», «safety innovation», «safety commitment», and «safety performance».

8.2.6 Reporting and learning culture

In the road sector, it seems that the SMS and the reporting systems mostly concern critical technical issues related to the vehicles, and less organizational and safety cultural issues. When he was asked about reporting culture, Interviewee 37 said that his company has ongoing safety controls of vehicles and particular controls before long trips and before authority inspections. They also have a reporting system, where people can use telephone and e-mail, and transport managers register the reports in the system. This reporting system only concerns technical issues with the buses. Safety issues, incidents and near misses are not reported.

The situation was different in the company of Interviewee 38, which has a well-developed SMS similar to those existing in e.g. rail and the maritime sector. He said that his drivers use their reporting system to report non-conformities, near misses and safety improvement suggestions. He also said that the aim of the company is to reach the same reporting level as in aviation, and that their annual goal has been to increase the reporting rate by 5 %. Additionally, Interviewee 38 said that the company evaluates all the reports each month, and that they use the reports in addition to the safety related key performance indicators (KPIs) (e.g. accidents per driven km's) to continuously monitor their safety situation and implement corrective measures when and where necessary. Finally, he also mentioned that his company conducts internal assessments of their SMS and their safety culture annually, as part of a continuous improvement process. Thus, we see that the SMS in this company is similar to those found in the other studied transport sectors. Finally, Interviewee 39 said that his goods transport company try to have a system where they report near misses, to be able to learn from these.

8.2.7 The relationship with the regulatory authorities

Interviewees in the road sector generally asserted that the relationship with regulatory authorities was good. They generally relate to the STA and the police. They asserted that their relationship with the STA contributes to a good safety level. Discussing their relationship with the STA, they noted that the STA generally regulate their compliance with the rules governing driver's hours and the technical state of the vehicles. Interviewee 39 said that, in his sector, mentioning the STA is synonymous with «driver's hours regulation», but that the STA could focus on more (e.g. more on transport permits, safe parking lots). Some also noted that the STA has been relatively inflexible while enforcing these rules, and that a more dialogue-based approach from regulatory authorities, focusing on the whole picture (e.g. the safety culture) in the organization, would be welcomed here. It was noted that the punishments for small violations are much too severe, and that this kind of enforcement actually may be detrimental to safety, as drivers may become very stressed and drive faster, being afraid to be fined for small violations. One of the interviewees noted however that the flexibility of the authorities has improved in this area. Interviewee 39 reported that he only knew about the STA's relationship with the companies from sector magazines and stories from other people in the business. Based on this information, he would be reluctant to contact the STA for help or asking them questions, as he thought that they might answer his query with a company inspection instead of help and advice. He noted, however, that his impression is based on negative media cases, and that it does not necessarily reflect reality. He also noted that the situation of the STA is challenging, with limited economical resources and downsizing.

Additionally, interviewees were worried about the resources of the police, asserting that it leads to less enforcement:

What is worrying us is the situation of the police, there is less and less surveillance from the police. Unless the police is monitoring speed etc., then it will be «wild west». (...) The police have few resources...the heavy [vehicle] traffic; it is the traffic police who have special training for roadside inspections, and there are [heavy] vehicle inspectors in the police, but they are disappearing in Sweden. What happens when the overall traffic surveillance disappears or is weakened in the long term? (Interviewee 36).

Interviewee 38 noted a central difference between the different branches of STA, indicating a considerable focus on role of the individual driver in legislation and the authorities' enforcement of it in the road sector. He contrasted this to rail and sea, where authorities focus more on the organizations surrounding the transport operators. It was also noted that it would be better if authorities in the road sector would champion the focus on safety culture, instead of the business organisations.

Finally, interviewee 40 mentioned that the Swedish Transport Administration (Trafikverket) recently has been asked by the government to evaluate how to implement ISO:39001 in their organization. This interviewee stressed that too few companies have implemented the standard. The idea behind the implementation of it in a public agency is to stand out as a good example, to implement the ISO:39001 line of thinking, and perhaps to get a better understanding of what it involves for the companies.

8.2.8 Views on potential future strategies to regulate safety culture

We asked interviewees whether they think that they would have had a stronger safety culture focus if safety culture had been requested by the legislation, and/or the regulating authorities, e.g. by introducing a legal «safety culture requirement». Interviewee 36 answered that he does not think so, as it is difficult to measure safety culture. Rather he suggested other measures, involving less rules and more stimulus from the authorities to increase the safety awareness among procurers, e.g. state authorities. He would also like more focus on threats and violence against bus drivers. Interviewee 37 and 38 were positive to a safety culture requirement, and one interviewee suggested that the STA should look to other sectors (e.g. rail), and to something similar; developing a structure for SMS.

Interviewee 38 argued in favour of an increased focus on function-based regulation in the road sector. He stated that the current detailed rule-based approach of the STA only ensures that the companies do what the laws require, and that «the carrot is a better motivator than the stick». He suggested that the STA could learn from the other transport sectors.

We also asked interviewees what they thought about the rule-based regulatory strategy of auditing safety culture. Interviewee 36 was also skeptical, based on the above-mentioned argument that it is difficult to measure. Other interviewees were positive. Interviewee 40 found that this a good idea, stressing the importance of involving the companies in a learning process; in a dialogue with the authorities. Interviewee 39 also said that a more dialogue-based relationship between authorities and companies would be positive; with authorities providing more support and help to the companies.

When asked about the regulatory strategy of using the safety culture concept in accident investigations, interviewees were somewhat uncertain, stating that very few accidents are investigated, and that it is difficult for authorities to say something about this; mostly they conclude about human factors or the agency responsible for the road quality.

Interviewees were also asked about advisory-based strategies, e.g. providing companies with the opportunity for self-assessment. Interviewee 40 said that this would be a good idea, and that it also would be interesting to compare with other companies. Interviewee 40

also found that it would be positive to provide companies with real examples of other companies' safety culture work, especially the outcomes of it. This interviewee contended that the main obstacle to more focus on safety culture in the road sector is that companies do not see the concrete utility of focusing on safety culture, e.g. fewer personal injuries and lower costs. Thus, this should be highlighted more.

When asked whether he would like his company to focus more on safety culture, Interviewee 39 said perhaps a bit more. He said that although they work to maintain a high level of quality on driver training and vehicle standard, they could improve their risk analyses, because when an incident happens, they are not quite certain about what to do to prevent similar instances in the future. Thus, this preventive work could be improved.

Interviewee 36 were relatively content with the safety level, and did perceive a need for companies' additional measures. He said that this is ensured by the companies will to survive in the business, and the requirements of procurers. Interviewee 37 said that his company actually conducts such self-assessment surveys about safety issues annually, with questions about safety on the roads and in the parking area. This survey has a high response rate (95 %), and they also get suggestions through free text answers.

We also asked interviewees about the regulatory strategies of providing knowledge about how safety culture is created and recreated, providing real and good examples of safety culture measures in companies and providing education about safety culture to managers and employees. Interviewees responses to these suggestions were mixed, based on the above-mentioned arguments. Interviewee 38 was uncertain about the utility of these measures and suggested instead a dialogue forum for the sector and the STA, where they could discuss questions that are important for both parties. He mentioned that there are such arrangements in other transport sectors, and that such a forum could be a natural place to introduce ideas about safety culture. He said that currently, he STA is mostly preoccupied with inspecting compliance with driver's hours rules.

8.3 Summing up

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. Instead they use the concepts «traffic safety» in goods transport and «passenger safety» in taxi and bus transport. These concepts are derived from the legislation that the interviewees base their inspections on. The concept «traffic safety» is also used with reference to non-professional road users (car, motorcycle, bicycle, pedestrian etc). Based on what the interviewees in the road sector said about the rules governing their regulatory activities, it seems challenging to justify safety culture audits in road transport companies. It must be noted, however, that the legislation review conducted by STA's human factors competence centre found a legal basis for focusing on safety culture in e.g. the rules governing the issuance of transport permits, stressing the companies' responsibilities for transport safety (STA 2016).

When asked whether they would like to focus on safety culture in their inspections, road authority interviewees were positive, but they mentioned several obstacles for doing so (e.g. EU-rules and equal conditions for competition). Interviewees in the road sector inspect companies based on risk profiles, focusing especially on previous violations of the drivers in the companies. Regulators contact the companies to get information about how they work with safety management. Authority interviewees said, however, that they do not have a systematic way or method of approaching the companies that they audit. What they do seem to be dependent on the character and content of the violations

Some of the authority interviewees in the road sector 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. It was mentioned that the STA works to improve this relationship into a more trust-based relationship. Authority interviewees also stated that they were concerned that introducing new safety culture requirements could be negative to their relationship with the companies. Interviewees generally asserted that the relationship with regulatory authorities was good. They generally relate to the STA and the police. Company interviewees were, however, worried about the resources of the police, asserting that it seemed to lead to less enforcement. Authorities in the road sector employ a relatively clear rule-based approach to safety inspections, focusing e.g. on driver's hours rules. It was noted that the STA has been relatively inflexible while enforcing the driver's hours rules, and that a more dialogue-based approach from regulatory authorities, focusing on the whole picture (e.g. the safety culture) in the organization, would be welcomed. A room for dialogue could e.g. be developed through joint seminars where authorities and companies could discuss commonly interesting questions.

Company interviewees in the road sector do not use the safety culture concept systematically. As a consequence of lacking SMS requirements, other actors than regulatory authorities work to maintain a certain SMS level 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.

It seems that the heterogeneity related to safety culture and SMS implementation in the road sector is considerable, as neither is required by the legislation or regulating authorities. Thus, some companies may have well developed SMS, based on their own choice, or because it is required by transport procurers. This is largely the case in the bus sector. Additionally, the business organization in this sector has also developed a set of safety policies for the companies, going beyond what is required by the legislation.

9 Concluding discussion

9.1 Methodological weaknesses and possible bias

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 in time (2017). Thus, the current situation may be different from what we describe: strategies, efforts, experiences, relationships etc. may have changed. It is, for instance, important to note that the safety culture audits in aviation were not fully implemented at the time of the interviews. At the time of the interviews, some sectors within aviation had started to focus on safety culture. Later, we heard, however, that the safety culture audits in aviation had been suspended (we do not know for how long).

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. The authority interviewees were largely chosen by the authorities, selecting personnel who had knowledge about, and experience with the studied issues in their sectors. The experiences and viewpoints of the interviewees are not necessarily representative of all the colleagues in their sector. We may potentially have interviewed the only five people of e.g. 20 in a department who know something about safety culture. If this is the case, we can neither use the interview data to say something general about the sector, nor compare sectors. We asked, however, the interviewees about «common ways of doing things in their departments» and sectors. Thus, we did not ask them what they do individually, but what they and their colleagues do in their daily work. In this sense, interviewees were largely interviewed as «expert interviewees», who were invited to talk both generally and specifically about the current situation in their own sector (although this of course primarily was based on their own experiences). 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, and that we nevertheless can use our data to say something about each sector and to compare sectors. Moreover, we submitted our descriptions based on the interviews to all interviewees for quality assurance, urging them to correct mistakes. This would also to some extent serve as a way of filtering individual or particular viewpoints and depictions of the situation.

It was relatively difficult to recruit interviewees in some of the groups, and we do not know whether some of the company interviewees chose to participate because of a particularly positive or negative relationship to safety culture and/or safety management. It is difficult to conclude about this, but again we may assume that the joint quality assurance of our depiction could filter out individual viewpoints, especially if interviewed people disagree on issues. It must be noted, however, that it is difficult to assess this in the very small interviewee samples, e.g. maritime authorities (N=3).

The possible bias caused by sampling can be evaluated first by considering the relationship between the information provided by authority interviewees and company interviewees within each sector. If the company interviewees' depictions had been very different from

the authority interviewees' depiction, there would be reasons to suspect sampling effects in one of the groups. This could, however, also have been due to different perspectives.

Second possible sampling bias can also be evaluated by considering the relationship between the information provided by each company and/or authority group and results found in previous research. We have conducted previous research on the studied issues in Norway, and we are also familiar with other previous studies on these issues. If the results of the current study had been very different from such previous research, with surprising results etc. we would have had to conduct more interviews to validate our findings. This is based on the premise that the situation in Norway is relatively similar to that in Sweden.

When drawing conclusions, we have attempted to take the small samples into account by clarifying opinions and viewpoints which are not shared by several interviewees, which only were held by one person. We also clarify whether results are in contrast to those held by other groups, and whether they are in accordance with, or in contrast to those found in previous research (this is done later in the report). Thus, when interpreting the results, it is important to note whether viewpoints have been shared by several interviewees, or only one. In some cases, we also present viewpoints from one person, as they may present interesting hypotheses that should be examined further in future research.

Finally, 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.

9.2 The relevance of safety culture as a regulatory concept

Previous research indicates that when regulatory authorities start using the safety culture concept as a regulatory concept, they should agree on how to define safety culture, how to assess it in inspections and how to legally and strategically justify their focus on it (Kringen 2009; Kongsvik & Gjørund 2016; Bye et al 2016; Antonsen et al 2017). In order to increase the utility of safety culture as a regulatory concept in transport, the present study seeks to develop knowledge on how regulatory authorities should approach these questions.

The present study therefore examines the relevance of safety culture in professional transport, comparing the experiences of regulators and companies from four sectors (including the nuclear industry). The first aim of the study was to examine the relevance of safety culture as a regulatory concept for transport authorities, focusing on: a) whether it is included, b) why it is included, c) how it is defined, and d) how it is assessed.

9.2.1 Is safety culture included as regulatory concept?

The study indicates that although the STA centrally has defined safety culture as part of the regulatory strategy, the sectors' focus on safety culture differs substantially. Aviation uses the 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, on webpages and in other communication with the companies. It is, however, important to note that the safety culture audits in aviation not is fully implemented at the current stage. 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. They said, however, that they talk about good and bad operators, and that this is related to safety culture. When asked whether they see different safety cultures in the companies, one of the interviewees said that «Everybody knows who has a good and a bad safety culture». Although they did not use the safety culture concept, interviewees agreed that many of the SMS-requirements of the ISM-code concern safety culture. Accordingly, the STA's rule review (STA 2016) found both implicit and explicit links to the seven safety culture aspects of the STA (2013) in the ISM-code. All but one of the authority interviewees in the rail sector said that they systematically use the safety culture concept 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. Instead they use the concepts «traffic safety» in goods transport and «passenger safety» in taxi and bus transport. These concepts are derived from the legislation that the interviewees base their inspections on. Additionally, it is important to remember that the concept «traffic safety» also is used with reference to non-professional road users (car, motorcycle, bicycle, pedestrian etc.).

These differences between the sectors are in line with those found in previous research from other countries, indicating a well-developed focus on safety culture in aviation (Hudson 2003), an ISM-based SMS focus in the maritime sector involving an indirect focus on safety culture (Lappalainen et al 2012), a certain focus on SMS and safety culture in rail and little to no focus on safety culture and SMS in the road sector, both among companies (Mooren et al 2014; Nævestad et al 2017a) and regulators (Elvebakk et al 2017). Table 9.1 sums up the relevance of safety culture in the studied sectors.

Table 9.1 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

9.2.2 What influences authorities inclusion of the concept?

Based on the interviews, it is evident that several different factors influence the sectors' inclusion of safety culture in their regulatory repertory. The first factor is the fact that the STA centrally has defined safety culture as part of the regulatory strategy, and chosen to focus on it. This was, however, not mentioned by the road sector authority interviewees. This is understandable, given their rule-based approach to the companies, focusing on e.g. driver's hours regulation and the technical state of vehicles.

This brings us to the second factor influencing the sectors' focus on safety culture, which is the legislative frameworks in the sectors. A rule review from the STA's «Human Factors Competence Centre» showed that the seven safety culture aspects defined by the STA were indirectly covered in the legal requirements governing inspections in all the transport sectors, and that a focus on safety culture in audits was legally justified (STA 2016). This especially applies to the SMS rules in aviation, the maritime sector and rail, but also in some of the rules applying to the road sector. STA's rule review did not find connections to all seven safety culture aspects in all transport sectors. The review concludes that it is easier to justify safety culture inspections in the transport sectors with SMS requirements (i.e. all except professional road), but suggests that an SMS is indirectly required in the rules applying to professional road transport.

These two factors (STA strategy and sector legislation) are the most important, as they were mentioned by interviewees in nearly all sectors (strategy was not mentioned in road). Additionally, it should be mentioned that one of the interviewees in the maritime sector said that he (and supposedly his colleagues) assesses whether vessels have a no-blame culture in the audits. He stated that this follows from the ISM-code's focus on reporting, and that this is implicitly acknowledged as part of their inspection strategy, but that it is not explicit or written in any document. He said that you cannot expect people to report incidents or suggest safety improvements if they are afraid to be blamed for an incident. In this case, it seems that the focus on safety culture, or at least a safety culture aspect («no-blame culture») is relatively loosely coupled to legislation (i.e the ISM-code) (cf. STA 2016).

A «just culture» was the safety culture aspect that it was most difficult to find a legal justification for in the STA rule review (STA 2016). This illustrates how inspectors may audit safety culture (aspects), although this is not legally required. It is however, important to note that especially one interviewee underlined the importance of auditing a no-blame culture, and thus that it may be difficult to judge the prevalence of this focus among other inspectors within the maritime sector. In section 9.5.1, we discuss six additional reasons that the road authority interviewees mentioned to explain why they do not focus on safety culture.

9.3 Safety culture as a safety management strategy for companies

The second aim of the study is to examine the relevance of 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) the status of key safety cultural aspects (management commitment to safety, employee involvement, reporting, just and learning culture).

Discussing the relevance of safety culture as a safety management strategy in transport companies, the study indicates that 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 in particular illustrates the importance of 5) the companies own strategies related to SMS and safety culture development.

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 and companies may also choose a stronger focus on safety culture and SMS than what is required by the legislative frameworks. The latter illustrates that sectors with relatively low legislative focus on SMS and safety culture (i.e. road) still may develop advanced SMS and safety cultures. The challenge, however, is that these sectors will entail a considerable heterogeneity when it comes to organisational safety management systems: while some companies may employ advanced SMS (e.g. ISO:39001), other companies may perhaps have no SMS or safety culture focus at all. The latter is indicated by Norwegian data (Nævestad & Phillips 2013). Additionally, European rules on equal conditions for competition may limit the possibilities of regulating at the national level to introduce stricter requirements in these sectors.

9.4 The relationship between regulatory authorities and companies

The third aim of the study was to examine the relationship between regulatory authorities and companies within each sector, focusing on: a) (clear) roles and expectations (e.g. function-based vs. detailed rule-based), b) trust and communication, and c) influencing factors. Discussing this, we focus on the issue of organisational maturity and trust, which came up as an important topic in several of the interviews. Discussing the role of the regulatory authorities vis-à-vis the companies, we ask whether it is possible for regulators to give too much advice, and whether safety culture assessments are more subjective than

assessments of compliance with rules. Finally, we also discuss how the relationship between the regulator and the regulated can be influenced by differences in national safety cultures and framework conditions.

9.4.1 Organisational maturity, trust and self-regulation

Safety culture may inform and improve safety regulation in several ways. Key activities of safety regulators include for instance issuing permits to companies for doing business, conducting inspections of safety management systems, overseeing compliance with rules, investigating accidents and providing guidance on how to work with safety. As noted, 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 (Kringen 2009). 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 compliance with rules (Grote 2012).

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. It seems that many of the interviewees held the view that organizational maturity evolves through a gradual implementation of measures aimed at developing organizational safety management. One of the authority interviewees from aviation said for instance that this is an important discussion, that may be perceived as provocative for many; 'you cannot go straight from generation 1 to generation 3'. He also said that if you introduce SMS in an immature organization, you may lose control over the situation.

We may illustrate the paradox with an example from rail. When asked about more advisory-based strategies, e.g. providing the companies with tools for self-evaluations of their safety culture, rail authority interviewees stated that they did this in 2005-2006, but that it did not work out as planned. The reason is related to trust and to the maturity level of the companies: while the serious companies pointed to their own flaws and weaknesses, the less serious companies did not report non-conformities. Instead, when these companies evaluated their own SMS, and whether they complied with the requirements, they answered in accordance with what they thought that the authorities «would like to hear», and not in accordance with their own level of compliance. Again, this illustrates the importance of trust between the regulator and the regulated in a function-based approach involving a high incidence of self-regulation. An interviewee suggested that only the big and well-performing company may benefit from such an approach.

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. Authority interviewees in rail said that have used a «safety culture maturity model» stemming from the European Rail Agency (ERA 2013). It seems that the use of this model was rather limited. Such measurements often provide quantitative index scores, describing e.g. three levels with negative, bureaucratic and positive safety culture (GAIN 2001), or pathological, bureaucratic and generative safety culture (Westrum 2004). Thus, the paradox seems to be that to be able 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 too bad 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.

Finally, it is important to note that the STA checklist for safety culture also measures «safety culture maturity», as its scores are based on the potential for improvement in each specific area. Thus, it seems that measuring or assessing «safety culture maturity», is a central aspect of auditing safety culture.

9.4.2 Is it possible to give too much advice?

Aviation, sea and rail employ a mixture of detailed rule-based and advisory-based approaches to regulation, perhaps leaning towards the latter. The more «consultancy-based», supervising role that function-based regulation involves was, however not viewed as unproblematic among the authority interviewees. When discussing how the regulators perceive their role vis-à-vis the companies, all authority interviewees mentioned the importance of stressing that the responsibility for safety lies within the companies. One perceived danger with the advisory-based approach, which involves giving advice to the companies, is that the regulating authority might be blamed in case of accidents. All interviewees were not equally worried about this.

As in the other sectors, authority interviewees in road were reluctant to give concrete advice to the companies, stressing that they do not have an advisory role. Following up this, the interviewee was asked whether they want to give advice on measures. Interviewee 35 answered:

They ask about this, and then we say that it is not our role, we cannot say what they should do and not do. You have to inform about what the law says. It is a very hard balancing act. A lot of companies would like the STA to inform and educate more; it is asked for. But, how much can you inform and educate - what is our role? This also applies to driver's hours. We cannot say «do like this», because then they might say afterwards, «but we did exactly as you said». (...) (Interviewee 35).

Most of the authority interviewees were very concerned about this balance, avoiding giving too concrete advice about what companies should do. However, given the increased tendency towards function-based regulation as noted by Grote (2012), and thereby a changing role of regulators to a more advisory approach, it is likely that this dilemma will be more pressing in the future.

9.4.3 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. As noted, 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. Authority Interviewee 10 from rail said for instance that: «Safety culture is what is not in the documents. It is what you may read between the lines in interviews with employees in a company.» One of the maritime authority interviewees said that «Everybody knows who has a good and a bad safety culture». Several interviewees also used the word «gut feeling» when they talked about assessing safety culture in companies an impression of «how things are actually done» in the regulated organizations. 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 this is a contention which may mean several different things, and that we may depict these different meanings on a «subjectivity scale», which has two «ideal typical» ends.¹¹ 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 can be argued that authority inspectors' assessments of safety culture not necessarily are more subjective than other assessments that they conduct in their audits.

The interviews seem to indicate that both of these views on subjectivity exist among the interviewees. Authority interviewees who do not use the 28-point safety culture checklist (e.g. road) were more inclined to lean towards the first view, while those who did use the checklist (e.g. aviation) were more inclined to lean towards the second view. It is generally acknowledged that the more general rules or principles are, the more discretion is required. Thus, for authority interviewees who do not use the safety culture checklist a lot of discretion is required to describe safety culture, perhaps to the extent that descriptions become «arbitrary», individual and potentially contested. For authority interviewees who do use the safety culture checklist, less discretion is required. For them, safety culture assessments (also) involves making specific assessments of 28 specific issues. In principle, we may perhaps assume that this is not necessarily very different from making assessments of compliance with specific rules.

However, making these assessments is a *new activity* for the inspectors and not the least for the companies. Several authority interviewees indicated that «written rules are objective». Such statements signify that «objective» (versus subjective) is what «is known», «agreed upon» and «uncontested». When interviewees say objective, they seem to mean «established», or «what authorities and companies are well aware of and agree upon». Safety culture has not yet reached this status, as it is a relatively new concept for both regulators and companies.

To sum up, it seems that the two views on subjectivity involved in safety culture assessments may indicate a possible paradigm shift when it comes to safety culture. The first view represents the «old way» of approaching safety culture, while the second view represents the «new way» of approaching safety culture. It seems that currently, interviewees held both views but that authority interviewees from aviation (who both held the first and second view) leaned most heavily to the second view. The contention that

¹¹ Based on the German early sociologist Max Weber, ideal types are analytical constructions that do not necessarily exist in their pure form in reality, but which are used for analytical simplification (Weber 1997).

aviation authority interviewees held both views is indicated in the statement that the 28-point checklist provide a way of conceptualizing what they previously referred to as their «overall impression», or gut feeling.

It seems that the challenge for the aviation authority interviewees was that some of the companies that they relate to leaned more heavily to the first view, questioning their assessments of safety culture. Thus, it seems that in order to normalize the second view and spread the notion that safety culture also can be a very concrete and specific concept, more education and information is needed. Focusing on safety culture requires, however, an «extra effort» as it is new, and it is perhaps challenging to legitimate a focus on this (requiring time, money, competence, education, possible conflicts with companies) when the inspectors also have to focus on the inspections that they actually are legally required to do.

9.4.4 Differences between national cultures

Interviewees from the maritime sector are to some extent exposed to different national cultures, as they may relate to crews and flag states of different nationalities. The influence of national culture on safety culture was brought up by some of the interviewees in the maritime sector, and aviation. We did not systematically study these issues in the interviews (it was not included in the interview guide), but it may nevertheless be important to discuss it, as it seems that national culture could have an important influence on safety culture in international sectors like the maritime sector and aviation. It may also be relevant in the road sector with increasing European competition (Nævestad et al 2017).

As noted, authority Interviewee 15a from the maritime sector underlined that the safety cultural differences between flag states and national groups largely concern the prevalence and preconditions of a «no-blame» culture and reporting. The following quote (that we previously have mentioned) sums this view up:

Yes, we see cultural differences related to e.g. no-blame and reporting. In Norway, Sweden and Denmark, people are «allowed to make mistakes». In 1996, when we introduced the ISM-code, seafarers in Eastern Europe did not dare to admit mistakes. In the Nordic countries, it is perceived as positive to report [mistakes, safety issues etc.]. (...) In this respect we are better off in the Nordic countries, as we dare to ask questions; «I will not be fired if I ask a question» (Interviewee 15a).

This interviewee said that how these issues are handled is related to the national cultures of each country, tracing these cultural differences to the relationship between employees and managers. When discussing this, we noted that it seems that in the Nordic countries, managers and employees are on a relatively equal footing, and workers have relatively strong rights. In other countries, e.g. Eastern Europe and Asian countries, (Philippines), the gap is larger, and workers' rights are weaker. It is important to mention that these views are hypotheses that should be followed up in future research. Nevertheless, several interviewees said that they have experienced that the relationship between managers and employees differ in different countries and that it seems that this may influence the quality of the reporting cultures, as indicated by Interviewee 15a.

Moreover, these views are in accordance with previous research. The maritime sector and aviation are international sectors, and previous research has found national culture to influence safety within these sectors (Håvold 2005; Merrit 2000). One of the national safety culture aspects most relevant to safety seems to be related to employees' attitudes to their managers (e.g. Helmreich & Merrit 1998). Reluctance to question managers' decisions, report safety issues, report your own mistakes etc. to managers are indicators of poor safety culture, and can be expected to vary along the national cultural dimension of value of

hierarchy, or deference to authority in a society (Hetherington et al., 2006; Hofstede 2001; Guldenmund et al 2013).

Studying aviation, Helmreich & Merrit (1998) found that airline pilots from different national cultures disagreed substantially when asked whether «Crew members should not question the decisions or actions of the captain, except when they threaten the safety of the flight» (respondents' agreement varied between 15 % and 93 %). Thus, we see that how respondents answer when confronted when this statement seems to be influenced by the degree of «power distance» in their culture. Helmreich and Merrit (1998) stress that in situations where the values of the national and the organisational cultures are in conflict, stress might arise and safety may be negatively influenced. These results are important, as they indicate that in spite of the internationalisation, the comprehensive regulation and extensive training involved in commercial aviation, found that national culture exerts an influence over the professional culture and safety behaviour of pilots (cf. Merrit 2000).

Finally, we may note that Interviewee 15a believed that it may be possible to spread this relatively open Nordic no-blame culture to other maritime countries through IMO's member state audit scheme and follow up based on IMO's Triple «I» code.

9.4.5 Safety culture is influenced by framework conditions

The present study indicates that the different subsectors within the maritime sector differ in their focus on safety culture. Interviewees underlined for instance that tank transport is at the forefront of safety and safety culture work. This is in line with previous research, which indicates that passenger vessels have lower risk of serious incidents than cargo vessels, and among the cargo vessels, the vessels related to the petroleum industry (e.g. gas tankers) have the lowest risk, while coastal cargo vessels have a higher risk (Hansen et al 2002). Petroleum tankers are known to have stricter regulations, a high safety focus from the transport buyers (oil companies) and a higher safety level (Mostad 2009). These differences are also reflected in safety culture scores in these subsectors (Nævestad et al 2017b; Nævestad et al under review).

Moreover, research indicates that such differences between safety performance and safety culture within maritime subsectors are influenced by the framework conditions of these subsectors. Størkersen et al (2011) attribute the relative high shares of risk taking and procedure violations (40 % violate procedures, and 33 % put themselves in danger to get the work done) in the coastal cargo sector to challenging framework conditions, e.g. tight economical margins. Similarly, interviewees in the study of Nævestad (2017) point to relatively low manning levels in this sector, a high number of port calls and a high work load between port calls. Additionally, the studies of Starren et al (2008) and Smith et al (2006) point to relatively intense working patterns in the sector.

Previous research has found that organizational safety culture scores differ between transport sectors, i.e. aviation, road, rail, and sub sectors (e.g. helicopter and airlines) (Bjørnskau & Longva, 2009), indicating that the safest lines of transport have the highest organizational safety culture scores. The observed differences in safety culture scores are probably due to differences in framework conditions like rules/enforcement, competition and regulation, which differ considerably in different sectors (Bjørnskau & Longva 2009).

Nævestad (2017) indicate that organizational safety culture actually may counteract the negative impact of framework conditions and working conditions on safety in maritime transport. Nævestad (2017) write that:

Although they may have little influence over their market, their pay, manning level and so on, our results indicate important differences between safety culture levels and working conditions. This could indicate that the captain and the crew may

develop positive safety cultures, which may counter-balance negative framework conditions. Understanding the importance of goal conflicts, talking openly about them and finding ways to tackle them seem to be important aspects of a positive safety culture. (Nævestad 2017: 260).

This highlights an important area for future research with practical implications for regulators; if a positive organisational safety culture can reduce the negative impact of framework conditions, it is important for regulators to develop knowledge on how they can contribute to this in «exposed» sectors.

9.5 Future potential of increasing the focus on safety culture in the sectors

The fourth aim of the study is to discuss whether and how the sectors could increase their focus on safety culture. Examining this, we first ask discuss whether it is possible to give general advice on safety culture development in the different sectors, noting that each sector and each company is unique, but that they still have some key facets in common. We also examine the relationship between SMS and safety culture, focusing especially on the maritime sector and aviation.

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

9.5.1.1 Each sector is unique

In line with previous research, the present study indicates that each transport sector is unique with different legislations, key actors, technologies and histories. Accordingly, we see that the sectors' work on safety is adapted to these contexts. In line with previous research, we see that the transport sectors are very different when it comes to their focus on work related factors like safety culture and SMS. Our study also indicates that each sectors' approach to safety culture is adapted to the current contexts and situations within each sector: in the maritime sector, the safety culture perspective is in light of the ISM, and in rail, safety culture is also linked to SMS. An important result of our study is that the different transport sectors have reached different maturity levels in their focus on organisational safety and safety culture, as a result of their specific contexts. The present study attempts to map and discuss this, and suggest possible ways to aid the sectors with the highest unfulfilled potential when it comes to safety culture (i.e. road).

9.5.1.2 Each company is unique

Our discussions with the authority interviewees also indicates the importance of remembering that each company is unique. Authority interviewees were very concerned that the different companies have different histories, managements, organizational structures, traditions and cultures. The companies each have 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. This is an additional reason that authority interviewees were reluctant to give concrete advice to the companies. Interviewee 18, said that: «Sometimes they ask us what they should do, and then we answer that they should do what is best for your company, in their unique situation.» This is also a very important point in this respect, which is very relevant to safety culture implementation. Another related challenge in this respect is what regulating authorities should do if companies perceive that

their safety management approach is very well developed, and that safety culture interventions not are needed, although authority representatives may disagree. This is an interesting dilemma that should be followed up in future research. Several descriptions of safety culture, concludes that complacency is an indication of poor safety culture, and that organisations with good safety culture are in a state of «chronic unease» (Nævestad 2010a).

9.5.1.3 What do the transport sectors have in common?

Based on our assertion that sectors and companies are unique, it is also tempting to ask what the different transport sectors actually have in common, and whether it is analytically feasible to treat them as a common group. Our answer is that they each are involved in the movement of people and goods by vehicles operated and maintained by safety-critical humans – yet their technology, infrastructure and socio-cultural contexts differ. They also deal with the same negative side effects related to their basic activities; i.e. accidents involving killed and injured people. Additionally, all sectors face the same organizational challenges when trying to avoid these side effects, related to the human factors influencing operators' strengths and weaknesses, and the organizational management systems developed to contain and reduce the effects of the operators' weaknesses and fully utilize their strengths. We have seen that some of the sectors clearly have reached a very high level in this respect, while others have not. This 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 to this. In the current study, we have included the nuclear sector as an example that aviation can learn from.

9.5.1.4 What do safety culture interventions in transport have in common?

Above we established that it is useful to analyse the four transport sectors together, at least for the sectors with organizational safety management systems that are less developed than aviation. Nævestad, Hesjevoll & Phillips (2018) map tools that can be used to develop good safety culture in transport companies within road, sea, air and rail, assess expected effects of these measures on safety culture and safety outcomes and identify factors influencing safety culture change, by means of a systematic literature review. In line with the argumentation above, they argue that the interventions are very different depending on the sector in question and the companies in question. They conclude, however, that future research should develop simpler interventions by focusing on the basic requirements of safety culture change. They contribute to this by identifying four key elements which seem to be common in all the reviewed interventions, independent of sector and company:

- 1) Appointing a key person (generally a manager) to be responsible for implementing the intervention,
- 2) Institutionalizing joint discussions and risk assessments of work place hazards, involving managers and employees,
- 3) Implementing and monitoring measures based on these discussions and joint risk assessments, e.g. reporting systems, training and
- 4) Maintain effective communication about safety issues in the organization, in line with Reason's (1997) depiction of an informed safety culture

9.5.2 Is a good safety culture the same as successful SMS implementation?

In aviation, the maritime sector and in rail, interviewees stressed that their SMSs indirectly concern safety culture, as they indirectly focus on the key aspects of safety culture. Our discussion suggests that facets of safety culture (e.g. reporting and just culture) cannot be viewed separately from the facets of SMS (reporting system). Moreover, research indicates that many of the key aspects of safety culture and SMS are similar (e.g. management commitment to safety) (Thomas 2012; Flin et al 2000). This is interesting, as it indicates how tightly interwoven formal (structure) and informal (culture) aspects of safety are (cf. Antonsen 2009). It may therefore be difficult to tell which comes first, and subsequently how to influence the safety level of a given transport sector. In a review of the safety outcomes of SMS, Thomas (2012) conclude that SMS typically includes include management policy, appointment of key safety personnel, reporting systems, hazard identification and risk mitigation, safety performance monitoring etc. (Thomas 2012). These aspects are not very different from the, above-mentioned, four key activities of safety culture interventions, described by Nævestad et al (2018). Thus, it may be hard in practice to discern between safety culture interventions and SMS. Then it may be tempting to ask what does the safety culture perspective add, and why we should focus on both SMS and safety culture? Based on this, authority interviewees in aviation noted that the safety culture perspective provide them with a very useful complementation to their SMS inspection, as it provides them with an assessment of how the SMS «works in practice». This illustrates how the focus on safety culture in the inspections also may serves as a way of assessing the actual SMS implementation throughout the organization. Safety culture is a symptom of this, as it denotes the informal aspects of safety («how things are actually done»), while the SMS denotes the formal aspects of safety («how things should be done») (Antonsen 2009).

Interviewees from aviation and the radiation authority emphasized that the safety culture perspective adds more than the management systems approach. The former noted that the companies are clear that the system requirements are not sufficient; they also go further to develop positive safety culture traits. This means to not only ensure that the required formal system aspects are in place, but also to focus on establishing important, informal safety culture aspects. This is important, as they underlined that sometimes it is required to do something other than the management system says. The safety culture provides the basis and justification for doing this.

Nevertheless, authority interviewees in some sectors, e.g. rail were skeptical to regulating safety culture, as the concept is abstract, while they held that SMS components are very specific and easier to evaluate. Discussing the relationship between safety culture and SMS, an interviewee from rail said that:

Safety culture is more abstract and not as concrete as safety management. Safety management is easier to control. Safety culture is what is not in the documents. It is what you may read between the lines in interviews with employees in a company. Much is the same, but I experience that safety culture is more than what is written. (Interviewee 10).

It is important to remember that rail authority interviewees also focus on safety culture in their inspections, and we see that the same mix of legitimization of SMS and safety culture audits that we have seen in the other sectors: the inspector audit SMS components, as these are required by their legal basis, but they also audit safety culture, as this can be justified based on the legal SMS requirements, and as it is the central strategy of the STA. Thus, the two approaches may be seen as complementary.

9.5.3 Is an explicit focus on safety culture necessary in the maritime sector?

We noted above that the safety culture measures implemented in each sector should be adapted to the specific situation in each sector, e.g. the legal context, the history, the organizational forms and the perceived needs of the key actors etc. Based on this, it is tempting to ask whether an explicit focus on safety culture necessary in the maritime sector. Company interviewees were content with the current ISM code focus, and they said that regulators currently cover the «informal aspects of safety», focusing on lacking ISM familiarity and lacking ISM practice in the companies. Company, interviewees were content with ISM, and they seemed to want «everything» to be channeled through ISM, in order to avoid unnecessary extra work and bureaucracy. Again, it should be asked what the safety culture perspective adds to ISM. The safety culture concept includes more than ISM familiarity and compliance, e.g. management commitment, employee involvement. It can however be said that these elements also can be seen as part of SMS (cf. Thomas 2012). More research should be done on this, but it nevertheless seems well suited to conclude that a further safety culture focus in the maritime industry would require the concept to be incorporated into the ISM code. A key challenge for the STA here is of course that their influence is smaller in the maritime sector, as they only inspect some of the vessels in Swedish waters in flag state controls, e.g. the small national vessels, and as their abilities to heighten the bar in port state controls is limited by IMO laws and the Paris Memorandum of Understanding (MOU).¹²

9.5.4 Is safety culture a concept that fits best in aviation?

We have argued that the safety culture concept should be adapted to each transport sector, and we have also seen that authorities and companies in the studied transport sectors have adapted the safety culture perspective to different degrees. The safety culture perspective seems to be most well adapted in the (nuclear industry where it originates and) aviation, from which Reason's (1997,1998) description of an informed, reporting, just and learning culture originates. Thus, it is perhaps not surprising that our study indicates that the safety culture perspective is most successfully implemented in aviation.

It should be noted that Reason's safety culture aspects also are well aligned with the legislation from other transport sectors with SMS requirements (e.g. the SMS requirements of the European Rail Agency, and the ISM-code in the maritime sector). However, when comparing the practical development of these safety culture aspects in the sectors, it seems that the functioning of their reporting systems, for instance, are not as good as in aviation. We have also seen that the companies in the other sectors use aviation as a model, trying to develop a similarly good reporting culture. But should they strive to be as aviation? We have seen that the argument on organizational maturity indicates that safety culture interventions should be adapted to the maturity level of organisations. Moreover, safety culture is an important indicator of organisational maturity. When asked whether the system from aviation could be transferred to other sector, one of the authority interviewees from aviation underlined that it is important to remember that we should not forget that generations of SMS that have brought the companies in the aviation sector to the high level where they are today. Thus, their systems may perhaps not be directly transferrable to other

¹² The Paris Memorandum of Understanding (MOU) is a port state control agreement, which maintains a list of port state control results, scoring different flag states on a white list, a grey list and a black list, depending on the port state control results. Black listed flag states and vessels are not allowed to enter the ports. Canada and 26 European states are members of the Paris MOU. There are eight other MOUs, in eight other oceans/areas.

sectors (e.g. road). He suggested that other sectors would have to go through the same stages first, to reach the level of aviation; starting with compliance monitoring, ISO standards, educating managers and so on before they be included in a system involving self-regulation and safety culture. This is an interesting hypothesis that could be followed up in future research.

If we again take the argument that each sector is unique as our point of departure, it is tempting to ask whether each sector should do something unique and sector-specific in their efforts to develop a good safety culture. This is a thought provoking question that could be followed up in future research. Accordingly, previous research do indicate that most safety culture scales are sector specific, incorporating some of the main facets of the industry or sector in question through sector specific items (Nævestad & Bjørnskau 2012). In spite of this, it may be argued that the main safety culture aspects nevertheless are relatively similar, often focusing on Reason's (1997) key aspects derived from aviation safety culture (reporting, learning, just).

Thus far, we may conclude that the best argument for following the example of aviation in the other transport sectors, is that previous research suggests that safety culture (measured generally) explains considerable variation in safety performance in various transport forms, and that it has considerable potential for improving safety in transport (Ward et al 2010; Nævestad & Bjørnskau 2012; Bjørnskau & Nævestad 2013). However, as each sector is unique, more research is needed for the safety culture perspective to become as crucial in the transport sector as it is in hazardous industries (Nævestad, 2010a). In addition, it is crucial to clarify how this knowledge can be used to enhance transport safety, both by the transport companies themselves and by regulatory authorities aiming to improve the safety level in their respective transport sectors.

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

9.6.1 Factors making it difficult for regulators to focus on safety culture in the road sector

Above, we mentioned that the two most important factors influencing the focus on safety culture in regulation in each sector were: 1) the central STA decision to include safety culture as part of the regulatory strategy, and 2) the legal justifications that were found after reviews of the most important rules governing regulation. We identified six additional factors, based on the interviews. Some of these were also mentioned by interviewees in other sectors, but they were particularly important in road. In sum, these eight factors seem to make it difficult for regulators to focus on safety culture and organisational safety management in general in the road sector. (We discuss the possibilities to overcome the challenges that these factors represent in Section 9.6.2.) In the following, we discuss the six factors making it difficult for regulators to focus on safety culture in the road sector, that are additional to the two mentioned above.

The third factor is the business structure of the sectors. This was mentioned by road sector interviewees, but also interviewees from other sectors to illustrate how they are different from the road sector. Additionally, 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. A fourth factor that was mentioned by road sector interviewees was that it would require more regulatory competence and resources to focus on safety culture. Fifth,

it was also mentioned that it would require competence and resources of the transport companies that is likely to be lacking in the road sector. Interviewees from aviation stressed the importance of safety culture education, both internally; focusing on their own inspectors, and externally; focusing on company representatives. Sixth, the organisational maturity level of companies was mentioned by interviewees from all sectors. Many interviewees pointed to organisations with a low maturity level within their sector. This affects the seventh factor; trust between regulators and the regulated. With low organisational maturity level, the basis for trust between the regulator and the regulated is weak. Based on the interviewees' description of the interaction with the less mature organisations, it seems that the reporting culture of these organisations are not as well developed as those found in other organisations. This means for instance that self-regulation can be difficult, if the regulator experiences that the companies fail to report non-conformities, and only answer «what they believe that the regulator wants to hear». It was mentioned that, when dealing with such organisations, regulators often prefer a rule-based approach to regulation. It seems that most interviewees agreed that the maturity level in average is lower among road transport companies, and this could be an argument in favour of a rule-based approach in this sector. Some counter-examples to this were, however, mentioned. And our company interviews also provide good counter examples to this. Discussing the level of trust between regulators and companies, it was mentioned that in the road sector, the relationship between the regulator and the companies historically had been characterized by a certain level of mistrust. Given such conditions, regulators would be reluctant to introduce new additional requirements to the companies. The eighth factor is the consideration of equal conditions for competition. In all the sectors, the regulators' focus in their inspections is influenced by the legislation governing safety in their sectors. When talking about introducing more requirements, interviewees in the road sector mentioned that introducing stricter requirements for companies in Sweden would threaten the equal conditions for competition between European road transport companies.

9.6.2 (How) can safety culture be introduced as a regulatory concept in the road sector?

Taking these eight factors (strategies, rules, organisational size, resources, competence, maturity, trust, equal conditions for competition) as the point of departure, we can discuss the possibilities to include safety culture as a regulatory concept in the road sector. It is important to recall whether the interviewees in the road sector actually want to focus more on safety culture. Interviewees said that they wanted to do this, although it seems that their general wish was to focus more on the organisations and the drivers, perhaps also visiting the organisations when doing their inspections. In the following, we discuss three approaches.

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 2017a). The structure of the companies in the road sector is a challenge to focusing more on safety culture, as this sector is comprised of many small companies with few employees, relatively low organisational maturity and few resources (e.g. competence on occupational health and safety, time) to focus on safety culture. Previous research indicates that many of the small goods transport companies often are run by owner-drivers with little interest in administrative issues and organisational safety management (OSM), reflected in the fact that these companies have little focus on OSM and more focus on the individual driver (cf. Nævestad & Phillips 2013). The same result has been reported in international research (e.g. Gregersen et al 1996; Newnam and Watson 2011). Given their little focus on OSM, it

is difficult to assess whether these companies should start with a safety culture focus, or whether they should implement key SMS measures first, before focusing on safety culture. Moreover, it is also an interesting empirical question whether these companies have reached an organisational maturity level at which they will be able to benefit from a safety culture focus (initiated by the regulator). Nævestad et al (2017) have suggested a safety ladder approach for small goods transport companies with few resources and little focus on safety. This «Safety ladder» for goods transport companies provides a solution to the «organisational maturity» dilemma, as it suggests that companies which do little with OSM should start at the bottom of the safety ladder, and then gradually implement more measures at the higher levels. The most basic steps of the safety ladder address the most important safety challenges in goods transport, by means of the most basic OSM measures. Thus, the safety ladder is implicitly based on an «organisational maturity» development idea, as it depicts a development from no OSM measures to a full SMS (e.g. ISO 39001). Based on this approach, we could suggest that small road transport companies with no OSM measures probably should start by focusing on the most basic safety culture aspects (e.g. management commitment for safety, which is the first step of the safety ladder).

Second, we suggest that regulators mainly should focus on safety culture in their regulation of the larger road transport companies. Given that the many small companies provide an argument against focusing strongly on safety culture in the road sector, a solution could be that the regulator only targets the large companies when focusing on safety culture in their regulation. The larger companies are likely to have more resources and to be more organisationally mature. This would probably also allow a certain degree of self-regulation and a high level of trust between the regulator and these companies. Additionally, because of their size, the large companies employ a high share of the drivers in the sector, and thus a fair share of people would be covered by this focus. This could be a way of gradually introducing safety culture thinking within this sector.

Third, we suggest that the regulator 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. We have also seen that the main argument for focusing on safety culture in the audits in the other transport sectors is that the set of rules governing the audits legitimize a focus on safety culture. This does not seem to be the case in the road sector. Based on these two arguments, it seems that the best current alternative for the road sector, is that working, with and focusing on safety culture is voluntary for the companies, and that for instance the business associations (e.g. the bus owner association) could assist the companies with this. Of course, regulators could also provide such voluntary help, but in the road sector this has traditionally been provided by the business organisations. Moreover, regulators may also provide assistance to and support the business organizations in their efforts to assist member organisations wishing to focus on safety culture.

9.7 Regulating a fuzzy concept: what can we learn from the radiation authority and aviation?

9.7.1 Education and self-assessment

In this study, we have found that both the Swedish radiation authority and Swedish aviation authorities have relatively well-developed ways of approaching safety culture. Looking at their experiences with regulating their concept, it is evident that this has required extensive internal education and reviews. Both authorities describe internal learning processes and self-assessments. We may assume that other authorities wanting to use the safety culture concept may have to go through similar processes.

Interviewees from the radiation authority said for instance that all managers and safety culture inspectors undergo an internal safety culture education program. In this program, participants learn about the importance of the authority's own safety culture. They also use the safety culture approach internally in their own authority; to review their own activities, as they influence the safety culture of the companies that they regulate. Moreover, they have conducted an evaluation of their own safety culture. Interviewees in the radiation authority said that they have been going through an internal process to develop a joint recognition of what safety culture is to them, and how they may set the premises for safety in the nuclear plant through their work.

Authority interviewees from aviation described a similar process. They said that the use of safety culture as a regulatory concept is quite new in this sector, stressing the importance of internal safety culture education of regulatory personnel key company personnel. This may contribute to a shared understanding of what safety culture is between the regulators and the companies. Several interviewees saw this is an important premise of a positive dialogue. Interviewees also said that the STA's human factors competence centre was crucial, providing information about safety culture and educating the inspectors.

9.7.2 Analytical maturation from a theoretical to a practical understanding of safety culture

Developing their own understandings of and approaches to safety culture, interviewees from the radiation authority and aviation described processes of analytical maturation from a theoretical to a practical understanding of safety culture. One of the interviewees from the radiation authority said that they were more theoretical in the beginning, focusing on theoretical definitions, conceptual development, and the theoretical aspects of safety culture. It was noted that this not necessarily is the right way of approaching the concept, as it may be too academic and abstract. The authority's approach to safety culture has, however, gradually become more practical; focusing on the concrete company at hand; e.g. what kind of risks they have, what kind of behaviours they have and so on.

Discussing the abstract character of the safety culture concept with the interviewer, two interviewees (one from the radiation authority and one from aviation) especially mentioned the challenge of academizing the safety culture concept too much. They stated that although they know that the definition and measurement of the concept is debated by scholars, it is important not to make the concept too abstract, both internally and externally while communicating with the companies. It therefore seems important to be as concrete and specific as possible, focusing on the specific aspects that make up the safety culture concept. This assertion should be followed up in future research.

10 Conclusion

Previous research from the Norwegian petroleum sector indicates that it may be difficult for regulators and companies to define and operationalize safety culture, as it is an abstract concept, that may lend itself to many different definitions, (Kringen 2009; Bye et al 2016, Kongsvik & Gjørund 2016; Antonsen et al 2017). The abstract and fuzzy character of the safety culture concept has also been underlined in safety culture research (e.g. Cox & Flin 1998; Guldenmund 2000; Haukelid 2008). This research has warned against «reification» (i.e. assuming that there is a separate entity called safety culture in organisations), reminding us that safety culture after all is an analytical construct (cf. Antonsen 2009). It is obvious that safety culture is a social construct. As mentioned, authority interviewees in aviation experienced this when a company disagreed with their construct (i.e. the authority's assessment of safety culture in their company). In this case, the authority had concluded that the safety culture of the company had deficiencies, and needed to be improved. The management in the company defied, however, this description and contended that their safety culture was very good. As noted, this example provides an ultimate test of the tools that the STA use to assess safety culture in the company: how «real» or valid is the result, and how can it be justified?

Our study indicates that it seems that «everybody» (i.e. authority and company representatives) «knows what safety culture is», and that they are also able to identify companies with good and bad safety culture, based on their gut feeling and overall impression. We have discussed the level of subjective assessments involved in safety culture audits. We concluded that when specified into concrete aspects or themes (e.g. reporting, learning, employee involvement), the safety culture concept is not necessarily more abstract than other regulatory concepts. Thus, the level of subjective assessment is not necessarily higher. Our discussion of the relevance of safety culture as a regulatory concept seems, however, to indicate that the utility of safety culture as a regulatory concept is contingent on its specification. The authority representatives from aviation's use of the 28-point checklist seems to provide a good example of such a specification of safety culture. It seems however that this requires competence, both from the regulator and the company.

The Nuclear radiation authority also has an interesting and more qualitative approach; maintaining a central and big «company safety culture database», where they conduct advanced analyses to identify underlying cultural patterns, to discern these patterns from isolated events which do not necessarily reflect or indicate safety culture. This work resembles that of social anthropologists at work, and it indicates an advanced analytical approach. Assessing safety culture of companies in the nuclear sector, they look for indications of «underlying cultural patterns», in accordance with Schein's (2004) analytical separation of organizational culture into basic underlying assumptions and more superficial levels (artefacts, like slogans, visions). As noted, interviewee 2 said that you have to go «under the surface to see the actual culture»; to find the pattern and arrive at an understanding that «this is what they do». After all, the work of social scientists studying culture and regulatory authorities focusing on safety culture both involves to identify culture in social groups. The interviews indicate that we all are able to do it intuitively, based on «gut feeling» but that the tricky part is to document it in a transparent and valid way.

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Appendix 1: Interview guide - authorities

1) Introduksjon – intervjuguide til myndigheter:

Transportøkonomisk institutt (TØI) gjennomfører en studie som skal gi Transportstyrelsen et godt vitenskapelig grunnlag for å legge til rette for forbedret sikkerhetskultur i transportbedrifter i alle transportgrenene.

Hovedmålene med studien er å kartlegge:

- 1) Hvilke metoder og verktøy som kan brukes for å oppnå god sikkerhetskultur i transportbedrifter innenfor veg, sjø, luft og jernbane
- 2) Hvilken effekt på sikkerhetskultur og faktisk sikkerhet vi kan forvente av disse tiltakene?
- 3) Hvilke faktorer fremmer og hvilke forhold hemmer utvikling av organisasjoners sikkerhetskultur?

Det er selvfølgelig frivillig å delta og du kan trekke deg fra undersøkelsen når du ønsker. Informasjonen du gir oss behandles anonymt. Vi er ikke nødvendigvis ute etter din organisasjons offisielle syn på dette, men at du «tenker høyt», basert dine erfaringer, og gir oss innspill som vi kan lære av. Det du sier skal ikke kunne knyttes til deg eller din organisasjon. Vi referer til alle som vi intervjuer fra myndighetene som «myndighetsrepresentanter», og alle fra bedrifter som «bedriftsrepresentanter». Du får fremstillingen fra intervjuene til gjennomlesning, slik at du kan kommentere og rette opp i evt. feil.

2. Ditt arbeid

2a) Kan du fortelle kort om hva du gjør i ditt arbeid?

- Utstede transportløyver til bedrifter, basert på...
- Føre tilsyn med sikkerhetsstyringssystemer
- Føre tilsyn med regeletterlevelse
- Granske ulykker
- Veilede bedrifter om hvordan de bør jobbe med sikkerhet

3) Sikkerhetskultur

3a) Bruker dere sikkerhetskulturbegrepet på din arbeidsplass?

(Hvis ikke: Hva er de viktigste tiltakene dere bruker for å indirekte bidra til sikkerhet i bedrifter?, og handler disse indirekte om sikkerhetskultur? «Felles måter og tenke og handle på i bedrifter, med konsekvenser for sikkerhet» Vi kommer tilbake til dette i pkt. 7)

GENERELT:

3b) Hva legger du og dere i sikkerhetskulturbegrepet?

3c) Har dere noe strategi eller prosedyrer knyttet til sikkerhetskultur?

3d) Har dere noen metoder eller verktøy for å vurdere sikkerhetskultur?

SPESIFIKT (JF. «ditt arbeid»):

- 3e) I hvilke sammenhenger bruker du og/eller dere sikkerhetskulturbegrepet?
- 3f) Hvordan bruker dere sikkerhetskulturbegrepet i disse sammenhengene?
- 3g) Hvordan synes du at det fungerer å bruke sikkerhetskulturbegrepet i disse sammenhengene?

4) Sikkerhetskultur i organisasjoner

- 4a) Observerer du/dere forskjellige sikkerhetskulturer i organisasjoner?
- 4b) Hva er grunnlaget for disse observasjonene? (uformelt inntrykk, målinger, sjekklister, indirekte gjennom sikkerhetsnivå eller andre indikatorer?)
- 4c) Ser dere sammenhenger mellom sikkerhetskultur og sikkerhetsnivå?
- 4d) Hva bruker dere denne informasjonen til, eller hvilke konsekvenser får den i deres arbeid?
- 4e) Har du synspunkter på hva som skaper god og dårlig sikkerhetskultur i bedrifter?

5) Tiltak for å bidra til god sikkerhet i bedrifter

Innenfor forskningen skiller man mellom såkalt regelbasert tilsyn og formålsbasert tilsyn. Regelbasert tilsyn fokuserer på etterlevelse av regler, mens det formålsbaserte definerer et mål, men ikke *hvordan* bedriftene skal nå målet. *Hvordan* eller «metoden» er fokus i det regelbaserte tilsynet (mer enn målet), dersom vi definerer det å følge regler som en metode. En annen «metodefokuseret» tilsynstype er systemtilsyn, som handler å føre tilsyn med at de riktige systemene er på plass i bedrifter.

- 5a) Hva er de viktigste tiltakene eller strategiene dere bruker for å bidra til sikkerhet i bedrifter? (fokus på regler, tilsyn, kultur, opplæring?) (vi kommer tilbake til dette mot slutten, i pkt 7.)
- 5b) Hvilke tilsynstyper er det dere benytter dere mest av?
- 5c) Har du noen tanker om hvor gode disse typene er og om de passer til ulike formål?
- 5d) Hvilke faktorer hemmer/fremmer deres strategier for å bidra til sikkerhet i bedrifter?
- 5e) Opplever dere en sammenheng mellom tiltakene deres og det faktiske sikkerhetsnivået i bedriftene?

6) Nåværende tiltak for å forbedre sikkerhetskultur

- 6a) Gjør dere noe for å forbedre og videreutvikle sikkerhetskultur i bedrifter?
- 6b) Hvis ikke, kunne du tenke deg at dere gjorde det?
- 6c) Synes du at det er deres rolle, eller at det ligger i deres mandat å gjøre det?
- 6d) Har du noen ideer til hvordan det kunne gjøres?
- 6e) Har du innspill til mulige problemer og muligheter knyttet til dette?

7) Mulige tiltak for å forbedre sikkerhetskultur

7a) Hva synes du om følgende «regelbaserte» strategier som dere evt. kan bruke for å forbedre sikkerhetskultur i bedrifter? *Vurder ift. I) økt sikkerhet? II) Ressurskrevende? III) Andre fordeler/ulempes? IV) Realistisk å innføre?*

- 1) Implementere et krav om god sikkerhetskultur i bedrifter

- 2) Føre tilsyn med sikkerhetskultur
- 3) Implementere mer spesifikke krav rettet mot til sikkerhetskulturelle aspekter (FRA-ikke straff for å rapportere)
- 4) Skape kultur gjennom å innføre nye regler (som fører til nye felles måter å handle på som fører til nye felles måter å tenke på gjennom kognitiv dissonans, eks. «røykeloven» i Norge).
- 5) Implementere kultur gjennom systemer—litt på samme måten, men mer omfattende (ISM-koden til sjøs, ISO:39001 på veg).
- 6) Bruke sikkerhetskulturbegrepet i ulykkesgranskninger

7b) Hva synes du om følgende «formålsbaserte» strategier som dere evt. kan bruke for å forbedre sikkerhetskultur i bedrifter? *Vurder ift. I) økt sikkerhet? II) Ressurskrevende? III) Andre fordeler/ ulemper? IV) Realistisk å innføre?*

- 1) Tilby bedrifter verktøy for selv-evaluering og læring
- 2) Tilby bedrifter verktøy for selvutvikling
- 3) Bidra med veiledning om hvordan sikkerhetskultur skapes/gjenskapes
- 4) Bidra med virkelige eksempler på sikkerhetskulturtiltak i bedrifter
- 5) Opplæring av ledere og ansatte
- 6) Økonomisk støtte for å øke motivasjonen

8) Avslutning

Er det noe annet du mener vi burde tatt opp, eller har du noen kommentarer til spørsmålene våre?

Kan dere nevne noen foretak vi kan ta kontakt med?

Tusen takk for din hjelp!

Vi sender deg vårt sammendrag av alle intervjuene, dvs. det som vi skal rapportere i rapport og artikkel, slik at du kan komme med innspill, nyansere og rette eventuelle feil. Teksten blir på engelsk.

Appendix 2: Interview guide – companies

1) Introduksjon -intervjuguide til foretak:

Transportøkonomisk institutt (TØI) gjennomfører en studie som skal gi Transportstyrelsen et godt vitenskapelig grunnlag for å legge til rette for forbedret sikkerhetskultur i transportforetak i alle transportgrenene.

Hovedmålene med studien er å kartlegge:

- 1) Hvilke metoder og verktøy som kan brukes for å oppnå god sikkerhetskultur i transportforetak innenfor veg, sjø, luft og jernbane
- 2) Hvilken effekt på sikkerhetskultur og faktisk sikkerhet vi kan forvente av disse tiltakene?
- 3) Hvilke faktorer fremmer og hvilke forhold hemmer utvikling av organisasjoners sikkerhetskultur?

Det er selvfølgelig frivillig å delta og du kan trekke deg fra undersøkelsen når du ønsker. Informasjonen du gir oss behandles anonymt. Vi er ikke nødvendigvis ute etter din organisasjons offisielle syn på dette, men at du «tenker høyt», basert dine erfaringer, og gir oss innspill som vi kan lære av. Det du sier skal ikke kunne knyttes til deg eller din organisasjon. Vi referer til alle som vi intervjuer fra foretak som «foretaksrepresentanter» og de vi intervjuer fra myndighetene for «myndighetsrepresentanter». Du får fremstillingen fra intervjuene til gjennomlesning, slik at du kan kommentere og rette opp i evt. feil.

2) Ditt arbeid

2a) Kan du fortelle kort om hva du gjør i ditt arbeid?

3) Sikkerhetskultur

3a) Bruker dere sikkerhetskulturbegrepet på din arbeidsplass?

(Hvis ikke:) Hva er de viktigste tiltakene dere bruker for å oppnå sikkerhet i bedriften?
(Handler disse indirekte om sikkerhetskultur? «Felles måter og tenke og handle på i foretak, med konsekvenser for sikkerhet»)

Sikkerhetsstyringssystem

3b) Har ditt foretak et sikkerhetsstyringssystem, dvs. en formalisert beskrivelse av hvordan dere arbeider med risiko. Dette kan for eksempel inneholde: sikkerhetspolicy, beskrivelser av sikkerhetsroller og ansvar, rutiner for risikoanalyser, gjennomførte risikoanalyser, iverksatte tiltak på bakgrunn av analysene, prosedyrer, opplæring, rapporteringssystem osv.

3c) Kjenner de ansatte til sikkerhetsstyringssystemet, og er deres faktiske atferd i tråd med de formelle beskrivelsene i sikkerhetsstyringssystemet?

Sikkerhetskultur: generelt:

- 3b) Hva legger du og dere i sikkerhetskulturbegrepet?
- 3c) Har ditt foretak noen strategi eller prosedyrer knyttet til sikkerhetskultur?
- 3d) Har dere spesielle tiltak eller kampanjer for å videreutvikle sikkerhetskultur i foretaket?

Sikkerhetskultur: spesifikt:

- 3e) I hvilke sammenhenger bruker dere sikkerhetskulturbegrepet?
- 3f) Hvordan bruker dere sikkerhetskulturbegrepet i disse sammenhengene?
- 3g) Hvordan synes du at det fungerer å bruke sikkerhetskulturbegrepet i disse sammenhengene?

4) Risikofaktorer og tiltak i bedriften

- 4a) Ut i fra din erfaring: hvilke oppgaver, eller situasjoner er mest ulykkesutsatte?
- 4b) Hva er de viktigste årsakene til ulykker og farlige hendelser i bedriften?
- 4c) Hva er de viktigste tiltakene eller strategiene dere bruker for å bidra til sikkerhet i bedriften? (teknologi, rutiner/prosedyrer, «kultur»)

5) Spesifikt og indirekte om tiltak rettet mot sikkerhetskultur i bedriften

5a) Ledelsens innstilling til og fokus på sikkerhet

- I) Opplever du at ledelsen alltid signaliserer at sikkerhet er viktigere enn produksjon og økonomi - eller gis det i noen situasjoner motstridende signaler?
- II) Opplever du at ledelsen alltid belønner ansatte som handler på en sikker måte (for eksempel: følger regler, rapporterer hendelser), selv om det kan medføre merarbeid og forsinke fremdrift og produksjon?

5b) Involvering av ansatte og tillit mellom ledere og ansatte

- I) Opplever du at ledelsen involverer de ansatte tilstrekkelig i spørsmål vedrørende sikkerhet, og drar nytte av deres kompetanse?
- II) Opplever du at det er et godt tillitsforhold mellom ledere og ansatte i foretaket?
- III) Hvordan informeres ansatte om spørsmål vedrørende sikkerhet, og i hvilke situasjoner de komme med innspill og synspunkter på sikkerhet?

5c) Rapporterende og rettferdig kultur

- I) hvilken grad opplever du at ansatte sier fra om sikkerhetsmessige mangler og farlige situasjoner som de opplever i arbeidet?
- II) Har dere rutiner og systemer for dette (som de ansatte kjenner til)?
- III) Oppmuntrer ledelsen de ansatte til å rapportere hendelser og mangler?
- IV) Hender det at ansatte lar være å rapportere, av frykt for sanksjoner?

5d) Lærende kultur

- I) Hvordan bruker foretaket erfaringer med a) ulykker, b) hendelser og c) rapporterte avvik d) forbedringsforslag, for å øke sikkerhetsnivået?
- II) Opplever du at slik informasjon brukes systematisk av ledelsen, dvs. at den fører til nye måter å gjøre ting på (eks: prosedyrer, rutiner) og nye måter å tenke på (eks: ny opplæring)?

6) Evt. synspunkter på mulighetene for å fokusere mer på sikkerhetskultur

- 6a) Hvis dere ikke fokuserer på sikkerhetskultur, er dette noe du skulle ønske at dere gjorde? (Hvorfor?)
- 6b) Har du noen ideer til hvordan dette kunne vært gjort?
- 6c) Har du synspunkter på hvorfor dere ikke fokuserer mer på sikkerhetskultur nå?
-Evt. fordi det ikke etterspørres i regelverk, eller av tilsynsmyndigheter?

7) Synspunkter på mulige myndighetstiltak for å forbedre sikkerhetskultur

- 9a) Hvordan synes du at kontakten med tilsynsmyndighetene fungerer i dag?
- 9b) Synes du at denne kontakten bidrar til å opprettholde, eller øke sikkerhetsnivået i ditt foretak?
- 9c) Fokuserer tilsynsmyndighetene på sikkerhetskultur ---HVIS ja: hvordan synes du dette fungerer?
- 9d) Hva tenker du følgende mulige tiltak fra myndighetene? (*Vurder ift. I) økt sikkerhet?, II) Ressurskrevende?, III) Realistisk å innføre?*)
 - 1) Implementere et krav om god sikkerhetskultur i foretak
 - 2) Føre tilsyn med sikkerhetskultur
 - 3) Bruke sikkerhetskulturbegrepet i ulykkesgranskninger
- 9e) Har du/dere noe ønske om veiledning fra myndighetene til hvordan dere kan implementere tiltak for å forbedre sikkerhetskultur? (*Vurder ift. I) økt sikkerhet?, II) Ressurskrevende?, III) Realistisk å innføre?*)
 - 4) Tilby foretak verktøy for selv-evaluering
 - 5) Tilby foretak verktøy for selvutvikling
 - 6) Bidra med veiledning om hvordan sikkerhetskultur skapes/gjenskapes
 - 7) Bidra med virkelige eksempler på sikkerhetskulturtiltak i foretak
 - 8) Opplæring av ledere og ansatte

10) Avslutning

Er det noe annet du mener vi burde tatt opp, eller har du noen kommentarer til spørsmålene våre?

Tusen takk for din hjelp!

Vi sender deg vårt sammendrag av alle intervjuene, dvs. det som vi skal rapportere i rapport og artikkel, slik at du kan komme med innspill, nyansere og rette eventuelle feil. Teksten blir på engelsk.

Institute of Transport Economics (TØI) Norwegian Centre for Transport Research

Established in 1964, the Institute of Transport Economics is an interdisciplinary, applied research centre with approximately 70 professionals. Its mission is to develop and disseminate transportation knowledge that has scientific quality and practical application.

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