TOOL TO BE USED TO SURVEY AND IMPROVE SAFETY CULTURE IN THE EUROPEAN RAILWAY INDUSTRY

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PREFACE

This diploma thesis is written in department of Industrial Economics and Technology Management at NTNU and concludes my master degree in the field of health, safety and environment. This thesis has been written in co-operation with SINTEF Industrial Management, department of Safety and Reliability. SINTEF participates in a project for the International Union of Railways (UIC) that seeks to improve safety culture in the European railway industry. The main objective with this thesis has been to develop and suggest a tool for surveying and improving safety culture in the European railway industry.

Several persons have been involved in this project with advices, guidance, professional knowledge, experience and motivation.

I am very grateful for all help and support given by both of my teaching supervisors, MTM Stig Ole Johnsen and cand.polit. Trygve Steiro at SINTEF Industrial Management, department of Safety and Reliability. Thank you very much for your contribution to my work, for your professional guidance and motivation.

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Trondheim, June 4, 2004

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ABSTRACT

There is an increased need for public transportation in Europe which implies that there is a more demanding need for viable and efficient transport systems all over Europe. In the *White Paper: European Transport policy 2010: time to decide* the European Commission have published their transport strategy for the next ten years. They have seen the necessity to refocus the quality and efficiency of Europe's transport networks.

The safety of Europe's citizens is an important aspect by the transport policy. Statistics show that travelling by rail is the safest way of travelling; it is up to 20 times safer than travelling by car. But today, the European railway system is fragmented and based on national boundaries and operation under domestic rules. The European Commission have therefore decided to revitalise the railway industry by improving competitiveness and to harmonise interoperability across Europe.

Interoperability implies that a train can run on any distance of the railway network in Europe. This gives several important challenges for safety that are necessary to address. As regulations are introduced to ensure interoperability of the railway systems all over Europe, issues of safety culture has become a subject of considerable interest to the railway industry. The International Union of Railways (UIC) has therefore seen the need for practical tools that can be used to survey and improve safety culture in the interfaces that arise between different actors collaborating across national and organisational borders.

The objective of this thesis has therefore been to develop and present a tool that can be used to survey and improve safety culture in the European railway industry.

Safety culture is in this thesis defined as *the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine commitment to (…) an organisation's health and safety management.*

Safety culture is related to interfaces because it is recognised that with increased interoperability across Europe, the different cultures existing in different organisations will interface with each other and directly influence safety. Safety culture at interfaces is therefore used to express the interaction patterns that exist at interfaces; that is, how people and organisations communicate and collaborate at interfaces.

The nature of this thesis' research questions made it natural to choose a qualitative approach to the thesis. Nine in-depth interviews were carried out to obtain knowledge about safety culture issues in the railway industry. Inspired by the Hearts and Minds programme to Shell International development of the *Track to Safety Culture Questionnaire* has been based on results from the interviews combined with experiences from previous research projects and Westrum's (1993) theories. The questionnaire's quality was ensured for through an evaluation process consisting of two workshops and evaluations from three independent researchers and a Ph. D. student. The workshops were arranged in Paris and

Trondheim. In the French workshop, there were participants from several European countries and in the Norwegian workshop the participants represented all the major railway undertakings in Norway.

The Track to Safety Culture Questionnaire has in this thesis been developed and presented as a tool which European railway undertakings can use to survey and improve safety culture. The questionnaire is constructed to reflect challenges that the railway industry is confronted with. These challenges were revealed through the interviews and are related to four main areas: (1) organisation, management, responsibility and resources, (2) individuals and groups at interfaces, (3) co-operation across interfaces, (4) and learning processes. 21 questions are constructed to reflect the challenges that railway organisations can experience within each of these areas. The structure of the questionnaire reflects a safety culture ladder in which organisations can climb, and for each question there are descriptions for three of the five safety cultural levels. Each description consists of illustrative examples and safety cultural considerations.

Through the research it has been revealed that the questionnaire has a wide area of application. It can be used within an organisation for diagnosing the organisation's safety culture level, and bringing into focus how the organisation handles safety cultural issues at interfaces. It can be used as a personal assessment tool which can create motivation and awareness for safety culture among organisational members. The Track to Safety Culture Questionnaire can also be applied between collaborating organisations in aiding common understanding on important safety cultural issues and in multi-national organisations.

The main objective with this questionnaire is to improve safety culture by creating good collaborating processes and group discussions, within and between organisations. It is believed that the Track to Safety Culture Questionnaire can foster better communication and collaboration within organisations and across interfaces. The power of the tool is present in its ability to serve as a foundation for rich and valuable discussions related to safety cultural issues in the railway industry. It can contribute to a positive evolution in the organisation with a higher degree of participation and sharing of information. Based on the definition of safety culture that is used in this thesis, there is no doubt that the Track to Safety Culture Questionnaire can contribute to reinforce safety culture in the railway industry.

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PART ONE: INTRODUCTION AND BACKGROUND

1 INTRODUCTION

1.1 Background – Increased Need for Transport in Europe

Transport is a key factor in a modern society. However, there is a contradiction between society, which demands more mobility, and public opinion, which is becoming increasingly intolerant of chronic delays and poor quality of some transport services. As demand for transport keeps increasing there will be an increased need for viable and efficient transport systems all over Europe. The consequence is that transport systems need to be optimised to meet the demands of enlargement and sustainable development.

The European Commission addressed its transport strategy in the *White Paper* entitled "European transport policy 2010: time to decide" (European Commission, 2001). The Commission's objective for the next ten years is to refocus Europe's transport policy on the demands and needs of its citizens. The paper sets out plans to improve the quality and efficiency of Europe's transport networks (European Commission, 2003).

The transport systems must not only meet the society's need for mobility, viability and environmental considerations; safety has to be at least an equal consideration (ETSC, 2001) Statistics shows that travelling by car has a death risk 20 times higher than for rail (see Table 1.1 below).

Table 1.1 Safety statistics in different modes of travel (after ETSC, 2001).

Deaths per 100 million persons km ETSC 1999	
Motorcycle/moped	16
Foot	7,5
Cycle	6,3
Car	0,8
Bus and coach	0,08
All road use	1,1
Ferry	0,33
Air (public transport)	0,08
Rail	0,04

The European Commission (EC) is becoming far more involved in railways than in the past. The primary purpose of EC intervention is not currently safety, but to improve competitiveness of railways relative to other modes of transport (ETSC, 2001; European Commission, 2001). The European Commission has therefore been aware of the necessity for revitalising the railways. This means the railway sector has to open up for competition between railway companies. However, today Europe has a fragmented rail system based on national boundaries and operation under domestic rules and regulations. When opening the railway market, not only for international services but also for cabotage on national markets, efforts have to be made to harmonise interoperability and safety across national and organisational borders (European Commission, 2001; 2003). Interoperability is defined *as the*

train's ability to run on any stretch of the railway network in the Union (European Commission, 2003, page 5).

However, the advantage is that railway has the ability to shift traffic off roads and thus, has a huge potential regarding safety. Even though the primary purpose of EC's intervention is not safety, there is a desire to improve safety in European railways: *"Interoperability must guarantee a level of safety at least equal to, if not higher than, that achieved today in the national context."* (European Commission, 2001, page 31).

Nevertheless, the statistics shows that travel by rail is declining. There are fewer railway lines now than 30 years ago; reflecting that rail's market share for both freight and passengers has decreased continually over the same period. Statistics shows that there was an inexorable rise in road use for the same period, which implies what form of transport citizens and industry favours. By opening up the markets, new railway undertakings will enter the market, and competition will be bolstered.

The European Commission stresses that there still remains a lot of work, both technically and culturally, if Europe is to improve and harmonise its currently fragmented rail system; a system which almost exclusively is based on national boundaries, and operates under domestic rules and regulation. If Europe is to have a competitive, integrated railway system, it requires that everyone in the industry must pull together to change working culture and attitudes. These involve public authorities, infrastructure managers, railway undertakings, manufacturers, regulators, social partners and customers (European Commission, 2003).

1.2 The *UIC Safety Culture at Interfaces* Research Project

As legislation is introduced these days to ensure the interoperability of railway systems across Europe, the issue of safety culture has become a subject of considerable interest to the railway industry. This is because it is recognised that the different cultures existing in different organisations will interface with each other, and that organisational culture has a direct impact on safety (European Commission, 2003; Johnsen et. al., 2003a).

The main objectives with the UIC-SCAI project[1] is to develop a clear understanding of the specific issues of safety cultures at interfaces and to develop techniques that can be used by the industry to predict where cultural interface issues may arise. The aim is to achieve a clearer understanding of how

[1] UIC is the abbreviation of *International Union of Railways*. UIC is the worldwide umbrella organisation for railway cooperation, and it is active in all the fields involved in developing rail transport. In December 2002, UIC sent out an invitation to tender the *UIC Safety Culture at Interfaces project* (UIC-SCAI project). In January 2003 SINTEF responded to the UIC Invitation to Tender (ITT) – Issue 1, and was assigned on the project. The project is still in progress.

cultural interfaces can be improved, and it is desired that the techniques created through the project should incorporate methods for making such improvements (Railway Safety, 2002).

In Figure 1.1, different identified interfaces in the European railway industry are presented. Based on the increased competition among railway companies, the primary interfaces to be analysed are between railway undertakings crossing borders within EU. The interfaces between infrastructure operators and maintenance operators supporting the railway undertakings should also be investigated. The UIC-SCAI project group has identified that the most important interfaces regarding cross border traffic is the interfaces between the "locomotive driver" and the "traffic control" and between "regulatory authorities" and the "industry" (or "railway undertakings") (Johnsen et. al., 2003c).

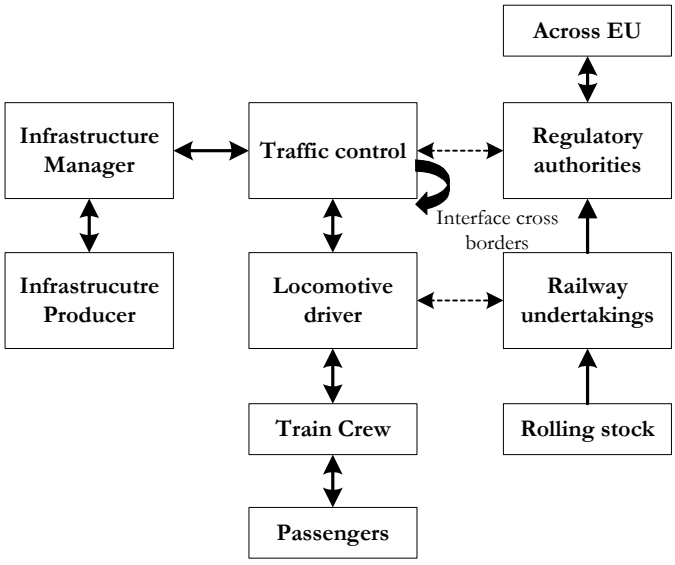


Figure 1.1 Identified interfaces in the railway industry (after Johnsen et. al., 2003a).

1.3 Objective

As presented above, the International Union of Railways (UIC) requests tools to survey and improve safety culture in European Railways. The purpose of this thesis is to develop a tool for European railways that reflects the challenges the industry is confronted with, in the age of deregulation and cross border competition. With this in mind, the following objectives are formulated for this thesis:

1. Examination of theory and relevant literature for solving the task.
2. Development and evaluation of a tool to survey safety culture in European railway industry.
3. Perform a user evaluation of the suggested tool. This will be done in order to gain information on user needs and experience when adapting the tool. The evaluation process will be accomplished through a limited examination, and will be supplemented through interviews and discourses.
4. The results will be presented in a report (this report).

1.4 Research Questions

Based on the objectives listed in chapter 1.3, two questions have been formulated for further research in this thesis:

Q-1: What challenges is the railway industry faced with in relation to safety culture at interfaces?

- What is safety culture and what is meant by interfaces?
- What are the main challenges in the railway industry?

Q-2: How can European railway undertakings improve safety culture at interfaces?

- Presentation of the questionnaire "Track to Safety Culture" as a tool for surveying and improving safety culture at interfaces.
- Evaluation of "Track to Safety Culture.

1.5 Scope and Limitation

Safety Culture at interfaces is a broad issue and therefore it is seen as important to define and limit the scope of this thesis.

The research questions presented in chapter 1.4, give the basis for this thesis. Question **Q-1** is answered through theory and nine in-depth interviews and is limited to give an account for safety culture challenges at interfaces as revealed through the interviews. The first subordinated issue is answered through theory in chapter 2. The second subordinated issue is answered through presentation of the results from the interviews in chapter 5. The aim with **Q-1** is to give scope and foundation for working with **Q-2**. Hence, the main aim with this thesis is to give a review of and to answer **Q-2**.

There exists several approaches on how to work with safety culture, and the intention is not to present these approaches. The aim with **Q-2** is to present a questionnaire; the *Track to Safety Culture Questionnaire* which is especially developed and specified to reflect the challenges the railway industry is confronted with regarding safety culture. The Track to Safety Culture Questionnaire is suggested as a facilitation tool for surveying and improving safety culture in the European railway industry, and is presented in chapter 6 and 7. Hence, the objective with this thesis is to develop and present a tool that can be used to survey and improve safety culture in the European railway industry.

A deliberate choice has been made omitting the challenges the railway industry may face regarding technical differences. It was seen as more interesting to develop a tool that reflected organisational challenges that occurs between and within organisations which operate at railway interfaces.

It is important to stress that the *Track to Safety Culture Questionnaire* is a draft. The version of the *Track to Safety Culture Questionnaire* enclosed here, is the version that was delivered to the UIC-SCAI project group at SINTEF Industrial Management for further improvements. The questionnaire will be examined through pilot tests, which will be accomplished in the period from December 2003 to March 2004, as part of the UIC-SCAI project.

1.6 Definitions

In this thesis there are some words that need a closer definition and limitation. Definitions are given below:

HSE	Health, Safety and Environment
Interfaces	Situations or places where people with different nationalities, professions and from different organisations meet, and need to co-operate (Author's definition).
Interoperability	Interoperability is defined as the capability to operate on any stretch of the rail network without any difference (Defined by the European Union).
Railway undertaking	Includes all rail participants; infrastructure managers as well as railway operators and other contractors.
Safety culture	The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine commitment to, and the style and proficiency of, an organisation's health and safety management (Health and Safety Executive[2]).
SINTEF	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (located in Trondheim, Norway).
TSC	Track to Safety Culture Questionnaire – the abbreviation of the suggested tool. Terms like 'TSC Questionnaire' and 'the questionnaire' may occur.
UIC	International Union of Railways (located in Paris, France).
UIC-SCAI	The UIC Safety Culture At Interfaces project.

[2] Third report of ACSNI (Advisory Committee for Safety on Nuclear Installations) study group on human factors – Organising for safety. HSE, 1993, p. 23.

1.7 Structure of the Report

An overview of the structure of this thesis is given below:

Introduction and Background

Chapter 1

The chapter presents the basis for the thesis. It gives the background information needed to understand the intentions with the work, presents the objective and the research questions, terminology and structure of the thesis.

Theoretical Framework

Chapter 2

The chapter gives the theoretical foundation for understanding issues regarding safety culture at interfaces. It presents different cultural perspectives, a view on safety culture, and levels of safety culture and finally why safety culture is interesting regarding interfaces.

Chapter 3

The chapter presents a tool for surveying and improving safety culture in the oil industry, and shows how the ideas behind and the configuration of this tool might be of interest to the railway industry. It presents Action Research as a possible approach to organisational change and also a theoretical introduction to organisational learning.

Scientific Approach

Chapter 4

This chapter presents the scientific approach used in this thesis: data acquisition, data analysis and presentation of results. It gives an overview of the accomplished tasks and the project's development process. It also gives an overview of the configuration of the remaining chapters.

Results and Discussion

Chapter 5

Research question Q-1, is answered. It presents challenges for safety culture at interfaces based on nine in-dept interviews.

Chapter 6

Research question Q-2, and the first subordinated issue is answered. It presents the *Track to Safety Culture Questionnaire* which can be used to survey and improve safety culture in the European railway industry.

Chapter 7

Research question Q-2, and its second subordinated issue is answered. Findings from the evaluation process of the questionnaire is presented, this includes area of utilisation, obstructions for use and suggestions for further improvements. This chapter also places the questionnaire in a wider setting.

Summary and Concluding Remarks

Chapter 8

This chapter summarises the main findings in this thesis and aims at closing the thesis. Here an self-evaluation of the scientific approach is given and also suggestions for further research is given.

Chapter 9

This chapter concludes the thesis.

PART TWO: THEORETICAL FRAMEWORK

2 SAFETY CULTURE AT INTERFACES

This and the next chapter will present the theoretical framework needed to answer the two research questions formulated in chapter 1.4. Primarily, in this chapter research question **Q-1** and its first subordinated issue is addressed. In the frame below the research question is presented. The second subordinated issue is presented and answered by empiricism in chapter 5.

Q-1: What challenges is the railway industry faced with in relation to safety culture at interfaces?

- What is safety culture and what is meant by interfaces?
- What challenges are identified in the railway industry?

In order to answer **Q-1** it is necessary to understand and define the term safety culture. Several approaches and definitions of safety culture exist, and the purpose with this chapter is not to give a fully overview of existing approaches and definitions, but rather to clarify the perspectives and definitions of this project.

The notion of safety culture first arose in the aftermath of the Chernobyl accident in 1986 (Pidgeon, 2001). Catastrophes like the Challenger accident (Haukelid, 2001) and Pipher Alpha accident (Glendon and Stanton, 2000) increased the interest for safety culture. In railways accidents like Paddington (United Kingdom) and Eschede (Germany) (European Commission, 2003) and the Hatfield accident in 2000 (Wolmar, 2001) have increased focus on safety culture in the industry.

To be able to understand safety culture, it is necessary to understand what culture is about. The next section will give an introduction to cultural perspectives of importance to safety culture.

2.1 Cultural Perspectives

Culture has been a key concept in anthropology for ages, but lately management and organisational researchers have shown interest in the term, and have adopted it. This has lead to development of two rather different approaches to culture; the functionalist approach and the interpretive (or symbolic) approach (Glendon and Stanton, 2000)[3].

- The *interpretive approach* assumes that organisational culture is an emergent complex phenomenon of social groupings. The culture is the prime medium for all members of an organisation to interpret their collective identity, beliefs and behaviours. Organisational culture is not owned by any group but is created by all the organisation's members. For an anthropologist a cultural study is to describe and to understand a particular culture, and not to change it (Haukelid, 2001).
- The *functionalistic approach* assume that organisational culture exists as an ideal to which organisations should aspire so that it can be manipulated to serve corporate interest. Organisational culture is thus a management tool and support

[3] For a thorough description of different cultural perspectives it's referred to Bergersen, 2003.

> management ideology, goals and strategy. Hence, culture is a control mechanism in the organisation, and management tries to develop the "right" culture as this is seen as essential to organisational efficiency (Schein, 1992).

More easily, one can say that the interpretive approach use culture to understand organisational life, while the functionalistic approach discusses the link between organisational performance and culture.

As the main intention with this thesis is to develop and present a tool which can be used to survey and improve safety culture, it is given that the cultural approach used here is functionalistic. This implies that it is assumed that culture can be changed or improved related to safety.

Schein (1992) have a strong position both within literature on organisational culture and safety culture. Many researchers build their analytical approach on his framework (Johnsen et. al, 2003a) and Schein's views of culture are so well-known that it is seen as essential to give a brief presentation here.

Schein (1992) argues that culture can be analysed at different levels, and where the term level refers to the degree to which the cultural phenomenon is visible to the observer. These levels range from the very tangible overt manifestation that one can see and feel (artefacts) to the deeply embedded, unconscious basic assumptions which Schein defines as the essence of culture. In between there exists a level where various espoused values, norms, and rules of behaviour that members of the culture use as a way of depicting the culture to themselves and others (for an exhaustive review it is referred to Schein, 1992, ch. 2).

Schein (1992) defines culture of a group as:

> *A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive , think, and feel in relation to those problems* (Schein, 1992, p.12).

This definition introduces three important aspects; the socialisation process, behaviour and the question if organisations only can have one culture. Related to the socialisation process, Schein (1992) emphasises that to reveal *how new members learn* in an organisation is more interesting than revealing what they actually are learning, as this expose deeper assumptions. The next aspect is about behaviour. Schein's definition does not include overt behaviour patterns, as behaviour reflects the basic cultural assumptions. Behaviour is determined by how we perceive, think about things and feel in combination with the situational contingencies that arise from the immediate external environment (Schein, 1992). The last aspect questions if organisations only can have one culture. The definition does not specify the size of a social unit where it can legitimately be applied. Schein claims that organisations at a certain size have variations among the subgroups, and it is therefore not appropriate to talk of "the culture". Over time a social unit will produce subunits that will produce subcultures as a normal

process of evolution. Some of these subcultures will typically be in conflict with each other (Schein, 1992).

Schein can be placed within a functionalistic tradition. The reason for this is his strong focus and believes in managers as cultural manipulators. One of the most powerful mechanisms that managers have available for communicating what they believe in or care about, are what they systematically pay attention to. This can mean anything from what they notice and comment on to, what they measure, control, reward or in other ways systematically deal with (Schein, 1992). Schein claims that managers can manipulate culture by:

- What they pay attention to, measure, and control on a regular basis.
- How they react to critical incidents.
- How they allocate scarce resources.
- How they do role modelling, teaching and coaching.
- How they allocate rewards and resources.
- How they recruit and select new members.

Schein stresses that if managers are aware of this process, then by being systematic in paying attention to certain things it becomes a powerful way of communicating a message. On the other hand, if managers are not aware of the power of this process, by being inconsistent in what they pay attention to, subordinates and colleagues will spend time trying to understand a leader's behaviour.

Guldenmund (2000) argues that the way Schein conceives and defines culture there is no need for a specific definition for safety culture. The basic assumptions permeate throughout the organisation, including its aspects of safety. However, in order to tailor the questionnaire to a definition of safety culture it is desirable with a more specific definition.

2.2 Safety Culture

Safety culture is a difficult concept to understand. There is lack of agreement between the theoreticians and practitioners within the field, on how to define, measure and approach safety culture (Johnsen et. al, 2003a). Hale (2000) concludes in a special edition of Safety Science on safety culture, that there is still a lot of research to be done to clarify the concept.

One route to an understanding of safety cultures is through the study of past accidents focusing in particular upon their organisational preconditions. Research has shown that accidents arise from an interaction between human factors and the organisational arrangements of the socio-technical systems set up to manage complex and ill-structured risk problems (Pidgeon, 2001). Bergersen (2003) has shown based on Schein's (1992) definition of culture and Argyris and Schön's (1996) theories in use, that basic assumptions pervade the organisation and give guidance for behaviour and actions. Hence, basic assumptions also affect organisational safety (Guldenmund, 2000).

According to Pidgeon (2001), organisations operate within a variety of cultural beliefs and norms with respect to hazards and their management, which might be formally laid down in rules and procedures,

or more tacitly taken for granted and embedded within the culture of everyday working practices. This implies that experience related to risk and risk handling is present in the organisation as tacit knowledge. However, over time there is an incubating build-up of latent errors and events at odds with the prevailing assumptions about hazards, which make the system vulnerable to catastrophe. An accident is nearly always associated with disturbance or a breakdown in existing cultural convictions and norms related to risk (Pidgeon, 2001).

Because safety culture is a difficult concept, actions need to be taken to make it more tangible. One way to do this is to define it clearly and exemplify what is good and bad culture. The next two sections gives an introduction to the view of safety culture that is used as a basis in this thesis.

2.2.1 Levels of Safety Culture

Westrum (1993) distinguishes between effective and ineffective organisations in the sense of their ability to handle problems that arise when developing large complex systems. Effective organisations quickly note serious problems and rapidly attack them. With ineffective organisations it is the opposite; problems are skirted and hidden, and only half-solved.

According to Westrum (1993) organisations must have a culture of conscious inquiry in order to assure for its safety. This implies that organisations must encourage individuals and groups to observe, to inquire, to make their conclusions known; and where observations concern important aspects of the system, actively to bring them to the attention of higher management. How well the organisation can do this, relies on how successfully information flows inside the organisation. Westrum (1993) has divided organisations in three classes depending on their ability to let information flow. This classification is shown in Table 2.1.

Table 2.1 How organisations treat information (Westrum, 1993)

PATHOLOGICAL	BUREAUCRATIC	GENERATIVE
Do not want to know	May not find out	Actively seek information
Messengers are shot	Listened if they arrive	Messengers are trained
Responsibility is shirked	Responsibility is compartmentalized	Responsibility is shared
Bridging is discouraged	Allowed but neglected	Bridging is rewarded
Failure is punished or covered up	Organisation is just and merciful	Inquiry and redirection
New ideas are actively crushed	New ideas present problems	New ideas are welcomed

Westrum (1993) emphasises that the “licence to think” is one of the key features of effective organisations and associates this with what the organisation encourages individuals to do. Individuals develop the will to think when there is reason to believe that their thoughts will be used. Accordingly

is a generative organisation an effective organisation when it gives its individual the "licence to think". By encouraging communication of ideas, thoughts and information that is of vital importance, the organisation can experience that its individuals eager to share their thoughts and ideas.

So how can organisations manage this in practice? Westrum (1993) has identified so called organisational "pop-out" programs or channels that encourage persons with important ideas or thoughts to share. A sample of these "pop-outs" is presented below:

- *Certain Multiple Entry Points:* The best way to stifle information is to insist that it only go through channels. Organisations that want better information flow encourage entry not only through the hierarchy, but virtually anywhere.
- *Spontaneous Independent Action:* Some organisations encourage individuals to act when they see something that needs correcting. These organisations clearly place much faith in their people. Workers in such organisations have a broad view of their responsibility and organisational operations.
- *Open Fora:* Management plays a key role for determining what will be acceptable as standards for performance. Their behaviour is a standard for the rest of the organisation. Through arranging small direct-contact meetings with employees, management can be brought closer to their workers and create an atmosphere for airing complaints and ideas.
- *Surveys:* Company wide surveys can serve as an important input to management if it is difficult to get workers to share their thoughts and ideas.

Based on Westrum's (1993) classification of organisations related to their culture for handling information, Hudson (2001) and Hudson and van der Graaf (2002) present an evolutionary model of safety culture and suggest that the three organisational classes can characterise various levels[4] of cultural maturity as shown in Figure 2.1.

The figure shows a ladder in which organisations can climb. The ladder starts at the bottom with the ***pathological culture*** where nobody cares to understand why accidents happen and how they can be prevented. Organisations with a pathological culture are ruled by a desire to preserve status quo; they deny signals, punish whistle blowers and avoid reporting. At the top, in the ***generative culture***, safety is no longer a topic of separate discussions – safety is totally integrated in the business and therefore a part of everything being done. Organisations with a generative safety culture are learning organisations with a higher order feedback system. They welcome and encourage danger signals, see wider implications, and are positive to system changes.

In between, at the ***calculative culture*** (same as the bureaucratic class in Westrum's (1993) model) the organisation plays it with the rules and downplays signals. The workforce in this kinds of organisations are of the opinion that everything is in place and that it is possible to tick off boxes to show that everything is done according to the books. An organisation with a calculative safety culture ignores wider system feedback and confines to deviation control.

[4] When the term level is used here, it should not be confused with the description of culture given by Schein (1992), as presented in section 2.1.

In addition to Westrum's (1993) three classes, Hudson and van der Graaf (2002) have included two extra levels of safety culture, i.e. reactive culture and proactive culture. The ***reactive culture*** lies between the pathological and calculative culture and is a stage in which a lot attention is given to safety, but only after an accident has happened. In the same way, the ***proactive culture*** lies between the calculative and the generative culture and it's recognised by that everything is in place but that the organisation is still looking for areas to make improvements (Hudson, 2001).

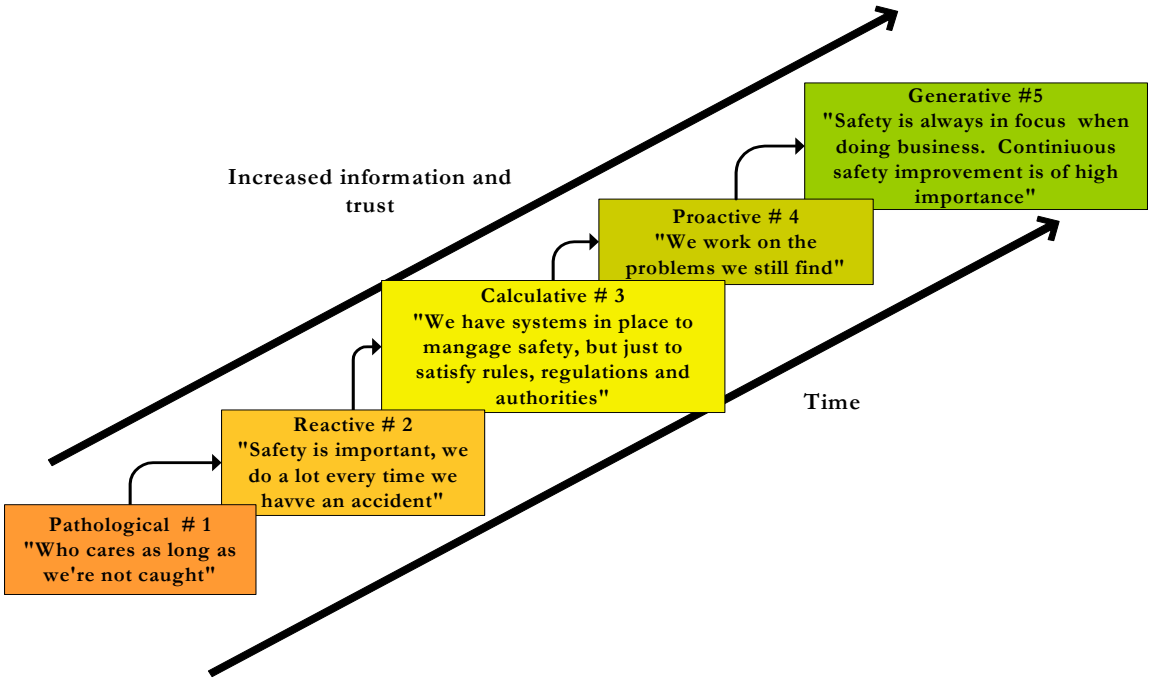


Figure 2.1 The safety culture maturity model (Hudson and van der Graaf, 2002).

2.2.2 Characteristics of a Good Safety Culture

As presented in the previous section, safety culture maturity can be described through five levels; from a culture where safety hardly is prioritised to a culture where safety is given high priority. But what characterises a culture that gives safety a high priority? Or, what is a good safety culture recognised by?

Reason (1997) has identified a number of characteristics that go to make up such a safety culture. These are:

- *A reporting culture* – a culture in which people are willing to report errors and near misses.
- *A just culture* – a culture of 'no blame' where an atmosphere of trust is present and people are encouraged or even rewarded for providing essential safety-related information – but also where it is a clear line between acceptable and unacceptable behaviour.
- *A flexible culture* – which can take different forms but is characterised as shifting from the conventional hierarchical mode to a flatter professional structure
- *A learning culture* – the willingness and the competence to draw the right conclusions from its safety information system, and the will to implement major reforms when the need is indicated.

These four components are four critical subcomponents of a safety culture. Together they interact to create an informed culture, which Reason (1997) equalises with safety culture; "An *informed culture* – one in which those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole. In most important respects an informed culture *is* a safety culture." (Reason, 1997, p. 195)

With this in mind, review the safety culture maturity model in Figure 2.1. Hudson (2001) argues that the four characteristics given by Reason (1997) form a culture of trust. Therefore, as the organisation strives to reach a higher level of safety culture maturity, the organisation aims a more informed culture and according to Hudson (2001) this implies a culture rich in trust.

2.3 Safety Culture at Interfaces

The first subordinated issue to **Q-1,** also asked what is meant by interfaces. As presented in Figure 1.1 at page 4, the term interface covers the interactions between different actors in the industry, both domestic and in cross border traffic.

But what makes interfaces particularly interesting in relation to safety culture? I will try to illustrate this by using Rasmussen's (1997) socio-technical system. According to Rasmussen we live in a dynamic society where our surroundings and our living conditions are under constant change. These conditions will be further strengthened when one is dealing with several interfaces.

Figure 2.2 illustrates the socio-technical system that is involved in the control of safety and the several academic disciplines involved at each of the various levels. At the top, society seeks to control safety through the legal system: safety has a high priority, but so has employment and trade balance. Legislation makes explicit the priorities of conflicting goals and set boundaries of acceptable human conditions. At this level, research is within the focus of political and legal sciences.

On the next level we find authorities and industrial associations, workers' unions and other interest organisations. At this level, legislation is interpreted and implemented in rules to control activities in certain kinds of work places, for certain kinds of employees. This is the level of management scientists and work sociologists.

The rules need to be operational, and at next level rules are interpreted and implemented in the contest of a particular company. Here the working processes and applied equipment are taken into consideration as a part of the interpretation and implementing process. Then, the rules are put into operation by management, which implies that rules and regulations once more are interpreted in a local context.

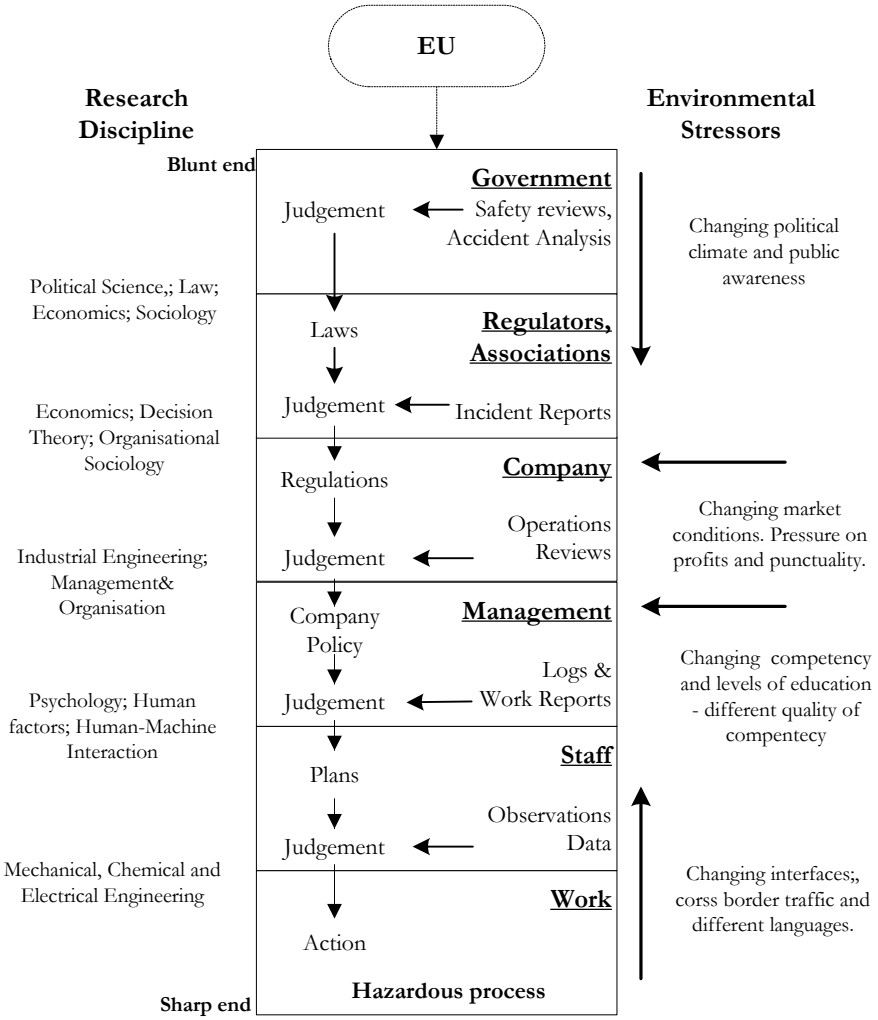


Figure 2.2 The socio-technical system (after Rasmussen, 1997)

Finally, at the bottom levels we meet workers with different professions and backgrounds that are involved in the hazardous processes and thus are in the sharp end of the decision processes (Rosness, 2001). These workers interpret the rules based on their surroundings; the rules are actuated by putting them into practice by workers' actions.

On the right hand side of the rectangular frame one can see the environmental factors that affect the socio-technical system in different ways. One may say that these factors are mental factors of strain for all decision makers at all levels. This means that decisions at different levels in different situations will be affected by these environmental stressors. On the left hand side of the rectangular frame one can se different research disciplines that also will make its influence on how decisions are made.

Schmidt (2003) has done research on "Human Factor and Safety in European Freight Traffic". The aim with this research was to provide methodological data and recommendations taking into account human factors in order to ensure the safety of interoperability (Schmidt, 2003). In her report, Schmidt presents a similar but still different approach to the socio-technical system, based on Fahlbruch and Wilpert (1998).

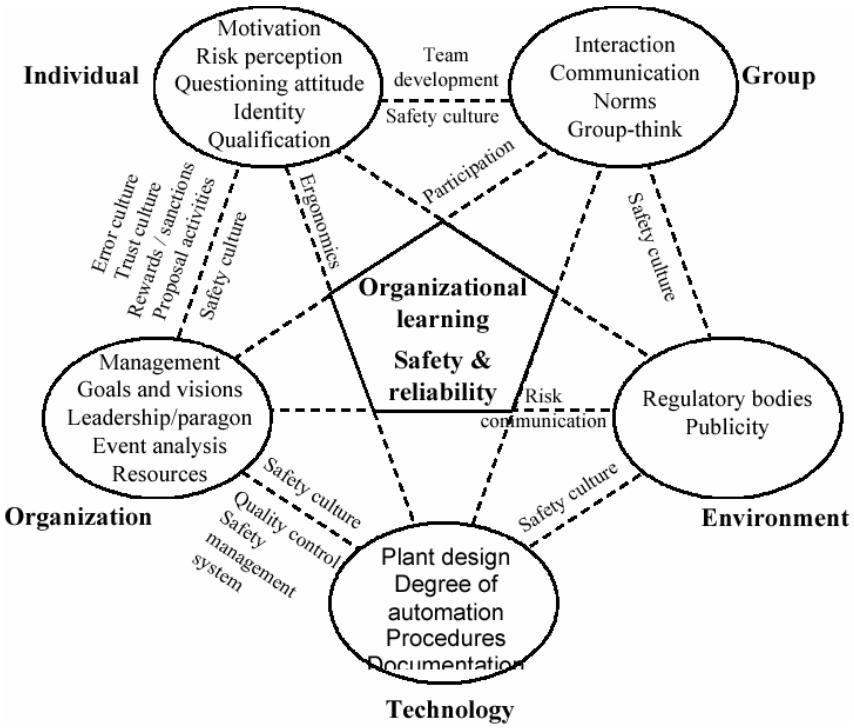


Figure 2.3 Sub-systems interacting for safety and reliability (after Fahlbruch and Wilpert, 1998)

This approach is presented here because it is used to organise and structure the findings from the interviews and the questionnaire. The figure includes five subsystems; individual, group, environment, technology and organisation. It illustrates the interactions between the different subsystems in a working system and the factors that may influence these interactions. According to Fahlbruch and Wilpert (1998; in Schmidt et. al., 2003) alongside technical, human and organisational error, an "inter-organisational" error or "inter-organisational failure" could arise. An "inter-organisational" error or failure are produced by the complex systems of different units interacting in unprepared, even neglected and unthinkable ways.

With these two approaches to the socio-technical system in mind, let's go back to the opening question of this section; what makes interfaces particularly interesting to safety culture?

As illustrated by Rasmussen's (1997) socio-technical system, each organisation is influenced by several factors prevailing through the system. However, different organisations are placed within different socio-technical systems, having various and different factors influencing their operation and workforce. And research has shown that accidents arise from an interaction between the socio-technical system and human factors (Pidgeon, 2001). When several organisations meet and interact at interfaces, either nationally or internationally, they are all influenced by different systems, depending on national culture, regional culture, organisational culture and even personal interpretations (Hofstede, 1991). When Westrum (1993) and Hudson (2001) then argues that there exists different levels of organisational safety culture, one can only imagine how this will affect collaboration at nationally and internationally interfaces. Seen in relation to the European Commission's (2003) transport policy, safety cultural issues at interfaces must be addressed: "*Changes in working culture*

and attitude are required if Europe is to have a competitive, integrated railway system." (European Commission, 2003, page 25)

2.4 Safety Culture Defined

In the previous sections an introduction to different aspects of culture and safety culture is given. By now, it is therefore time to narrow the scope and define safety culture. As mentioned in the beginning of this chapter, the purpose has not been to give an account for all existing views on safety culture, but to clarify the perspectives of this thesis.

The safety culture definition used in this thesis is taken from Health and Safety Executive[5]:

> *The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine commitment to, and the style and proficiency of, an organisation's health and safety management.*

To narrow the view even more; when talking about safety culture at interfaces, the focus will be on *characteristic interaction patterns, i.e. how people collaborate and communicate at interfaces.*

The first research question **Q-1** in this thesis, raises the question: *What challenges is the railway industry faced with in relation to safety culture at interfaces?* Seen in relation to the above theoretical perspectives, definition and approach; safety culture challenges at interfaces can be related to management involvement and commitment, shared commitment an level of care for hazards in the organisation, organisational learning, if there exists a reporting, just or flexible culture in the organisation and how organisations co-operate across interfaces. In chapter 5, research question **Q-1** is more thoroughly answered through empiricism.

[5] Third report of ACSNI (Advisory Committee for Safety on Nuclear Installations) study group on human factors – Organising for safety. HSE, 1993, p. 23.

3 SURVEYING AND IMPROVING SAFETY CULTURE BY USER PARTICIPATION

Research question **Q-2** focus on *how European railway undertakings can improve safety culture at interfaces*. This chapter focus on relevant theory related to organisational learning and changing processes. It presents Argyris and Schön's (1996) view on organisational learning and connects these principles to Action Research, which can be used to approach organisational change. Finally, a brief presentation of the Hearts and Mind programme to Shell International is given. This programme is used since 1986 to work with HSE issues and safety culture in the company, showing interesting results in developing a culture for safety.

3.1 Organisational Learning

In Figure 2.3 a view of how the socio-technical system affects organisations was given. Here, five subsystems interact in the working system and influence organisational learning. Argyris and Schön (1996) see organisations as areas of learning. According to them, an organisation learns when it acquires information (knowledge, understanding, techniques or practices) of any kind by whatever means.

Argyris and Schön (1996) present two learning processes that can be present in organisations; single-loop-learning and double-loop-learning. Double-loop-learning implies organisational learning, while single-loop-learning does not. They argue that the most common learning process present in organisations is single-loop-learning. *Single-loop learning* is characterised by instrumental learning in that the organisation changes strategies of actions or assumptions in ways that leaves the values of a theory-of-action[6] unchanged. *Double-loop learning* is a learning which results in a change in the values of theory-in-use, as well as its strategies and assumptions. Single-loop-learning and double-loop learning is illustrated in Figure 3.1. Double-loop learning refers to the two feedback loops that connect the observed effects of an action with strategies and values served by strategies. Double-loop learning may be carried out by organisations, when individuals or members of the organisations by their inquiry change the values of their theories-in-use and in that way changes the values of the organisational theory-in-use. More easily; single-loop-learning mean that the organisation correct deviations without asking why the deviation occurred. By not asking why, the organisation does not

[6] Argyris and Schön (1996) argue that theories-of-action, take two different forms; espoused-theory and theories-in-use. The espoused-theory is the theory of action which is advanced to explain or justify a given pattern of activity. On the other side, theory-in-use is the theory of action which is implicit in the performance of that pattern of activity. Theory-in-use is not given; it must be constructed from observation of the pattern of an action.

learn from the incident. On the other hand, double-loop-learning exists if the organisation questions the actions that resulted in the deviation, and use this experience to avoid similar actions in the future.

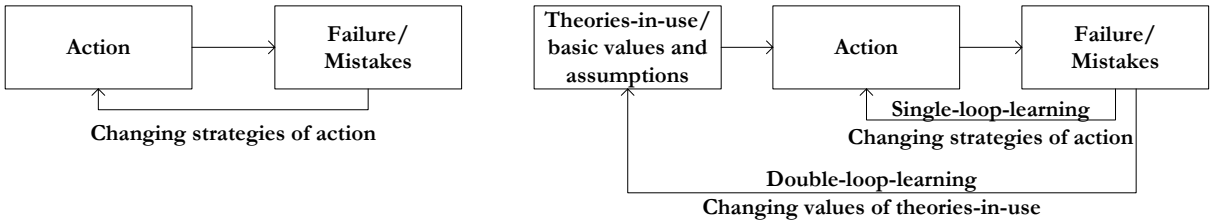


Figure 3.1 Single-loop-learning (left) versus double-loop-learning (right).

Argyris and Schön (1996) argue that organisational learning includes some informational content, a learning product; a learning process which consist in acquiring, processing and storing information, and a learner to whom the learning process is attributed. They also argue that people are more likely to provide valid information about their own intentions and reasons for action when they share control of the process of generation, interpreting, testing and using information.

In the next section a research approach, called Action Research, will be presented. The approach represented by Action Research can be used in organisational changing processes. Action Research is social research that is concerned as much with individual and group learning as it is with achieving change (Arnold et. al., 1998).

3.2 Action Research

Action Research is social research carried out by a team encompassing an action researcher and members of an organisation or community seeking to improve their situation. Action Research seeks to promote broad participation in the research process and supports action leading to a more just or satisfying situation for the stakeholders (Greenwood and Levin, 1998). Action Research aims to solve organisational problems through social action or dialogue. An important aspect with Action Research is that the action researcher is a facilitator, not a director or a doer. This means that the real task for the action researcher is to develop those involved, and to create a learning environment that allows them to gain new insight into themselves and their circumstances (Arnold et. al, 1998). Hence, Action Research rests on the belief that all people, both the action researchers and participants from the organisation, accumulate, organise and use complex knowledge constantly in everyday life.

The Action Research process can be described as a cyclic wheel as shown in Figure 3.2 (Alteren, 1999). This wheel represents that the change process is continuous and that a central part of the changing process is the close cooperation between the action researcher and the members of the organisation.

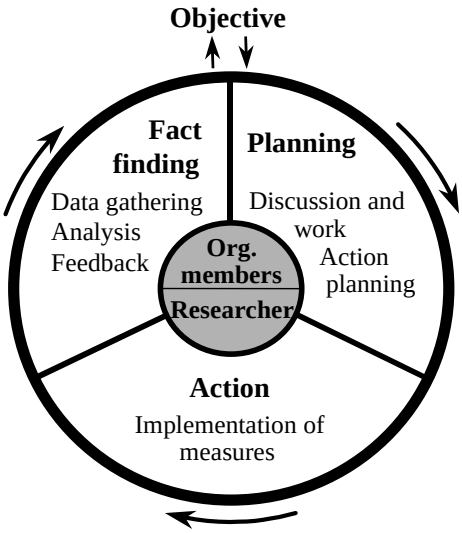


Figure 3.2 The Action Research Wheel (Alteren, 1999)

"Fact Finding" represents the first phase in the cyclic action research wheel. This phase encompasses information acquisition, analysis and feedback to the organisation. This phase exposes problems and challenges for the organisation, e.g. a poor safety culture that leads to unsatisfactory safety performance. In this phase the action researcher plays a vigorous part together with the members of the organisation, in revealing these problems and challenges.

As a result of this first phase, the researcher together with the organisation, develop an objective. For instance, this objective can be to develop a tool for surveying safety culture at interfaces. In the next phase, "Planning", challenges and problems are discussed jointly. Several suggestions for solutions for each problem can arise as a result of this phase. The main aim with this phase is to make the formulation of the solutions as concrete and clear as possible so that all members can agree upon and understand the given premises (Guttormsen, 2001).

In "Action", the suggested solutions and actions are implemented in the organisation. In this phase it is of high importance that the action researcher acts as a facilitator, while the members of the organisation as those who are affected by the process, administrate most of the process themselves (Guttormsen, 2001). This is to ensure a higher degree of commitment to the changes.

When the process has passed all phases, the wheel starts rolling again. The "Fact Finding" phase is now used to evaluate the process in order to see if the objectives are achieved. If they are not, new information is found, new objectives are defined and a new planning phase is actuated, and so the wheel keeps rolling. As the organisation needs a continuous improvement process new areas for research are defined and planned.

The action research wheel can be comparable with Deming's circle used in quality management. As for the action research wheel, the idea behind the Deming's circle is to ensure continuous improvement through consecutive rotations of the circle or wheel. Deming's circle shows the cycle in

a learning process from planning, through execution and check to correction (Kjellén, 2000). The first three phases in Deming's circle "Plan-Do-Check" corresponds to the phases in the action research wheel, as shown in Figure 3.2 (Alteren, 1999). The "action" phase, is the fourth phase in Deming's circle, and represents a phase where corrective actions are implemented and the experiences are summarised, and where the organisation ensures that improvements are standardised and practiced continuously (Kjellén, 2000). Standardising and follow-up of improvements of the process are essential. However, this is regarded as the responsibility of the organisation and is thus left out of the action research wheel (Alteren, 1999).

According to Greenwood and Levin (1998) is Action Research composed of a balance between three elements:

- *Research* – is the power and value of knowledge, and Action Research is one of the most powerful ways to generate new knowledge.
- *Participation* – Democracy and control over one's own life situations creates a strong general commitment to the knowledge generation process. The involved researchers act as facilitators and teachers of the members of the organisations. Together the participators establish the agenda, generate the knowledge necessary to transform the situation, and put the results to work. Action Research is thus a participatory process in which everyone involved takes some responsibility.
- *Action* – Action Research aims to alter the initial situation of the group, organisation or community in the direction of a more self-managing, liberated state. These reforms are democratic rather than revolutionary.

According to Greenwood and Levin (1998) is the research process not Action Research if one of these elements is absent. This means that the wheel in Figure 3.2 presents the actual *research process* where new knowledge is generated. In the centre of the wheel, organisational members and facilitating researchers is located. This is to illustrate the broad focus on *participation* that Action Research promotes. The action research wheel needs to continuously roll, like Deming's circle, in order to ensure that the *action* element is preserved. That is the only way that the organisation can ensure for double-loop-learning and lasting changes.

3.3 The Hearts and Minds Programme

To close this chapter dealing with surveying and improving safety culture by user participation, a tool which has been used in the oil industry for several years is presented. The structure of the Track to Safety Culture Questionnaire has been inspired by the Hearts and Minds programme used by Shell International. It is important to stress that the content of the TSC Questionnaire, its questions and alternatives, are evolved and fitted to the railway industry by interviews and thorough evaluations. The Track to Safety Culture Questionnaire is a tool for the railway industry.

In 1986 Shell International Exploration and Production started sponsoring a research programme to better understand why accidents occur and what can be done to avoid them. The Hearts and Minds programme was an outcome from this research programme. This programme is an evolutionary

approach to HSE culture and enables organisations and individuals to understand the HSE culture and their personal behaviours in the context of the culture (Hudson and van der Graaf, 2002; Hudson et. al., 2002b)

The programme is intended to move the basis for effective HSE performance past the mechanical implementation of HSE management systems and reliance upon top-down control of the workforce. The original remit for the research program was to create a workforce that is sufficiently well motivated to behave in a safe and responsible ways without external control. Such a workforce would be intrinsically motivated to act in ways that were safe, environmentally responsible and fundamentally healthy (Hudson et. al., 2000).

The Hearts and Minds programme consist of different tools to measure cultures[7]. These involve a *readiness to change scale*, assessment of differences between *national cultures* and the *safety culture scale* based on Westrum (1993)[8] (Hudson and Willekes, 2000). Here, the focus will be on the safety culture scale which is based on Westrum's (1993) characteristic of organisations as presented in chapter 2.2. The Westrum Safety Culture test provides a way of measuring the safety culture of an organisation, and it models an evolution of safety culture (Hudson et. al., 2002b). The reason for measuring safety culture is to find out how people are actually thinking about safety and how safely they work.

The philosophy of Hearts and Minds' safety culture is that development is characterised by the possibly gradual development from unskilled to highly skilled performance at managing safety. Skills have to be developed and require practise, they do not suddenly appear just because you read the manual. This means that focus on safety has to be kept up, it is not enough to succeed once (Hudson et. al., 2002b). In this case managers serve at cultural manipulators by what they, for instance, pay attention to (Schein, 1992). When developing safety culture one needs to go through a number of inescapable stages and the organisation and its individuals, will be characterized by all the behaviours and attitudes that those different levels imply.

The safety culture scale, *HSE Understanding your culture* brochure, consist of a set of descriptions of organisational behaviours for each of the five cultural levels, from pathological to generative, as shown in Figure 2.1, over 18 dimensions (one dimension is one question in the brochure). These 18 dimensions are organised and assigned to appropriate HSE management systems categories. There

[7] It is referred to Hudson and Willekes (2000) for a review of the statistical methods used to prove the tools reliability. In brief, the accomplished tests are acceptably reliable and have generated interesting results.

[8] Other tools for working with HSE are included in the Hearts and Minds programme. It is seen as outside the scope of the purpose with this thesis to give an account for these, and the interested reader is referred to Hudson et. al., 2002a.

also exists a scoring sheet. For a thoroughly description of the components of the brochure, see Hudson et. al., 2002b.

As mentioned introductorily, Shell International has worked with the Hearts and Minds concept since 1986. Related to research question **Q-2** a proper question to ask would be; have Shell experienced any improvements regarding safety? Figure 3.3 shows a graphical presentation of different HSE indicators; LTIF (Lost Time Injury Frequency), TRCF (Total Reportable Cases Frequency) and FAR (Fatal Accident Rate). Significant improvements have been made in the years since the research started. The figure below shows that the Shell companies have shown continuous improvements since 1986 (Hudson and van der Graaf, 2002).

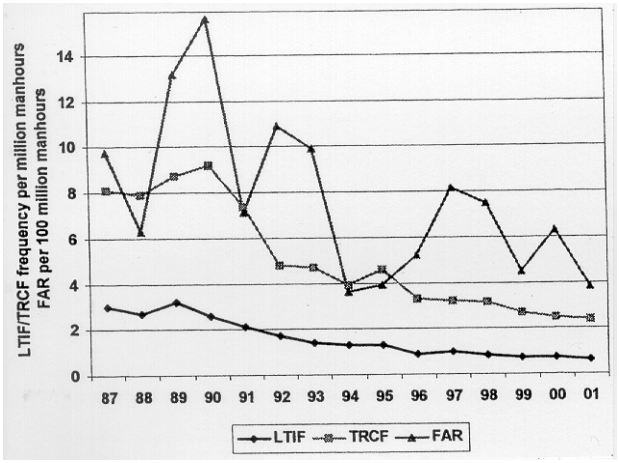


Figure 3.3 Safety statistics of Shell E&P companies (Hudson and van der Graaf, 2002).

3.4 Summary

This chapter has given a review of theory and research that makes it possible to answer and discuss research question **Q-2**.

Argyris and Schön's (1996) view on organisational learning have been presented, showing that if the organisation is to obtain lasting changes, it has to practise double-loop-learning principles. This implies that the organisation needs to focus on the underlying causes of unwanted actions that have lead to incidents or accidents, and learn from these experiences. One way the organisations can practise double-loop-learning is through the principles of Action Research. Action Research is a participatory process which generates new knowledge that the organisation can benefit from. Action Research can be applied when implement organisational changes which often includes changing existing practise in the organisation.

The positive experiences from applying the Hearts and Minds Programme have inspired us to develop a similar tool for use in the railway industry. The overall idea is to combine this tool together with the principles from Argyris and Schön's theory and Action Research in order to survey and improve safety culture in the railway industry.

PART THREE: SCIENTIFIC APPROACH

4 SCIENTIFIC METHODOLOGY

The theoretical framework used as a basis for answering the research questions **Q-1** and **Q-2** (see chapter 1.4) is presented in the previous chapters. This chapter presents the scientific methodology and the process used to approach and answer the research questions.

According to Ringdal (2001), scientific methodology is plans and techniques used to give answers to research questions. This includes techniques to collect different types of data and how to analyse the collected data. Ringdal stresses that there are two reasons for why it is important to be familiar with scientific methodology. First, methodology is of high importance when doing research. One can not trust own abilities and base research on intuitions. It is necessary to use available resources on the basis of known methods and techniques. Second, knowledge of different methodologies is necessary in order to gain insight in research done by others. Choosing the right scientific methodology is thus crucial for answering research questions.

In Figure 4.1 a description is given for this thesis' research process:

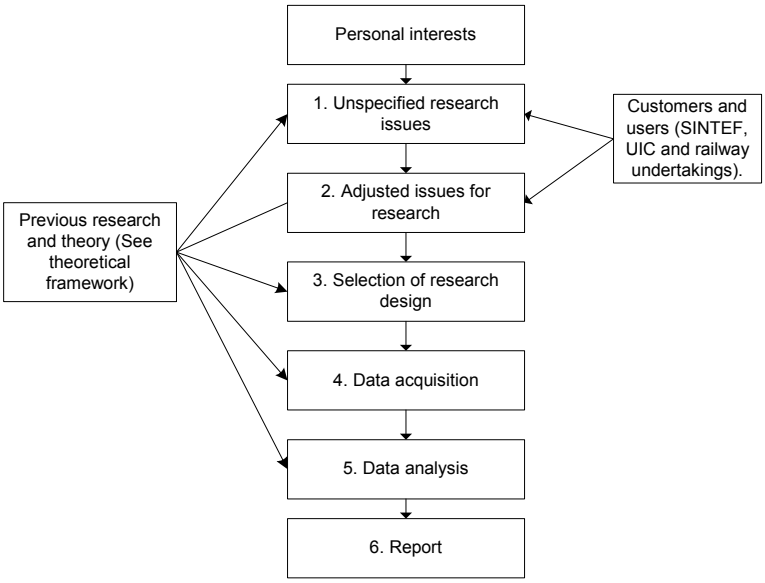


Figure 4.1 The research process (after Ringdal, 2001).

My personal interests for safety culture influenced the selection of topic and research questions. I was first introduced to the complex challenges for safety culture in the Norwegian oil industry during a summer job in 2002 for SINTEF Industrial Management, department of Safety and Reliability. The following year I continued working with safety culture in the oil industry and wrote an in-depth study on challenges for changing safety culture in fragmented organisations. In order to widen my area of competency, I was given the challenge to investigate and write about safety culture in another business area than the oil industry. Since last summer I have been concentrating my focus targeting the European railway industry.

During the summertime 2003, preparations for developing the Track to Safety Culture Questionnaire were performed at SINTEF Industrial Management in co-operation with a project student, Malene Tungland. We were engaged for the summertime to do necessary preparations, and the work was further expanded into an in-depth study, by Tungland, and my thesis. Nine in-depth interviews, followed by an analysing process and development of the Track to Safety Culture Questionnaire (TSC Questionnaire) were carried out together with Tungland. Through this thesis I have experienced that it is of invaluable and vital importance to be two persons in such a process. It makes it possible to perform in-depth discussions and evaluations in such a way that one can assure for the best quality of the desired outcome.

The next two sections will give a satisfactory record for the process worked out to define the research issues and objective for this thesis. According to Kvale (1997) the original meaning of the word methodology is *the road towards the goal*. If one is to find this way, it is vital to know the goal, and thus the first step in the methodology is to define issues and the objective of research. Then with clearly defined research issues and objectives one can make more thought-through selections of research design, or more easily said; how to find the answers (Kvale, 1997).

4.1 Unspecified Research Issues (1)

Research projects often start with unspecified research issues like areas of interests or ideas (Ringdal, 2001). The first step in a research process is to transform these ideas to professional and suggestive research issues. Systematic search for literature and articles, giving information about former research projects and their results, can be of high usefulness when developing research issues.

As SINTEF is working on a project for the UIC, UIC's needs and demands had major influence in the choice of research issues. In early phases my unspecified research issues were related to safety culture in the European railway industry, and the contingency to develop a tool for surveying and improving safety culture. Well guided by my teaching supervisors I started search in available literature in order to find out more about the safety culture situation in the railway industry. Search was also performed to identify tools for surveying safety culture that already are available. With this increased knowledge in mind, the research issues were further adjusted.

4.2 Adjusted Research Issues (2)

The approach used to develop the TSC Questionnaire was consolidated in available research literature. The development process was based on the idea that the TSC Questionnaire had to reflect the challenges the railway industry are confronted with, and it had to be a tool which was easy to implement and adapt. The unspecified research issues were adjusted to reflect both the development process and utilisation of the TSC Questionnaire. The adjusted research issues are presented in chapter 1.4. According to Hn Tjora (2002a) it is more difficult to make the correct query, than to answer it.

This process was therefore carried out in co-operation with my teaching supervisors, and it has been an iterative process. The advantage by doing this as an iterative process is that the research issues can be adjusted and consecutively evaluated as the work is carried out and knowledge about the selected areas increases (Hn Tjora, 2002a).

4.3 Selection of Research Design (3)

To be able to carry out a research project a researcher needs a plan or a sketch that tells him or her how and what to do (Ringdal, 2001). This is research design (Ringdal, 2001), and can first be decided when the researcher has evolved the research issues and the objective with the study (Kvale, 1997).

When choosing a research design, the choice is mainly between a qualitative or quantitative approach. In brief, a quantitative research design seeks to support existing theories and definitions through statistical methods. On the other hand, a qualitative research design is explorative, in that a researcher starts out with general issues and then through research finds new theories and definitions. An important distinction between qualitative- and quantitative research design, is that qualitative research seeks to gain in-depth knowledge about a specific issue, while quantitative research seeks to gain comprehensive knowledge (Ringdal, 2001; Hn Tjora, 2002a).

Based on this thesis' objective and its formulated research questions, a qualitative approach has been chosen and Figure 4.2 illustrates the main tasks that were carried out when developing the TSC Questionnaire.

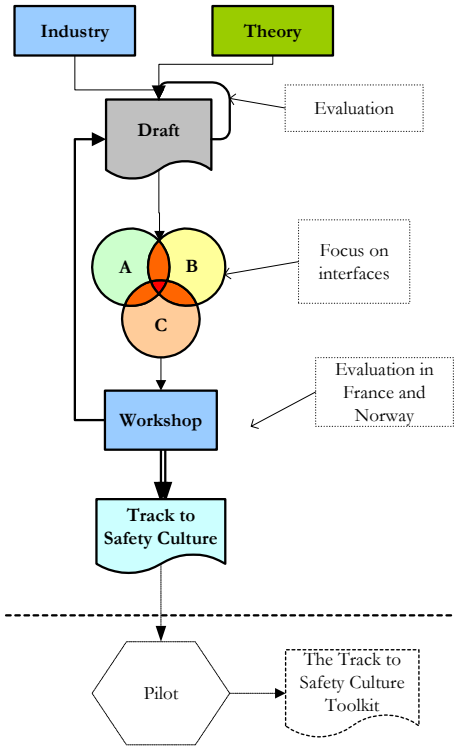


Figure 4.2 The development process of the TSC Questionnaire

First, a draft version of the TSC Questionnaire was evolved based on theory and practical experience. Previous research projects, as the Hearts and Mind project at Shell International, was evaluated and seen as an appropriate basis for developing TSC. Practical experience was included through nine in-depth interviews with railway personnel representing different professions in the industry.

Based on the interviews and theory new questions and alternatives were evolved and a draft version of the TSC Questionnaire was created. The draft version was then improved through several steps; it was continuously evaluated by us and our teaching supervisors and was also evaluated by three researchers (these evaluations are to be found in Appendix D).

Some efforts were put into focusing the questions to reflect challenges at interfaces before TSC was presented in the first workshop in Paris. Here, the tool was evaluated and discussed, and the reversing arrow shows that these changes were included, and thus improved the TSC Questionnaire.

Back in Norway, a new workshop was planned for and previous to this workshop it was seen as necessary to fine-tune the questionnaire. This was done by letting a Ph.D. student, with practical experience from the Norwegian railway industry, evaluate the questionnaire (Blakstad, Appendix D). Further improvements were then suggested and, among other things, an increased focus on interfaces was sought after, both in the way the questions were queried and in the alternatives. This was seen as crucial to the questionnaire, as its aim is to survey and improve safety culture at *interfaces*.

Then, the second workshop was carried out with participants from the Norwegian railway industry. Here the questionnaire was presented and the participants gave constructive criticism related to further improvements and utilisation.

The dashed line shows where this thesis ends its work. The version of Track to Safety Culture that was delivered to, and evaluated in the Norwegian workshop, is the result of this thesis. The UIC-SCAI project group now includes the suggested improvements from this workshop and pilot tests will be arranged by the UIC-SCAI project group in the period from December 2003 to March 2004. Then, with further improvements and adaptations, the questionnaire will be an important part of the SafeTrack[9] toolkit SINTEF is proposing to the UIC.

The next sections will go into details on the different tasks that were accomplished during the development process.

[9] A brief introduction to SafeTrack is presented in chapter 7.6.

4.4 Data Acquisition (4)

When the researcher has selected an appropriate research design, it is requisite to select different methods for data acquisition. With the qualitative approach chosen for this thesis, the following data collection methods were used to ensure the best possible outcome:

- Research literature
- Documents from the UIC-SCAI project
- Interviews
- Pre-evaluations by researchers
- Workshops

Choosing different types of data collection methods is called triangulation. Triangulation of methodology is powerful to give synergic perspectives on the thesis' results (Hn Tjora, 2002b) and this approach was chosen to ensure for the best possible outcome in the development process.

There are two types of data; existing data (secondary data) and personal data (empiricism). The existing data, also called secondary data, can be collected from available databases, previous research projects and inquiries. The personal data, also called empiricism, is information that is personally gathered by the researcher and tailored to the specific research issues (Ringdal, 2001).

The secondary data used in this thesis were collected from research literature and accessible documents from the SINTEF UIC-SCAI project. Empiricism was collected through interviews, workshops and informal talks with relevant persons.

4.4.1 Research Literature

Primarily, research literature from the Hearts and Minds programme of Shell International is used in this thesis, as this programme is used as a basis for development of the TSC Questionnaire. Additionally, general literature covering safety culture is used. Online databases, recommendations from teaching supervisors among others and previous project work[10] have been sources of information where hints and ideas of what kind of literature to use have been adopted during the working process.

4.4.2 Documents from the UIC-SCAI Project

As this thesis is carried out as a part of the SINTEF UIC-SCAI project, relevant project documents have been used as input. This includes documentation with background information and

[10] During the summer 2002 I carried out a literature study about safety culture for SINTEF Industrial Management, department of safety and reliability. During spring 2003 I carried out an in-dept study of safety culture in the Norwegian oil industry. Experiences from these two projects have been used as inputs to the work with this thesis.

documentation from SINTEF's deliveries to the UIC. These documents were used to gain better understanding about the needs and requirements of the industry as presented by the UIC and SINTEF.

4.4.3 Interviews

Interview is one of the most powerful methods in qualitative research (McCracken, 1988). The main objective with interviews is to gather important information about the identified research issues (Ringdal, 2001). Before the questionnaire could be developed, it was necessary to gain better understanding of safety culture issues in the railway industry. With this purpose in mind, nine in-depth interviews, all with high skilled and experienced railway persons, were carried out.

According to Ringdal (2001) one can choose between a flexible or strict[11] approach to the interviews. In this thesis a flexible approach has been chosen. The flexible approach is an iterative process that gives room for changes as the interviews are carried out.

Preparations and interviews were done together with Tungland. It was seen as a huge advantage to work together with these tasks. It gave us the opportunity to do peer reviews, as we could supply each other while selecting informants, developing the guiding questionnaire, accomplishing the interviews and analysing the results.

The interviews were all carried out as partly structured as we used a guiding questionnaire with predefined topics. We did not follow the exact order of the questions, but allowed the informants to talk free and flexible during the interviews. We allowed for digressions, with the intention that we could gain some additional understanding about important safety culture issues. As new issues arose we added new questions to our guiding questionnaire, which were then used in the next interviews. We adapted this approach as we knew that there were different aspects that we had not taken into account and which were of high importance for our work. As we carried out the interviews we found that some of the questions were not relevant to be answered by all informants as a result of their experience, background and profession. We considered this not to be of any problems to our results, as the main intention with the interviews was to gather as much information as possible and not to analyse similarities and differences between different professions.

Development of a guiding questionnaire

A guiding questionnaire[12] has several functions. A questionnaire should ensure that the researcher covers all the terrain and it should establish channels for the direction and scope of the discourse

[11] The strict approach does not allow for changing the questions during the interviews or to substitute the selected informants.

[12] This questionnaire should not be confused with the TSC Questionnaire.

(McCracken, 1988). A guiding questionnaire can vary from thematically arranged entries to complete formulated questions (Ringdal, 2001).

Because of our limited experience with interviews we chose to develop a questionnaire with complete formulated questions. The questions were based on gathered information from relevant literature and information from our teaching supervisors, and were organised into seven areas which was seen as important areas for safety culture in the railway industry. The guiding questionnaire is to be found in Appendix E.

Informants

The informants were picked out in three different ways:

- By teaching supervisors
- By gatekeepers
- By recommendations from informants (snowball technique)

Our teaching supervisors gave several ideas of whom to contact. This included both potential informants but also gatekeepers. Gatekeepers are persons inside organisations that can establish contact with inside persons (Hn Tjora, 2002c). Then, when we got the hold of potential informants, some of them recommended other persons that could be of interest to our project. This is called the snowball technique.

To ensure the best feasible result it was of great importance to assemble a wide range of persons. This included both persons that work near to the hazards (in the sharp end) as well as persons in management positions (in the blunt end). It was therefore desirable to interview persons with different backgrounds and professions. It was also important that they had high competency about railway safety and safety issues at interfaces. Table 4.1 gives an overview of the nine respondents; their position and company.

Table 4.1 Informants used in interviews

Position	Company	Information
Traffic Control leader	Norwegian National Rail Administration	Infrastructure manager in Norway.
Safety adviser	Norwegian National Rail Administration	Infrastructure manager in Norway.
Safety Supervisor	Norwegian National Rail Administration	Infrastructure manager in Norway.
Supervisor of Marketing	Norwegian National Rail Administration	Infrastructure manager in Norway.
Supervisor Auditing	Norwegian Railway Safety Board	Regulatory authority in Norway.
Safety and Quality director	BaneService (Norway)	BaneService contributes towards efficient development and maintenance of railways in Norway.
Locomotive driver	NSB	The Norwegian train operator.
Locomotive driver	Linx	Operates on particular distances between Norway and Sweden.
Project director	Connex	Traffic operator. Operates in different countries in Europe.

As shown, we interviewed persons in management positions, locomotive drivers, an independent traffic operator and a representative from the regulatory authorities. These persons represented different perspectives due to a variable distance to the sources of hazards. Hence, they had different perceptions about risk. We saw it as important to reveal these different perceptions as the purpose of the thesis is to achieve the best possible understanding of safety culture issues in the railway industry.

Accomplishment of Interviews

Before the interviews were carried out, a bright introduction to the UIC-SCAI project was given. An explanation on how outcomes would be used was also presented. Several researchers have written about the meeting between researchers and informants, and how the first impression will affect the following interview (Ringdal, 2001; Hn Tjora, 2002c; McCracken, 1988). By starting out with general information and simple, informal opening questions, we felt that we established a good relationship of trust between us and our informants. This is acknowledged as vital for the quality of the outcomes as it is in these opening stages that the informant sets his or her defences (McCracken, 1988).

All the interviews were carried out in direct meetings considered as the best way to accomplish the interviews. None of us had ever met any of the informants, and we thought of it as very important that we could meet them face-to-face. An interview consists of more than spoken words and by carrying out the interviews in direct face to face meetings we were able to observe the non-verbal reactions in addition to their answers. To be able to sit down and talk informally creates an atmosphere of trust and thereby contributes to a better outcome of the interviews – which we also experienced.

During the development of a guiding questionnaire, efforts were made to ensure that none of the questions were of a particular personal type or encouraged whistle blowing. During the interviews we did not experience that any of the informants denied answering our questions. However, we experienced that some of them not fully understood their importance for the outcomes of the interviews and this was reflected in their way of answering the questions, e.g. they showed less willingness to give complementary answers to the questions.

One of the most usual ways to log data is to use a recorder (Ringdal, 2001). To ease the analysing process we decided to use a recorder. A disadvantage by using a recorder is that informants can feel tied up and thus be restrictive with sharing information. All informants were therefore asked for permission, and no one was against it. The interviews were then partly transcribed in Norwegian. When this work was completed, the interviews were returned to the informants and they were asked to check the contents and to approve for further use of the material. We received some small changes, but none of them were seen as affecting the outcome in a negative way. After this, when this thesis was written, I translated the partly transcribed interviews into English and presented them in the tables that are enclosed in Appendix F. Here the informants are made anonymous and the informants' answers are organised into groups.

4.4.4 Pre-evaluations from Researchers and a Ph.D. Student

In early stages of the development process three researchers with different professional backgrounds did individual evaluations of the TSC Questionnaire. These evaluations can be found in Appendix D. These evaluations were accomplished to assure that TSC became as good as possible before we travelled to Paris for a workshop and closer evaluation (see section 4.4.5). In brief, their feedback was related to particular questions and formulations.

A Ph.D. student (Blakstad, Appendix D) did an evaluation after the first workshop in Paris. This evaluation was done to fine-tune the TSC Questionnaire prior to the workshop in Norway. The result of this evaluation increased the focus on interface issues in the questions as well as in the alternatives.

4.4.5 Workshops as Arenas for Generating Knowledge

Workshops are something in between unstructured group interviews and field observation, and can be compared with so-called focus groups. Focus groups are basically group interviews, although not in the sense of an alternation between the researcher's questions and the participant's responses. Instead, the reliance is on interaction within the group, based on topics that are supplied by the researcher. In the focus group the researcher acts as a facilitator with the opportunity to observe a large amount of interaction on a topic in a limited period of time (Morgan, 1988).

Compared to interviews the focus groups have the ability and advantage to observe interaction on a specific topic. This kind of interaction leads to relatively spontaneous responses from participants as well as producing a high level of participant involvement. The practical strength of focus groups compared to interviews, lies in that they are easy to conduct and can be done relatively cheaply and quickly. Focus groups have the ability to explore topics and generate hypotheses and it gives the researcher the opportunity to collect a large amount of data from group interaction.

A disadvantage with focus groups is the creation of chaotic data that gives challenges for the analysing process. Another disadvantage is that focus groups are not based in natural settings and thus uncertainty can occur about the accuracy of what the participants say. Related to the interaction in the group it is difficult to determine if it would mirror individual behaviour (Morgan, 1988).

Workshops were chosen as arenas for evaluating the TSC Questionnaire because of its ability to explore and create large amount of knowledge and practical information. In the following the working method and other details from the workshops will be presented.

Workshop in Paris

At September 25 and 26, SINTEF arranged a workshop at UIC in Paris. The aim with this workshop was to get input to SafeTrack which is the methodology SINTEF propose to the UIC. The reader will get an introduction to SafeTrack in chapter 7.6. In brief the methodology is split in two; one part

dealing with scenario analysis and the STEP diagram, and the other part is the TSC Questionnaire for surveying safety culture in the European railway industry.

The work was carried out in groups and in plenary discussions. We used computers for presentations and summing up the results, group discussions and presentations as well as plenary discussions. We, as the representatives from SINTEF, realised that in order to get the best outcome, we had to act as facilitators, working in the background and letting the participants share as much information as possible.

The second day, where Tungland and myself had the responsibility, the workshop focused on user evaluation of the TSC Questionnaire as well as improvements. We first gave an introduction to the questionnaire; why we had chosen the particular design, the configuration and its main intentions. We then gave the participants the opportunity to get to know the questionnaire better as we gave them twenty minutes for reading it through and filling it out. Later the participants were separated in two minor groups for more efficient group discussions. Here, the discussions were about important aspects related to TSC; the usefulness and relevance of the questions and alternatives, and in addition, how the railway industry can adapt the questionnaire. The outcome of the evaluation is referred in Appendix C.

Selection of Participants

The participants at the workshop in Paris were selected by SINTEF and the UIC-SCAI project group. As previously written, UIC is an umbrella organisation for European Railway undertakings, and the participants attending the workshops were persons from associated organisations. Altogether 13 persons attended. Appendix C covers the overview of attending participants and minutes of meeting.

Two of the participants are members of the UIC-SCAI project group and their participation was seen as important for the anchoring of the questionnaire in the project group as well as in UIC's associated organisations.

Workshop in Norway

At October 30, we carried out a Norwegian workshop with the purpose to achieve an evaluation of the questionnaire from actors in the Norwegian railway industry. By this workshop the industry was also challenged in order to get commitment for future use of the questionnaire. The workshop was arranged at SINTEF Industrial Management in Trondheim, Norway.

The working method was similar to the workshop in Paris. The participants were selectively divided into three groups, including persons from different companies in each group. Tasks were carried out in the groups, presented and discussed in plenum. In Paris time did not allow the results from the evaluation of Track to Safety Culture to be discussed in plenum. This was seen as a minor problem as we, when we came back, started working on the results from the evaluation. At that time we did not know if the suggested changes from the evaluation were personal or common opinions. It is important

to stress that this is not seen as a weakness in the scientific approach. Very often the most interesting discussions are to be found in the minor groups in a workshop, as smaller groups provoke more participation and involvement from the participants. However, in the Norwegian workshop we carried out plenary sessions where the participants were able to discuss the changes and thus we achieved better understanding of the suggested changes.

Selection of Participants

The participants at the Norwegian workshop were primary chosen from the informants used in the in-depth interviews and by using the snowball technique. Some of the informants from the interviews could not participate in the workshop, but recommended other persons. Some of the participants also invited others to attend as they saw these persons as important contributors. Altogether 10 persons from the Norwegian railway industry attended the workshop. Additionally four researchers from the UIC-SCAI project group at SINTEF Industrial Management also attended. Appendix B covers the overview of attending participants and minutes of meeting.

4.5 Data Analysis (5)

As shown in the previous section, data is collected through interviews, informal talks with researchers who evaluated the questionnaire and workshops. A lot of time and effort where put into the process with analysing the gathered information as this process is of vital importance to the quality of the results and findings.

The interviews were partly transcribed in Norwegian. Then, all the informants received a draft of their interview with the opportunity to make comments and changes, with request for approval for further use. Then the analysing process started with intention to gather as much information about safety culture issues in the railway industry as possible. Each question was revealed for common denominators and together with the ideas from Hearts and Minds programme from Shell International and revealed theory, this made the foundation for organising the findings and hence the structure of the TSC Questionnaire.

During the work with my thesis, the partly transcribed interviews were translated into English and simplified as the main points for each question were recorded in tables. The most important criteria for validity in interviews are privacy (Polkinghorne, 1991) and were ensured for by making the informants and their belonging anonymous in these tables. In Appendix F the tables are enclosed. Here, the informants are organised into the groups identified at interfaces by the UIC-SCAI project group, as illustrated in Figure 1.1.

During the workshops efforts were made to write down the revealed information. These documents together with personal notes have formed the basis for analysing and presenting the suggested improvements and changes to the TSC Questionnaire. The evaluations from the workshops and the

researchers are enclosed in Appendix B, C and D. The suggested changes were quickly taken into consideration and included in the questionnaire.

4.5.1 Evaluation of Reliability and Validity

In the previous chapters the scientific approach to this thesis has been presented and made transparent. In chapter 8.3 a personal evaluation of the scientific approach to my thesis will be given based on the notions of reliability and validity. In this section a brief introduction to the notions are given.

Reliability and validity are familiar concepts in quantitative research. It is much discussed whether these concepts are relevant for describing qualitative data or not (Ringdal, 2001). Thagaard (1998; in Ringdal, 2001) prefer to use the concepts trustworthiness and verification instead of reliability and validity, respectively. Trustworthiness is related to whether or not the research inspiring confidence in the way it is carried out. Verification is related to quality of interpretations and if the results are supported by other research results.

Trustworthiness, or reliability, is in general used about measuring errors. In qualitative research trustworthiness is related to the researcher's reflections about how the data acquisition is carried out and with deliberate focus on possible sources of errors. In brief, verification or validity is the extent to which the research gives the correct answer (Kirk and Miller, 1986). However, in qualitative research evaluation of validity will most likely be vaguer compared to an evaluation in quantitative research. Often validity is evaluated either by the researcher herself or by her informants. Validity evaluations done by informants are especially relevant when the research emphasise the informant's conceptualisations (Ringdal, 2001).

4.6 Report (6)

Kvale (1997) claims that the process of writing is a social construction of knowledge that is gathered through interviews A report communicates with the reader and forms the basis for the research community's evaluation of the validity of the presented knowledge.

Publication of research results can raise questions about morality. The publication should be seen in relation to ethical guidelines as informed approval and confidentiality. Informants and participants at the workshops were informed about the use and purpose of the work. The informants were also given the opportunity to read through and approve or disapprove for further use of the results. As a matter of course all informants in the interviews have been made anonymous in the presentation of the results. However, the participants at the workshops are represented with name and company, as they are key figures in further work with the questionnaire and are involved in the SINTEF project.

The main intention with my thesis is to present the TSC Questionnaire, how it was developed and the evaluations that were given through the workshops. Efforts has been made to present the results in a way that makes the report easily read and understood.

The next part, part four, takes the reader through the whole development process (that was illustrated in Figure 4.2). First, in chapter 5, background information used in developing questions and alternatives, are presented. The building stones in the questionnaire are the areas, questions, alternatives and score card, and are presented in detail in chapter 6. The reader is recommended to closely read through and become familiar with the TSC Questionnaire that is enclosed in Appendix A. Chapter 7 presents the results from the evaluation process. It presents areas of utilisation, obstructions for use and suggested improvements. This chapter also place the questionnaire's areas of utilisation in a wider setting by introducing the reader in brief to the SafeTrack toolkit.

PART FOUR: RESULTS AND DISCUSSION

5 SAFETY CULTURE CHALLENGES AT INTERFACES

To be able to develop a tool for surveying and improving safety culture at interfaces it is necessary to gain information and knowledge about existing challenges. This chapter will answer research question **Q-1**:

Q-1: What challenges is the railway industry faced with in relation to safety culture at interfaces?

- What is safety culture and what is meant by interfaces? (Answered by theory in chapter 2)
- What challenges are identified in the railway industry? (Answered by interviews in this chapter)

Chapter 2 presented the theoretical perspectives on safety culture and interfaces, and hence answered the first issue for **Q-1**. The second issue will be answered in this chapter: W*hat challenges are identified in the railway industry?* The answer to this issue is based on nine in-depth interviews with railway persons with different professions and backgrounds (see section 4.4.3, Appendix E and F) and the main results from the interviews are presented in this chapter. However, these two issues are closely linked, and when discussed together they answer research issue **Q-1**.

In the theoretical framework in section 2.3, Fahlbruch and Wilpert's (1998; in Schmidt, 2003) framework for illustrating how sub-systems interact for safety and reliability in organisations was presented. This framework has been combined with results from the interviews. During the analysing process it was identified four important areas for safety culture at interfaces, as illustrated in Figure 5.1. In the following these four areas are used to organise the presentation of the main findings from the interviews. These areas are also used as a basis for organising and structuring the questionnaire which is presented in chapter 6.

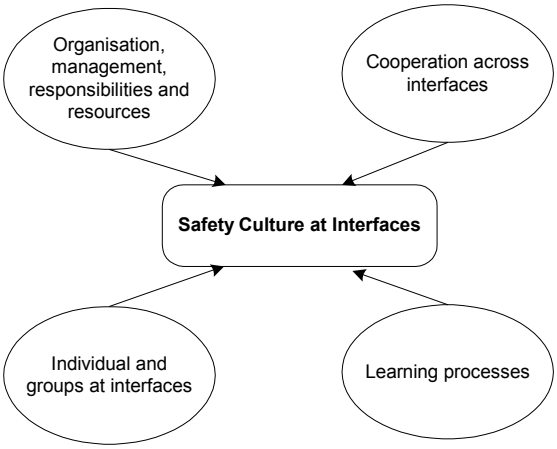


Figure 5.1 Four important areas affecting safety culture at interfaces (identified through interviews)

A bright description of the four areas is presented below:

Organisation, management, responsibilities and resources
This area deals with the formal parts of the organisation that affect how work is done, and thus safety culture. This includes, among other things, communication and prioritisation of safety and how these issues will affect the level of safety culture.

Individual and groups at interfaces
It is assumed that how individuals interact and their attitudes towards competing organisations will affect safety culture at interfaces. This also includes how well labour unions and management co-operates across interfaces.

Co-operation across interfaces
An organisation's ability and willingness to co-operate across interfaces will affect safety culture. Interfaces are seen as meeting points both between different companies and between different countries.

Learning processes
Learning processes are related both to organisational learning and how railway personnel are educated. A high level of organisational learning as well as good educational programs for personnel is assumed to impact safety culture.

In section 5.1 through 5.4 these four areas are presented in detail. Each section presents the results in tables. These tables show a selection of questions that presents revealed challenges for safety culture within each area[13]. The informants are grouped and their answers are given for each question. This is done to give the reader the opportunity to easily compare the answers.

5.1 Organisation, Management, Responsibilities and Resources

Table 5.1 presents a selection of questions that throw light on the area; organisation, management, responsibilities and resources and how challenges related to this can affect safety culture.

Schein (1992) claims that managers can manipulate culture by what they pay attention to and how they do role modelling. When asked about what influences commitment to safely work practice, nearly all informants answered; management and their example, attitudes and focus (Question 5, Appendix F).

The regulatory authorities stressed that in the age of deregulation and privatisation the lack of transparency in the contracts and relationships between operators and contractors would create new challenges. Maidment (1998) has been involved in the privatisation process of Britain's railway

[13] It is referred to Appendix F for complete tables with results from the interviews.

system and stresses that one of the greatest worries related to HSE, has been the management of all new interfaces. According to the informant, the authorities see lack of transparency as something that will make it more difficult for them to keep a clear overview of the actors and important new safety issues that may arise.

The informants were in addition asked about what they see as challenges for managing safe work in cross border traffic (Question 13). The challenges brought up corresponded with the risks that Schmidt (2003) revealed through the study of European freight traffic.

Table 5.1 Organisation, management, responsibilities and resources

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
Which particular challenges do you see in managing safety work related to cross border traffic? (Question 13)	- Different training programs - Emergency communication - Handle the complex interfaces - To have overview of risk.	- Management has to set an example - Prioritise training - Implement a reporting culture	- *This question was not asked to this informant.*	- Different language - Different signalling systems and technology - More actors to deal with.	- Different signalling systems - Training - Emergency training	-National companies can work against new actors. -Differences in rules and regulation and in technology.
How can one facilitate for good safety work when dealing with cross border traffic? (Question 16)	- The infrastructure manager needs a modern safety management system as they automatically will fulfil the role as a premise provider for the industry (in Norway).	- Superior co-operation - Common training and education - Accident and incident reporting in Synergi. - Exchange of information - Common rules and rule competence - Common language	- Common education and training.	- Common rules and signal systems - Good communication and co-operation related to identify problem areas.	- Accomplish a emergency scenario and analysis that includes both countries - Need training and education, also in emergency handling.	- Common rules - Common competency systems
Do you see any problems in handling goal conflicts between HSE and competing concerns like profitability, effectiveness, and operational demands? (Question 17)	- *This question was not asked to this informant.*	- There is an constant trade-off - Important that the organisation demand safety	- *This question was not asked to this informant.*	- No	- If you think safety is expensive – try an accident!	- An organisation can risk to be forced to work on a low budget at the sacrifice of safety.
What problems would you expect to arise with an increasing level of privatisation and a greater number of small operators? (Question 20)	- Competence can be erased after some time. - Less transparent relations between operators and contractors.	- Increased demand for profit. - Difference between large and small undertakings concerned to safety - Increased demand for access to infrastructure - Standardisation of infrastructure	- Have to be more strict concerning arrivals (need to adjust to aviation – those who are delayed have to wait)	- Increased demands for profit which will be at the sacrifice of safety - A risk for minimising education and training	- None. The regulatory authorities need more resources and have to become more unambiguous.	- We welcome competition. This will foster organisational development and sharpen demands for safety.

The challenges revealed by our informants were related to training, communication, differences in language, technology and signalling systems, challenges of dealing with several new actors and differences in rules and regulations.

It is well known that safety related issues often loose when competing with other concerns as profitability and effectiveness. Our informants were asked if they could see any problems in handling this (Question 17). Some of them did not as they stressed that safety always were first priority. Others answered that *"there is constants a trade off with available resources"*. The trade off between safety and competing concerns is of high importance to address, as several informants stressed that with increased privatisation there would become an increased demand for profitability (Question 20).

The results from the interviews showed that the following areas are of particular interest related to organisation, management, responsibilities and resources:

- Managements involvement in safety work
- Communication of safety issues
- The culture for blame
- Prioritising of safety when competing with other concerns
- Transparency of contracts
- Ability to adapt to new interfaces
- Use of statistics and trends
- Emergency training
- Procedures

5.2 Individuals and Groups at Interfaces

Research has shown that there exist differences between railway branches in operator's attitudes and perceptions. These differences exist in spite of the fact that branches do not differ in terms of employment, management systems or operating procedures. Based on this research it seems like different branches have developed its own local ways and informal culture, which implies that safety cultural differences exists (Itoh and Andersen, 1999).

Table 5.2 presents a selection of questions that were used to reveal important issues about how individuals will affect safety culture at interfaces (Question 7 and 8). Some informants stressed the labour unions impact on safety culture, as they in some situations use safety as an argument for achieving other benefits or simply to prevent changes. The absence of clarified roles and areas of responsibility can also affect safety as it can result in lack of commitment and ownership to safety.

One of the informants pointed that locomotive drivers working for the national operators can adopt a profession culture that do not welcome other participants which possibly creates areas of conflicts and a non co-operative environment. When other informants point out the interface between locomotive drivers and the traffic control as the most important interface, one can see that the attitudes towards foreign operators is important to address.

Related to individuals and groups at interfaces it is important to address the following issues:

- Attitudes towards new entrants.
- Co-operation between labour unions and management.

Table 5.2 Individuals and groups at interfaces

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
In your opinion, what affects workers commitment to safe work practice? (Question 5)	- Management attitudes - Safety ensured by the operative units	- Training - Attitude campaigns - Organisational structure - Personal perceptions of usefulness.	- Management and their focus - Training	- Culture for taking care of each other - Feedback when discovering mistakes	- Management attitudes - Quality of safety management systems	- Rules - Dialogs and discussions - Media - Oblige the workers to do risk analysis
How would you describe the different professions in railways? Could you please describe the different cultures within each of these professions? *(Question 7)*	- Labour unions have affected safety work as they have used safety as an argument for achieving benefits.	- More conflicts among professions earlier. - The most important interface is between the locomotive driver and traffic control.	*- The informant did not really answer this question. The answer is therefore omitted.*	- Every one has the same goal and the same regulations as a base for work.	- Traffic control is one of the most important intersections – most of the communication has its origin here.	- Locomotive drivers working for the major operators can adopt a profession culture that not welcome other participants
In what way will different professional cultures influence on safety work? How does this depend on different national cultures? *(Question 8)*	- Labour unions have affected safety work as they have used safety as an argument for achieving benefits.	- Clarifying roles are of importance. - Disperse of responsibility can create lack of ownership to safety. - The competition for scarce resources can create friction in the organisation.	- Safety and stability has become less favourable now as a result of how the system has become.	- Lack of knowledge about other professions work can cause conflicts of interests.	- We do not experience such problems as we have implemented an organisational structure that takes care of these problems.	- Safety has been used as a substitute motive in discussions

5.3 Co-operation across Interfaces

Through the interviews it was desirable to achieve empiricism and information about challenges that can arise when co-operating across interfaces. A selection of questions that throws light on this area is presented in Table 5.3.

The major challenges pointed out were related to differences between the actors at interfaces; differences in language, technical standards, signal systems, and rules and regulations (Question 13). Other challenges were differences in organisational strategies like differences in ambitions, acceptance criteria and desired level of safety (Question 19). Some organisation's ability to oppose to foreign operators was also pointed out as a possible challenge (Question 13).

These challenges are considered as a natural part of the organisation's interactions in the socio-technical system (Rasmussen, 1997; Fahlbruch and Wilpert, 1998). These differences can also be related to co-operating organisations who find themselves at different levels at the safety culture ladder in Figure 2.1. With so many possible differences both in practical and cultural considerations

the organisations need to accomplish some concrete actions and adaptations to foster a satisfactory level of co-operation. In order to do so, the organisations need to show a willingness to co-operate.

Table 5.3 Co-operation cross interfaces

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
Do you have specific experience with safety critical issues related to cross border traffic? (Question 12)	- Technical differences - Different regulations	- Different signals. - Confusion in communication.	- Never had any safety problems.	- Different signalling systems.	- Never experienced any safety problems.	-Different signal systems -Different regulation
Which particular challenges do you see in managing safety work related to cross border traffic? (Question 13)	- Different training programs - Emergency communication - Handle complex interfaces - To have the complete overview of risk	- Management has to set an example - Prioritise training - Implement a reporting culture	*- This question was not asked to this informant.*	- Different language - Different signalling systems and technology - More actors to deal with, which contribute to a higher risk level.	- Different signal systems. - Training. - Emergency training.	-National companies can work against new actors. -Differences in rules and regulation -Differences in technology.
How does your organisation adapt to handle safety cultural interfaces? (Question 15)	- There is a lack of foundation in the regulations related to culture - We do not have the competency to deal with i.e. audits and safety culture.	- Traffic safety seminars to exchange safety experience.	*- This question was not asked to this informant.*	*- This question was not asked to this informant.*	- Apprehension of cultural similarity between Norway and Sweden.	- We collaborate with established companies that know the systems.
Do you see any problems that can arise in co-operation between companies with different safety policies? (Question 19)	- That the organisations develop their own acceptance criteria for safety. - Need a common understanding of desired safety level.	- Different standards and acceptance criteria. - Different ambitions in the organisations.	*- The informant did not really answer this question. The answer is therefore omitted.*	- No, no conflict as long as the companies sticks to the regulations.	- If the ALARP goals are different. - Need to agree upon a common level.	- Yes, that will cause problems.
What challenges do you think the Norwegian infrastructure manager will meet in relation to new entrants? (Question 21)	- More demanding to safeguard safety. - To keep hold of new operators and their contractors.	- Need to demand for safety and emergency planning. - How to distribute capacity	- Language problems	- Higher demands for profit - More pressure from independent operators for getting priority on the track.	- Challenges related to changing from an administrative culture to a service culture.	- To qualify new entrepreneurs and to ensure equally treatment. - To control that rules and regulation are kept.
Would it be favourable to standardise work and emergency procedures throughout the European railway industry? (Question 25)	*- This question was not asked to this informant.*	- Yes. Everyone need to now what to do in an emergency situation. - A disadvantage is that procedures are reactive; you deal with a historical risk perception rather than the future.	*- This question was not asked to this informant.*	- Emergency procedures are important and should be standardised.	- Yes. But as the systems are different it's not possible to develop identical standards – find the best solution.	- Yes. Emergency procedures should be standardised. - Work procedures related to traffic and communi-cation might be standardised, but other work procedures should be a part of competitive strategies.

Another important side of co-operation across interfaces is the organisation's willingness to co-operate with foreign authorities. One of the informants pointed out that one of the major challenges for authorities would be to keep hold of new operators and their contractors, and to have an overview of the new risk levels (Question 13 and 21). An increased number of operators will give new interfaces (Maidment, 1998) and hence give new and increased challenges managing relationships between authorities and different operators.

In question 25 the informants were asked about the need for standardised work and emergency procedures across the railway industry in Europe. Almost everyone agreed upon the need for such standards, but some were restrictive as they considered the differences in technical as well as organisational systems too extensive to make common working standards. Here, establishing best practice was seen as more desirable than to standardise work procedures. However, the need for common emergency procedures was emphasised.

Related to co-operation cross interfaces the following issues are important to address:

- Willingness to co-operate.
- Concrete arrangements for co-operation at interfaces.
- Co-operation with authorities.
- Attitude towards standardisation.
- Adaptations to handle cultural differences.

5.4 Learning Processes

Learning processes are related both to internal learning processes but also how railway personnel are educated. How members in an organisation are educated, or how they actually learn, is an interesting aspect of how culture is developed in an organisation (Schein, 1992). Table 5.4 presents a selection of questions that was questioned to the informants to gain knowledge about railway organisations' learning processes.

Informants were asked about the existence and need for common training systems[14]. Research has shown that motivation is a key factor for safety in railway safety, and that motivation is highly related to satisfaction with training systems, among other factors (Itoh et. al., 2000). One of the infrastructure managers stressed the need for common demands for competency across Europe, but according to one of the locomotive drivers it is not possible to have similar education and training systems as the infrastructure systems are different (Question 24). The Norwegian authorities demand that foreign locomotive drivers need a special course in the Norwegian rail system, before permission to convey a train on Norwegian soil is given (Question 23). However, this education is simplified, and according

[14] The answers given related to learning processes is only related to the Norwegian railway industry as all informants where Norwegians.

to Ph. D. student Blakstad[15], the challenge related to the locomotive driver's ability to switch mode when travelling between the countries will always be present and give additional safety issues that are not possible to handle through any courses.

Reason (1997) emphasises that an organisation with a satisfactory safety culture has a good culture for reporting incidents and accidents. Most informants welcomed the idea of a common reporting system throughout the European railway industry (Question 28).

Table 5.4 Learning processes

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
Is there a training system in cross border traffic? *(Question 23)*	- *This question was not asked to this informant.*	- No, need local education - Need to satisfy the other country's demands.	- No	- Yes, it's an additional education. - A simplified education in the other country's signal and safety systems.	- We have developed our own educational plans for locomotive drivers driving in new and foreign countries.	- Need to satisfy the other country's demands.
Do you think that there will be any need for a standardised training program for the European railway industry? (Question 24)	- *This question was not asked to this informant.*	- Yes, today foreign locomotive drivers need special licenses to drive in Norway. - We need common demands for competency.	- Need common systems for education and training.	- Education and training can not be similar as we have different systems. - Need a system for approval so we can assure that the educational level is satisfying.	- Yes, at least between Norway and Sweden.	- *This question was not asked to this informant.*
Will there be any need for standardised report routines? *(Question 28)*	- That would have been favourable. - Need to agree upon how to manage such a system as the authorities will get capacity challenges if they were in charge.	- That would be favourable as it gives common under-standing - Collecting and making information common is practical.	- Yes.	- Yes, to ease reporting.	- This is a good idea as it can result in the best way of reporting and that the reporting is standardised.	- Yes, that would be an advantage. - Stick to one system - Increase reporting - Larger statistical material
How do you imagine that such a common report system can be used in further work? *(Question 29)*	- *This question was not asked to this informant.*	- Use statistics to identify trends and problem areas.	- I don't see how this can be used, as in time of an accident the existing administration has to do their job at their distance.	- As a common central for experience where one can learn from each other.	- Favourable to record different types of accidents.	- *This question was not asked to this informant.*
Would it be appropriate to do benchmarking on safety performance? *(Question 35)*	- I have not considered this. But it is interesting.	- Assume use of common tools. - Will foster demands for safety. - Assume measurement on the same things.	- *This question was not asked to this informant.*	- *This question was not asked to this informant.*	- I have never considered safety as a competitive advantage. I do not know if this is possible.	- We have this in our business plan but we have not adapted it systematically yet.

[15] After conversation. H. Blakstad is a Ph.D. student at the Norwegian University of Science and Technology.

And when asked about how the system could be adapted in the industry, several suggestions were given (Question 29). These suggestions were related to the possibility to use this as a common "central for experience where one can learn from each other". If the organisation desire a *double-loop-learning* process it is necessary that the reporting systems are used in such way that the organisation and its members can learn from previous events.

Reason (1997) also emphasised that an organisation needed a just culture to be able to have a good safety culture. A just culture is recognised by the organisation's ability to create an atmosphere of trust and where people are encouraged and rewarded for providing essential safety-related information. The informants were asked if such rewarding system exists in the Norwegian railway industry, and the answers concluded that it is not widespread (Question 6, Appendix F). A just culture is also a culture of no-blame (Reason, 1997) and according to one of the informants, it exists a difference between countries in how guilt is dispersed (Question 33, Appendix F). This is related to different national cultures and each culture's culture for dealing with conflicts (Hofstede, 1991).

Rules and regulations are given by authorities to protect and for safe guidance. Organisations are obliged to follow prevailing rules and regulations, but this does not prevent members of the organisation to take short cuts and to make their own judgments of the necessity of particular rules. To what extent the workers wish to follow rules and regulation, depend on their understanding of the underlying meaning of a particular rule (Question 26, Appendix F).

This chapter has shown that there are some important issues that need to be addressed related to learning processes in organisations:

- Focus on learning processes.
- Reporting routines.
- Use of reports and reporting.
- Organisational commitment to rules and regulation.
- Use of audits and reviews.

6 THE TRACK TO SAFETY CULTURE QUESTIONNAIRE

In the previous chapter, chapter 5, different challenges for safety culture at interfaces was presented. These challenges were used as input for developing the Track to Safety Culture Questionnaire (TSC). In this chapter the TSC Questionnaire is presented as a tool for surveying and improving safety culture at interfaces.

As presented in chapter 1.4, **Q-2** is divided into two subordinated issues. The first issue will be answered in this chapter, and the second issue, the evaluation of TSC, will be answered in chapter 7. Below, question **Q-2** with the first issue is presented:

Q-2: How can European railway undertakings improve safety culture at interfaces?

- Presentation of the questionnaire "Track to Safety Culture" as a tool for surveying and improving safety culture at interfaces.

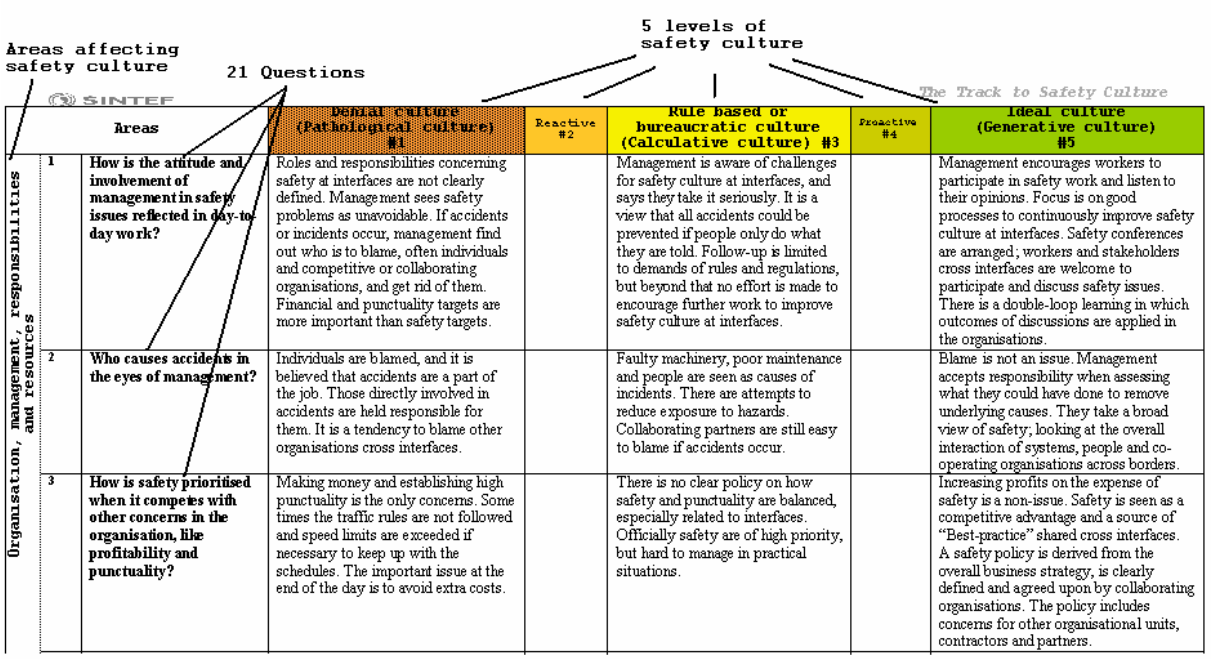
The Track to Safety Culture Questionnaire is developed for surveying and improving safety culture at interfaces in the European railway industry. TSC can be used as an assessment tool, in that it can be used to classify an organisations safety culture. However, the main objective with the questionnaire is to initiate good collaborating processes and group discussions, and to create awareness in the organisations related to safety culture. The questionnaire is seen as a tool that can foster individual and organisational understanding of important safety culture aspects at interfaces, and what is recognised by a good safety culture.

The main objective with this questionnaire is to improve safety culture by creating good collaborating processes and group discussions.

During the development process several persons have been involved in evaluating the questionnaire. A pre-evaluation was accomplished by three researchers at SINTEF Industrial Management. The main evaluation was accomplished by the participants both at the French and Norwegian workshop. It is not possible to track all the changes done while developing TSC, but in Appendix B, C and D an overview of the main changes and suggested improvements are presented. In this chapter the questionnaire is thorough introduced as the different parts of the questionnaire are presented. Additionally some of the comments from the evaluations are included in the comments.

As shown in Figure 6.1, TSC is formed as a table with 21 questions where each question has five alternatives. These represent the five levels of safety culture presented in chapter 2.2.1. The 21 questions are organised into the four areas presented in chapter 5 (Figure 5.1) and each area's revealed challenges are used to develop the 21 questions and the descriptions within the levels of safety culture.

In the following sections the different elements of TSC are presented. In order to get at better understanding of TSC the reader is encouraged to read it through and get familiar with the questionnaire, which is enclosed in Appendix A.



		Areas	Denial culture (Pathological culture) #1	Reactive #2	Rule based or bureaucratic culture (Calculative culture) #3	Proactive #4	Ideal culture (Generative culture) #5
Organisation, management, responsibilities and resources	1	**How is the attitude and involvement of management in safety issues reflected in day-to-day work?**	Roles and responsibilities concerning safety at interfaces are not clearly defined. Management sees safety problems as unavoidable. If accidents or incidents occur, management find out who is to blame, often individuals and competitive or collaborating organisations, and get rid of them. Financial and punctuality targets are more important than safety targets.		Management is aware of challenges for safety culture at interfaces, and says they take it seriously. It is a view that all accidents could be prevented if people only do what they are told. Follow-up is limited to demands of rules and regulations, but beyond that no effort is made to encourage further work to improve safety culture at interfaces.		Management encourages workers to participate in safety work and listen to their opinions. Focus is on good processes to continuously improve safety culture at interfaces. Safety conferences are arranged; workers and stakeholders cross interfaces are welcome to participate and discuss safety issues. There is a double-loop learning in which outcomes of discussions are applied in the organisations.
	2	**Who causes accidents in the eyes of management?**	Individuals are blamed, and it is believed that accidents are a part of the job. Those directly involved in accidents are held responsible for them. It is a tendency to blame other organisations cross interfaces.		Faulty machinery, poor maintenance and people are seen as causes of incidents. There are attempts to reduce exposure to hazards. Collaborating partners are still easy to blame if accidents occur.		Blame is not an issue. Management accepts responsibility when assessing what they could have done to remove underlying causes. They take a broad view of safety, looking at the overall interaction of systems, people and co-operating organisations across borders.
	3	**How is safety prioritised when it competes with other concerns in the organisation, like profitability and punctuality?**	Making money and establishing high punctuality is the only concerns. Some times the traffic rules are not followed and speed limits are exceeded if necessary to keep up with the schedules. The important issue at the end of the day is to avoid extra costs.		There is no clear policy on how safety and punctuality are balanced, especially related to interfaces. Officially safety are of high priority, but hard to manage in practical situations.		Increasing profits on the expense of safety is a non-issue. Safety is seen as a competitive advantage and a source of "Best-practice" shared cross interfaces. A safety policy is derived from the overall business strategy, is clearly defined and agreed upon by collaborating organisations. The policy includes concerns for other organisational units, contractors and partners.

Figure 6.1 Structure of the Track to Safety Culture Questionnaire

6.1 TSC Areas

In chapter 5 four areas and several important challenges for safety culture at interfaces within each area were presented. Fahlbruch and Wilpert's (1998; in Schmidt, 2003) socio-technical system which presents different areas of high importance to organisational learning for safety critical systems have been used together with the identified areas in the Hearts and Minds brochure, as a basis for the interviews. In the interview guide, the questions were organised into seven important areas for safety culture (See Appendix E). During the following analysing process of the interviews, it was feasible to reduce the number of areas to four, as these four areas comprised the results. Below the areas with belonging challenges are repeatedly presented.

Organisation, management, responsibilities and resources:

- Managements involvement in safety work.
- Communication of safety issues.
- The culture for blame.
- Prioritising of safety when competing with other concerns.
- Transparency of contracts.
- Ability to adapt to new interfaces.
- Use of statistics and trends.
- Emergency training.
- Procedures.

Individuals and groups at interfaces:

- Attitudes towards new entrants.
- Co-operation between labour unions and management.

Co-operation across interfaces:

- Willingness to co-operate.
- Concrete arrangements for co-operation at interfaces.
- Co-operation with authorities.
- Attitude towards standardisation.
- Adaptations to handle cultural differences.

Learning processes:

- Focus on learning processes.
- Reporting routines.
- Use of reports and reporting.
- Organisational commitment to rules and regulation.
- Use of audits and reviews.

6.2 TSC Questions

Based on the identified challenges (from the interviews) for safety culture presented in chapter 5 and 6.1, 21 questions have been evolved for the questionnaire. These questions form the TSC Questionnaire and are presented in Table 6.1. In the table the questions are arranged in the same order as in TSC, and organised into the four areas of importance to safety culture. The four areas are included in the table in the column at the left-hand side.

The questions were evolved in steps. The challenges for safety culture were first revealed through the interviews and then further developed into meaningful questions. Then the draft was evaluated repeatedly by us (me and Tungland) and our teaching supervisors. In the next stage, evaluations were accomplished by three researchers. These evaluations were related to minor changes in content and structure (See Appendix D). Efforts were then made to do small changes to focus the questions to reflected challenges at interfaces in the best possible way.

In Paris a more thorough evaluation of the questions were carried out (See Appendix C). Here, participants were asked to extract four questions they saw as the most important and four questions they evaluated as less important for safety culture at interfaces. This information has been used to prioritise the upgrading of the questions. It was seen as necessary to improve the questions that were classified as least important, as they from our point of view were seen as essential to safety culture and interface issues. Other feedback on the questionnaire was related content and structure, which have been considered and included.

Table 6.1 Questions in the Track to Safety Culture Questionnaire

Areas	No.	Questions
Organisation, management, responsibilities and resources	1	How is the attitude and involvement of management in safety issues reflected in day-to-day work?
	2	Who causes accidents in the eyes of management?
	3	How is safety prioritised when it competes with other concerns in the organisation, like profitability and punctuality?
	4	How precise and transparent are the contracts between operators and contractors?
	5	Is management interested in communicating safety issues related to interfaces with the workforce?
	6	How do the organisations adapt to new interfaces and co-operation across borders?
	7	How are rules and regulations used at interfaces?
	8	How is emergency situations planned for at interfaces?
	9	How is Benchmarking, trends and statistics used at interfaces?
Individual and group	10	How do individual attitudes towards competing organisations affect safety work at interfaces?
	11	Does management and labour unions co-operate and work towards the same safety goals?
Co-operation across interfaces	12	Is there willingness to co-operate with stakeholders across national borders?
	13	Have there been made arrangements to co-operate at interfaces?
	14	How do the company co-operate with authorities?
	15	What is the attitude in the organisation towards standardisation across borders?
	16	How is company structure adapted to manage cultural differences? (Evaluate for both a domestic and an international level)
Learning processes	17	How are skills upgrading and competency training ensured in the organisation?
	18	How are incident and accident reporting, investigation and analysis performed? (Evaluate for both a domestic and an international level)
	19	How is experience feedback used in the organisation?
	20	How is commitment to procedures and rules in the organisation?
	21	How are audits and reviews performed?

As part of the preparation to the Norwegian workshop, a Ph.D. Student was asked to give an evaluation of TSC. Her experiences from the railway industry were seen as valuable to the development process, and she was asked to evaluate the questions and the alternatives (Blakstad, Appendix D). Related to the questions she stressed the necessity to make the questions more concrete regarding interface issues. As a result of this, a large job was done to focus the questions (and also the alternatives – see chapter 6.3) on interfaces.

6.3 TSC Levels of Safety Culture

As shown in the theoretical framework for this thesis, Hudson and van der Graaf (2002) have identified five levels of safety culture in organisations based on Westrum's (1993) classification of organisations. These levels are also used in TSC, as the five possible options where the users can tick off their answers. A description is given within three of the five levels; the pathological, the calculative and the generative culture, as shown in Figure 6.1. This was a deliberate choice as too much text was considered as making the questionnaire too complex. Our assumptions were confirmed through the evaluation process, as it was stressed that it was satisfactorily to describe only three of five levels, as it would have been difficult to follow with text in all fields.

Westrum's and Hudson's framework has been combined with Reason's (1997) characteristics of a good safety culture. This implies that there is a growth for each of these characteristics for each level of safety culture. For instance, question number 1 in the TSC questionnaire, deals with management attitude towards involvement in day-to-day safety work. This can be related to Reason's (1997) characteristic of an informal culture, which is recognised by that those who manage and operates the system have current knowledge about the human, technical and organisational factors that determine the safety of the system. One way to achieve such culture is that management are interested in day-to-day safety work in the organisation. The alternatives therefore range from a culture where it is a lack of this kind of involvement, to a culture where this kind of involvement is present.

As written in the previous chapter a large job was done when changing the alternatives to reflect challenges at interfaces to a larger extent. The reason was twofold. The first reason was to fit the questionnaire to better reflect its main aim; to survey safety culture at interfaces. The second reason was to make the alternatives as relevant and genuine as possible. It was desired that the users, in this case railway persons, could recognise the different alternatives and link them to practical experience.

> *For every other question I got chills down my spine, because I recognised the challenges described in the alternatives* (Participant at the Norwegian workshop).

6.4 TSC Score Card

As emphasised in the onset of this chapter, the main aim with TSC is to achieve good collaborating processes and group discussions regarding safety culture issues at interfaces. Nevertheless, some might find it interesting to use the questionnaire as a comparative tool either within an organisation or between two collaborating partners. A score card has therefore been developed, as shown in Figure 6.2.

The scorecard lists all the questions with the opportunity to tick-off the most suitable safety culture for each question. Question 16 and 18 should be evaluated for two different dimensions; within an organisation and between organisations (question 16), and at a domestic and an international level (question 18). Separate rows in the scorecard have been created to include these options.

	SCORE CARD	1	2	3	4	5	
	Description of Dimension	Denial	Reactive	Rulebased	Proactive	Ideal	
1	Attitude and involvement of management in safety issues.						
2	Who causes accidents in the eyes of management?						
3	Prioritisation of safety in competition with other concerns.						
4	Contract transparency and clarity.						
5	Interest in communication of safety issues.						
6	Adaptation to new interfaces and co-operation cross borders.						
7	Rules and regulations.						
8	Emergency planning.						
9	How is Benchmarking, trends and statistics used?						
10	Individual attitudes towards competing organisations.						
11	Co-operation between management and labour unions.						
12	Willingness to co-operate with stakeholders cross national borders.						
13	Have there been made arrangements to co-operate at interfaces?						
14	Co-operation with authorities.						
15	Attitude towards standardisation cross borders.						
16	How is company structure adapted to manage cultural differences?						
	A: Within an organisation:						
	B: Between organisations:						
17	Ensuring competency training and skills upgrading.						
18	Performance of incident and accident reporting:						
	A: Domestic:						
	B: International:						
19	How is experience feedback used in the organisation?						
20	How is commitment to procedures and rules in the organisation?						
21	How are audits and reviews performed?						
	Total ticks per column: **a**						
	Weighting factor: **b**	1	2	3	4	5	
	Number of ticks per column (a) x Weighting factor (b) Sum total weighted scores: **Total = (a) x (b)**						**Sum =**
	Calculate average Safety Culture Score: **Total (Sum(a x b))/23:**				/23 =		

Figure 6.2 The TSC Score Card

In Figure 6.3 the TSC Score Card already has been filled out by a fictitious user. The idea behind the scorecard is that after filling it out, the total ticks per safety culture column is calculated and written down in the row called "Total ticks per column". In the next row, "Weighting factor", a weighting factor is allocated to each level of safety culture. This weighting factor shall be multiplied with the finite answer of summarised ticks per column. The answers from each column are noted in the row called "Sum total weighted scores". In the rightmost column, in the cell called "Sum", the total sum of scores is summarised. In the last row, the final safety culture score is achieved by dividing this sum with the total number of questions.

As shown in the figure above, the filling-out process is easy to perform. However, some participants at the workshop found the score card not feasible for the purpose of the questionnaire. More details about this are to be found in chapter 7.5.1.

	SCORE CARD	1	2	3	4	5	
	Description of Dimension	Denial	Reactive	Rulebased	Proactive	Ideal	
1	Attitude and involvement of management in safety issues.				✓		
2	Who causes accidents in the eyes of management?			✓			
3	Prioritisation of safety in competition with other concerns.				✓		
4	Contract transparency and clarity.		✓				
5	Interest in communication of safety issues.					✓	
6	Adaptation to new interfaces and co-operation cross borders.			✓			
7	Rules and regulations.			✓			
8	Emergency planning.				✓		
9	How is Benchmarking, trends and statistics used?			✓			
10	Individual attitudes towards competing organisations.			✓			
11	Co-operation between management and labour unions.		✓				
12	Willingness to co-operate with stakeholders cross national borders.			✓			
13	Have there been made arrangements to co-operate at interfaces?		✓				
14	Co-operation with authorities.				✓		
15	Attitude towards standardisation cross borders.	✓					
16	How is company structure adapted to manage cultural differences?						
	A: Within an organisation:			✓			
	B: Between organisations:		✓				
17	Ensuring competency training and skills upgrading.				✓		
18	Performance of incident and accident reporting:						
	A: Domestic:			✓			
	B: International:	✓					
19	How is experience feedback used in the organisation?				✓		
20	How is commitment to procedures and rules in the organisation?				✓		
21	How are audits and reviews performed?			✓			
	Total ticks per column: a	2	4	9	7	1	
	Weighting factor: b	1	2	3	4	5	
	Number of ticks per column (a) x Weighting factor (b) Sum total weighted scores: **Total = (a) x (b)**	2	8	27	28	5	Sum = 70
	Calculate average Safety Culture Score: Total (Sum(a x b))/23:						70/23 = 3,0

Figure 6.3 An illustrative example of the TSC Score Card filled out

7 EVALUATION OF THE TSC QUESTIONNAIRE

In the previous chapter, chapter 6, the TSC Questionnaire and its different parts have been presented. However, an important question still remains unanswered; how should one utilise the questionnaire? Through the evaluation of the questionnaire the researchers demanded a precise description for use and purpose. This description is needed to include areas for utilisation, by whom and how the questionnaire should be applied, and how often. The aim with this chapter is not to give a detailed user manual or description for using the TSC Questionnaire, but rather to introduce the reader to the opportunity set of TSC. This chapter also present identified challenges by use, and aims to place utilisation of TSC in a wider setting.

The different aspects presented here, is based on ideas and suggestions brought up through the workshops. This chapter's aim is thus to answer the second subordinated issue for **Q-2,** as shown in the frame below:

Q-2: How can European railway undertakings improve safety culture at interfaces?

- Presentation of the questionnaire "Track to Safety Culture" as a tool for surveying and improving safety culture at interfaces (Chapter 6).
- Evaluation of "Track to Safety Culture (Chapter 7).

7.1 Why does the Railway Industry need a Tool like the TSC Questionnaire?

The railway industry has been a rule based industry, which leaves this industry with challenges that needs to be handled. There exists some fundamentally basic assumptions for rules within all countries, and these assumptions are as much different as the countries and organisations. This means that one company's rules can not automatically be used in another country. This, together with differences in national and organisational culture, even personal culture, makes it complicated to interface across national and organisational borders.

As presented in chapter 3.3, the Hearts and Minds programme has been used in the oil industry for 15 years, and Shell International has experienced continuous improvements regarding safety. These positive experiences from another industry should serve as a motivating factor for the railway industry, in that they try to adopt ideas and transform them into useful tools adjusted to the needs of the railway industry.

Itoh and Andersen (1999) did a questionnaire-based survey on night train operators' attitudes toward management and organisational issues that potentially impact safety. Their research concluded that operator's morale and motivation are potential risk factors of railway safety. Managers serve highly as cultural manipulators in their organisation (Schein, 1992) and the informants in this thesis pointed out

that, managers by their example, attitude and focus affect the workforce's commitment to safety and thus, motivation and morale to safety.

It is believed that the Track to Safety Culture Questionnaire can serve as a useful tool to call attention to cultural differences of importance to optimise collaboration and safety culture at interfaces. By using a tool like the Track to Safety Culture Questionnaire in the organisation, management can show that they are involved in managing cultural differences, and by letting the workforce participate in the process, management may achieve a higher degree of workforce commitment to safety culture.

7.2 The overall Utilisation Process of the TSC Questionnaire

Figure 7.1 illustrates the overall idea for how to utilise the TSC Questionnaire. First, it illustrates a person (or different persons in an organisation) that fills out the questionnaire by themselves, seeing safety cultural challenges from their point of view. Next, they might take the questionnaire with them to a group meeting, where several peoples' questionnaires are used as a basis in group discussions. Here, the group can look for differences and similarities, and reveal where their organisation's major challenges regarding safety culture are concentrated.

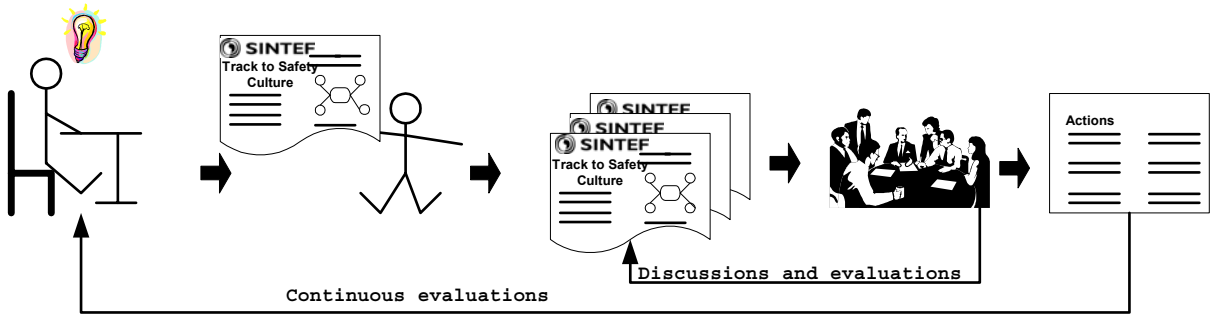


Figure 7.1 The overall utilisation process of TSC

A desired output from a process like this should be a detailed plan for concrete actions. These actions should thereafter be used as a basis for further evaluations and new discussions to see if the organisation has improved for the selected areas, or not. The reversing arrows show that it is necessary to continuously carry out this process to ensure constantly improvements. Another aspect is that this gives the opportunity to constantly monitor the safety culture status in the organisation.

The process sketched above, reminds more or less about the Action Research process presented by the action research wheel in Figure 3.2 (page 21). An organisation that wishes to improve its safety culture needs to know three important things (Hudson et. al., 2002b). First, it is necessary to know where the organisation, or part of it, is currently located in the safety culture ladder in Figure 2.1 (page 14). The fact finding phase, in the action research wheel, encompasses information acquisition and exposes problems and challenges within the organisation (Alteren, 1999). By involving organisational members in the fact finding phase, managers are more likely to obtain valuable information about the

organisation's situation. In this way they can find out how far the organisation can progress up the ladder, depending on its current situation. This is the second thing that is needed to know in a culture changing process (Hudson et. al, 2002b) and these discussions are also an important part of the planning process in the action research wheel (Alteren, 1999). The third thing to discuss, which also is an important part of the planning process is how far it is credible for the organisation to climb at the time, based on its current situation (Hudson et. al., 2002b). As a result of these discussions concrete plans for action for improvement should be formulated, and in the final phase action, in the action research wheel, these solutions and actions should be implemented (Alteren, 1999). Action Research is a participatory process where everyone involved takes some of the responsibility. This will foster a higher level of commitment to the implemented changes, and thus it is more likely to succeed (Hudson et. al, 2002b; Greenwood and Levin, 1998). Finally, the process starts over again, by doing new evaluations and discussions, and making new plans for how to stay at a desired level or to continue climbing in the safety culture ladder.

It is believed that by adopting TSC in processes like the one presented above, the organisation is more likely to achieve the knowledge necessary to improve its safety culture, and to foster a broader and higher level of participation in and commitment to the safety cultural changing process.

In the next sections different fields where TSC can be utilised are presented. Identified challenges by use are also presented.

7.3 The TSC Fields of Utilisation

Through the workshops three main fields have been identified as favourable for applying the questionnaire[16]. These fields are:

- Internal in an organisation.
- Between organisations.
- Multi-national organisations.

In the following these fields are presented.

7.3.1 Internal in an Organisation

Internally in an organisation, the TSC Questionnaire could be used to diagnose an organisation by telling what safety culture level the organisation finds itself. Management can use the questionnaire to

[16]Those field of utilisation presented here, was suggested in the two arranged workshops. Other fields of utilisation most likely exist, but it is seen as outside the scope of this thesis to give an account for all existing fields.

survey where there are critical needs and thus implement effective measures that can improve safety culture. Hence, TSC can serve as a monitoring tool for safety culture in the organisation.

A diagnose process can be either client-centred or self-diagnose (Harrison, 1987). The client-centred diagnoses involve clients or organisational members that are appointed as feasible for the case of the study. This process is facilitated by an external consultant. One benefit with this approach is that members can more readily contribute their insights and expertise about organisational life as they participate actively in gathering and analysing diagnostic data. In addition, participation often increases members' commitment to the importance of the study and makes the feedback more believable and salient for them (Harrison, 1987; Greenwood and Levin, 1998). The principles for client-centred diagnosis are much like the principles for Action Research, which also promotes highly participation by organisational members to ensure a strong commitment to the study and its outcomes (Greenwood and Levin, 1998).

The second approach, the self-diagnosis, implies by its name that the organisations conduct a self-diagnosis without the aid of a professional consultant. In order for the organisation to succeed with this approach it has to be open for self-analysis and criticism, and some organisational members need to have the skills needed for gathering and interpretation of information (Harrison, 1987).

The light bowl above our person's head in Figure 7.1, illustrates other important aspects of where TSC can be used. It was suggested that organisations can use the questionnaire as a personal test for their members. Motivation is a key factor for railway safety (Itoh et. al., 2000) and is seen as a driving force for behaviour (Hudson et. al., 2000). However, people need to be motivated to behave or act safely, and participation is a key factor for motivation (Arnold et. al., 1998). TSC is seen as motivator for safe work practise by using it as a personal test, as well as it will create awareness for safety cultural issues in their working environment (Appendix C).

Another area of application is after an accident. In the investigation period after an accident the Track to Safety Culture Questionnaire can be a useful tool to indicate and reveal areas where a possible absent of focus on safety culture might have had direct or indirect impact on the cause of the accident (Appendix C).

7.3.2 Between Collaborating Organisations

Track to Safety Culture can be used as a tool for monitoring, evaluating and identifying challenges between collaborating organisations. The main principles for using TSC, as shown in Figure 7.1, can be applied in these situations as well.

TSC can be used to initiate discussions between organisations to find out if they are at the same level of safety culture or not. It is important to realise that organisations can be at the same level of safety culture even though the cultures express themselves in different ways (Appendix C; Schein, 1992). By

using the TSC Questionnaire two organisations can be on different cultural levels but still aid understanding about each other's organisations, and their own organisation. As the main intention with TSC is to achieve good collaborating processes and group discussions, TSC can aid organisations in reaching a common understanding on important safety culture issues. This foster awareness and draws attention to safety culture in and between the organisations (Appendix C).

A simplified illustration of this is presented in Figure 7.2. Here, two organisations, A and B, have filled out the TSC Questionnaire and their results are summarised in a table that shows the origin of the two organisations. As shown in the figure, the two organisations have the same safety culture in only two questions (Question 2 and 5), in the remaining questions they are rather different. It would not be too wise, if the two collaborating organisations started to work at the same time with all areas where they had a different safety culture. In the figure, a red arrow points out where the two organisations have the largest gap in the safety culture scale. If these two questions turn out to be of vital importance to the organisations' collaboration, the organisations need to start focusing on solving these areas together.

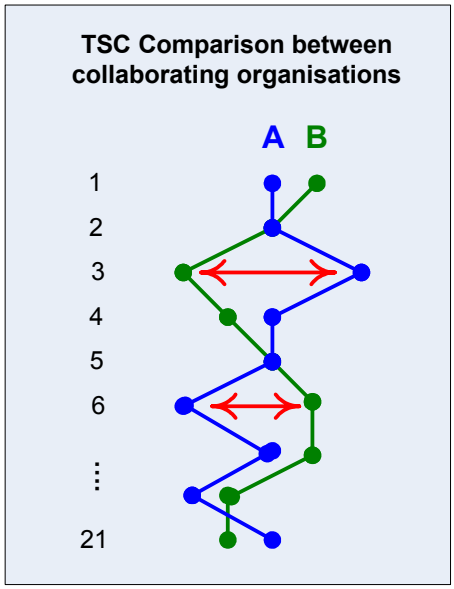


Figure 7.2 Comparison between two collaborating organisations

A desired outcome from using TSC between collaborating organisations is that the actors can agree upon and work together with important factors for safety. By initiating discussions related to safety culture, understanding of language and terms used during operation also may increase (Appendix C).

At the workshop in Paris another area of application was suggested for TSC. TSC can be used in the evaluation process of new actors, when hiring new contractors. If TSC is to be used when signing contracts and start-up of business alliances, it was seen as favourable to make TSC more extensive. A greater number of questions was not seen as an obstacle, as the time spent on filling out the

questionnaire would, in any case, be considered as minimal compared to the importance of the decision.

7.3.3 Using TSC in Multi-National Organisations

One of the greatest problems facing a multi-national organisation is the diversity of cultures with which it has to work (Hudson and Willekes, 2000). National culture is about what surrounds the actual work place and is thus a part of the character of the culture in an organisation (Lamvik and Ravn, 2004). Even within national cultures there exists a diversity of regional and ethnic cultures (Hofstede, 1991). Several railway undertakings have offices and operational units in two or more countries and this creates challenges related to differences between national cultures, differences within cultures, differences in language and dialects, and management styles (Hofstede, 1991). These challenges are also present in a situation where two organisations from different countries are collaborating, as presented in the previous section.

However, work practice is constituted by a number of factors and national culture is a part of and works through such factors. For instance, national culture prevails through corporate strategies and through rules and regulations procured by authorities, and affect how work is actually carried out (Lamvik and Ravn, 2004). The complexity of this can be illustrated by Rasmussen's (1997) socio-technical system, as presented in chapter 2.3.

It is believed that the TSC Questionnaire can be used in multi-national organisations which face such challenges as mentioned above. By using the questionnaire those organisations can identify similarities and differences between its units in different countries and regions, and hence be more aware of what to pay attention to.

Hofstede (1991) has conducted a study which aim was to group different countries into certain cultural areas. This grouping was based on five different dimensions power distance, collectivism versus individualism, femininity versus masculinity, long- versus short term orientation, and uncertainty avoidance. These five dimensions vary with national culture. When it comes to the TSC Questionnaire and its application in multi-national organisations, challenges to the cultural dimension *power distance*, may arise (Hofstede, 1991). This dimension is related to people's relation to authority and their level of respect when facing organisational authorities.

The nature of TSC makes it possible to give constructive criticism of one's organisation and its management. In countries where there exists a high level of power distance, it can be problematic to achieve good processes when using the questionnaire, because of peoples' natural retention of criticism (Hudson and Willekes, 2000). For instance, in Norway people are open and independent, and mostly our respect for other people is related to them as persons, their knowledge and competency, and not their title and position. Using TSC in such environment will not be as challenging as when using it in a country or environment where people are more restrictive and feel less comfortable to

express their ideas and ask questions to their superiors. These aspects are of high importance to address in further development of Track to Safety Culture (Appendix D).

7.4 By Whom should TSC Questions be Answered?

Two important questions arose at the workshops: Who should answer the questions? And, should everyone answer all questions? (Appendix B, C and D)

Some of the questions in the questionnaire are probably not relevant to all levels of an organisation. The reason is variations of competency and knowledge about different parts of one's organisation. A locomotive driver probably do not know exactly how his or her organisation handle transparency in contracts (Question 4 in TSC, see Appendix A) or how the organisation use benchmarking and statistics to improve collaboration at interfaces (Question 9 in TSC).

One way to solve this is to make a list of which questions that are to be answered by whom. For instance an organisation suggested split into two kinds of users; management and workforce. Management should be able to answer all questions, but the same is probably not possible for the workforce. By specifying which questions that should be answered by each group, the questionnaire becomes an even more interesting tool as it therefore can be used as a comparison tool between two organisational levels. This can create interesting knowledge about the different views and cultures that exists in the organisation.

Another important question that arose at the workshops was about how many that ought to fill out the questionnaire. Experiences from using Hearts and Minds show that small samples usually are sufficient and that it is not necessary to survey all members of an organisation (Hudson and Willekes, 2000). The most correct answer to this question is therefore that this depends on the purpose of use. If the intention is to gain statistical material about an organisations safety culture level, a representative sample of persons in the organisation should be asked to fill out the questionnaire. On the other hand, if the intention is to gain depth knowledge about organisational safety culture issues at interfaces, a smaller group of persons can be favourable.

7.5 Identified Obstructions for Use and Further Improvements of TSC

During the evaluation process constructive criticism for improving TSC was given. It is impossible to track all changes that have been done during the evaluation process with TSC. The improvements that are presented below, is still not included in the questionnaire, as time did not allow for it. It is now up to the UIC-SCAI project group to evaluate and include the remaining suggested improvements. For a wider description of suggested improvements it is referred to the appendices.

As the TSC questionnaire is a new way of working with safety culture in railways, some challenges were revealed in the workshops related to the practical use of the questionnaire. The challenges that are seen as most important are presented here.

7.5.1 Challenges and Suggested Improvements to the TSC Score Card

Some miscellaneous responses to the score card were observed at the workshops. The questionnaire was seen as loosing its value if the score card turned out to be a competition tool, where different companies strived towards achieving the best outcome (Appendix B). Some participants even stressed that the score card should be removed from the questionnaire, as they feared that it could be used as a part of a competition between two or more organisations. The process in using the questionnaire is seen as more important than compete on the best results. However, if the score card was used to monitor an organisation's growth or lack of growth, and using this information to guide the organisation for further improvements along the safety culture ladder, it was seen as a useful tool.

Some participants were sceptical to the way the calculation of the "average safety culture score" is accomplished (Appendix D). Today, the average safety culture score is calculated based on the number of ticks within each column, multiplied with a weighting factor which is then summarised, and finally divided by the number of questions (today: 23 questions). When the calculation is done in this way, it automatically implies that all questions are equally important to safety culture. But in the French workshop, the participants were asked to identify the four most important and the four least important questions for safety culture. This exercise demonstrated that the users have different opinions about the questions' importance for safety culture (Appendix C).

Based on this, one of the researchers suggested (Ph.D. J. Vatn, Appendix D) that there should be a supplementary weighting of the questions, depending on an a priori understanding of the importance of the questions. An immediate challenge related to this is to find a solution to the fact that different companies might have different opinions and a priori understandings of the questions' importance. How this should be accomplished therefore need carefully considerations and discussions in the further development and use of the questionnaire.

When evolving a score card for evaluating safety culture, one easily initiates a discussion on whether it is possible to measure safety culture or not. This thesis has a functionalistic approach to safety culture, but whether a number can be enough to describe a good or bad safety culture, can be a comprehensive discussion (Haukelid, 2001). My intention is not to start a discussion on this subject here, but rather to emphasis that this need to be taken into consideration in further application of the TSC Score Card.

7.5.2 Challenges and Suggested Improvements to the TSC Levels of Safety Culture

Through the evaluation process comments regarding the sketched levels of safety culture were given. Ph.D. Vatn (Appendix D) emphasised that it is not obvious that the generative culture is always the best and desirable culture for all railway organisations. For some organisations it can be satisfactorily enough for selected issues to be at a lower level, for instance the calculative level. A participant at the Norwegian workshop claimed that for some areas it is even critical for some organisations to be at a calculative or rule based level.

An interesting aspect in this case is Perrow's (1999) view on organisations. He sees organisations as systems and classifies them based on two dimensions; their level of interaction and their degree of coupling (tight or loose coupling). Based on this classification Perrow analyses organisations' accidents and their catastrophic potential. Organisations can either be classified as systems with linear interactions or complex interactions. Linear interactions are those in expected and familiar production or maintenance sequence, and those that are quite visible even when unplanned. Complex interactions are those of unfamiliar sequences, or unplanned and unexpected sequences, and either not visible or not immediately comprehensible (Perrow, 1999).

Organisations can either be tightly coupled systems or loosely coupled. Tightly coupled systems have little slack which means that failed equipment entails a shutdown in the system, because temporary substitution of other equipment is not possible. On the other hand, in loosely coupled systems something can be done twice if it is not correct the first time.

Perrow (1999) classifies railway transport as a tightly coupled system with linear interactions and argues that systems like this need centralised control. Perrow builds this argumentation to the fact that linear and tightly coupled systems operates with well established technology and standardised equipments and procedures. Tight coupling is required for efficiency and can be tolerated because the technology is well understood and the materials well controlled. In a linear system when failures occur they will not interact in an unexpected way, but in visible and expected ways. The system has programmed responses to these failures which need to be carried out immediately and precisely because of the tight couplings. In systems like this there is also need for a tight coordination in normal situations in order to avoid conflicts in and between activities. Applied on railway transport this implies that if two trains are at the same track or something is present on the track the outcome is evident; an accident will occur unless someone are able to stop the trains before they meet or remove the items from the track.

When someone claims through the evaluation process of the TSC Questionnaire that the rule based culture would be the most appropriate culture for selected issues in the railway industry it agrees with the Normal Accident Theory of Perrow (1999). However, when it comes to the increased level of interoperability a rule based culture may cause challenges. Each European country has a fundamental basis on which their rules are developed. This implies that when a train crosses national boarders,

these rules can not automatically be applied in the foreign country. Even though organisations need centralised control they may need to detach from the rule based culture and look at the possibilities to work towards a more generative culture. In the short run this means that one needs to take into account the human limitations that arise when personnel is forced to work under different rules and regulations. In the long terms, the industry needs to work towards a harmonisation of rules, equipment and regulation. This can result in a common centralised control for Europe, rather than centralised control within each organisation or country. My intention is not to give the answer to this discussion, but rather to emphasise that this is an important view to take into consideration in the further development and application of the questionnaire.

Another challenge that can be seen in relation to the score card and the five levels of safety culture is the possibility that given answers can be manipulated to generate a better result. Organisations may train themselves in giving the right answers depending on whom to read the results, or the application of the results (Appendix B). A solution to this is to include so-called trick questions randomly in the questionnaire. The purpose of these trick questions are to serve as checkpoints to see if the given answers are sincere or not, and to check for internal consistence. Another suggested solution was the contingency to randomise the alternatives. However, this is seen as a problem for the purpose of the questionnaire. The questionnaire is based on the idea that different types of safety cultures exist and that these can be generalised in a five points scale, starting at a pathological culture and ends at a generative culture (Hudson and van der Graaf, 2002). As TSC exist today it seems not feasible or possible to randomise the alternatives.

However, it is important to be aware of that the safety culture levels used in this questionnaire are not finite and the only solutions. The levels given, illustrates a potential growth from a less informed culture to a culture that is more informed (Reason, 1997). It is important to stress that it is up to each organisation to decide its desired and sufficient level, and to find a way to achieve this level of safety culture.

7.5.3 Language and Formulation

The Track to Safety Culture Questionnaire is developed in English and it has a set of academic terminology that is unfamiliar for most operating railway personnel. However, as the questionnaire is a part of the tool SINTEF is proposing to UIC, English was the most feasible language to use.

At the Norwegian workshop some challenges related to this was mentioned. As the used formulations are academic it was seen as difficult to use among operational personnel. The participants stressed that if the questionnaire is to be used throughout the organisations, it is essential that difficult words and concepts are removed from the questionnaire. This was also indicated by one of the researchers (Appendix D). Because of the questionnaire's academic nature it was suggested to translate it into the native languages of the countries where it will be adapted. It was deliberately chosen to use an

academic terminology in the questionnaire, as it is desirable to introduce the industry to this particular set of words and phrases. The intention is to create a common understanding of these phrases so that they can be adapted and used in everyday work throughout the industry.

However, some challenges are associated with translating the questionnaire into several languages. How does one assure that formulations of questions and alternatives remain the same in all languages? Or that the sense is preserved? Which language is preferred when using TSC in cross border relations? It is seen as outside the scope of this thesis to give an account for these challenges. But it is seen as requisite that these challenges are addressed in further development and utilisation of the TSC Questionnaire.

7.5.4 The Necessity of Preparation

The necessity of preparation first becomes a challenge when no one have prepared. Because of the nature of TSC – it is an extensive questionnaire – individual preparation is seen as highly essential. Feedback and observations at the workshops indicated that preparation is essential for the discussions. Preparation is especially important when users have problems in understanding and communicate in English.

7.5.5 TSC Questions

Finally, at the Norwegian workshop it was suggested to include a few new questions to the questionnaire. These questions are not included in the enclosed version of Track to Safety Culture, but are considered interesting to the questionnaire, and are therefore presented below:

- *Are the working environment adjusted for execution of safety critical tasks?* The alternatives should include how satisfactory the temperatures are, conditions when working by night, general working restrictions and other tings that affects humans in carrying out their work. This question should throw light on the relationship between humans and machines.
- *How does the organisation handle management by objectives?* The alternatives should reflect how the organisation follows up and achieve objectives.
- *How does the organisation ensure the quality of its own safety systems?* The alternatives should be shaped to initiate a discussion between the participants on how this problem is solved.
- There should be a question that handles how acceptance criteria (ALARP[17]) are evolved and decided for.

7.6 The TSC Questionnaire in a Wider Perspective

In Figure 7.1 the principles in utilising TSC was presented. This figure illustrates that the outcomes from using TSC should be a part of a continuous evaluation and improvement process. When TSC was

[17] ALARP (As Low As Reasonably Practicable) expresses that the risk level has been reduced as far as reasonably practicable in the organisation (Kjellén, 2000).

presented in the workshops it was not fully integrated in a context, and the participants emphasised that TSC should be a part of a complete toolkit; TSC should be supplemented by more tools, including what measures to implement to reach a higher level of safety culture.

These days SINTEF is proposing a tool, SafeTrack, to UIC for addressing safety cultural issues at interfaces in the European railway industry (Johnsen et. al., 2003b). SafeTrack consists of a set of tools; the TSC Questionnaire, scenario analysis on selected scenarios and checklists. These tools can be applied during planning and operation of cross border traffic. In the way SafeTrack exists today, the TSC Questionnaire and the Scenario analysis can be used independently.

The main activities in SafeTrack are described in Figure 7.3. Notice that this process has elements of the Action Research process. Here, five main activities are presented. Activity '0' is a preparation and organisation activity. Inputs in this phase are results and information from previous SafeTrack accomplishments. Additionally, the team need to collect necessary documentation to identify differences at interfaces, identify important stakeholders, establish a analysis group and to identify structural differences between key stakeholders related to; infrastructure, organisation, routines, environment and individual, and team. The output from this activity is an overview of structural differences, which are supported by a checklist.

In the next activity, activity '1', the safety culture assessment process is carried out by using the TSC Questionnaire. This activity includes filling out TSC and to discuss the questionnaire. The UIC-SCAI project group has identified three areas where TSC can be used; (1) within own company (see chapter 7.3.1), (2) Across companies meeting at interfaces (see chapter 7.3.2) and finally (3), it can be used by an external party, performing quality control of railway undertakings cooperating cross borders.

Within this activity, the UIC-SCAI project group suggests the same utilisation process as presented in Figure 7.1 (see Johnsen et. al., 2003b). First, it is filled out individually, then safety culture is discussed within each stakeholder organisation, and finally it is discussed between key stakeholders. The outcome from this activity is areas where differences may have safety impact. This outcome can serve as an important input to the next activity, which is the scenario analysis.

A scenario analysis is a step-by-step analysis of a real or fictitious incident or accident. The selected scenario should represent significant areas of concern to the involved parties (Kjellén, 2000). Hence, it is vital to the output of the analysis that the preparation activity (activity '0') and the safety culture assessment process (activity '1') is carefully carried out, and that the outcomes from these two activities are included in the selection process. The scenarios should also be realistic, in that the involved parties should feel that they might occur (Kjellén, 2000).

The analysis is then carried out by a method called the STEP diagram. In brief, a STEP diagram describes a scenario in detail; all involved actors are identified and the actions that terminates in the incident or accidents are divided up into smaller parts and presented chronological in a well arranged

table. This helps the participating stakeholders to gain a better understanding of the actual course of events. This was actually observed at the workshop in Paris where participants with different backgrounds and native language were asked to carry out a scenario analysis on an unfamiliar accident or incident.

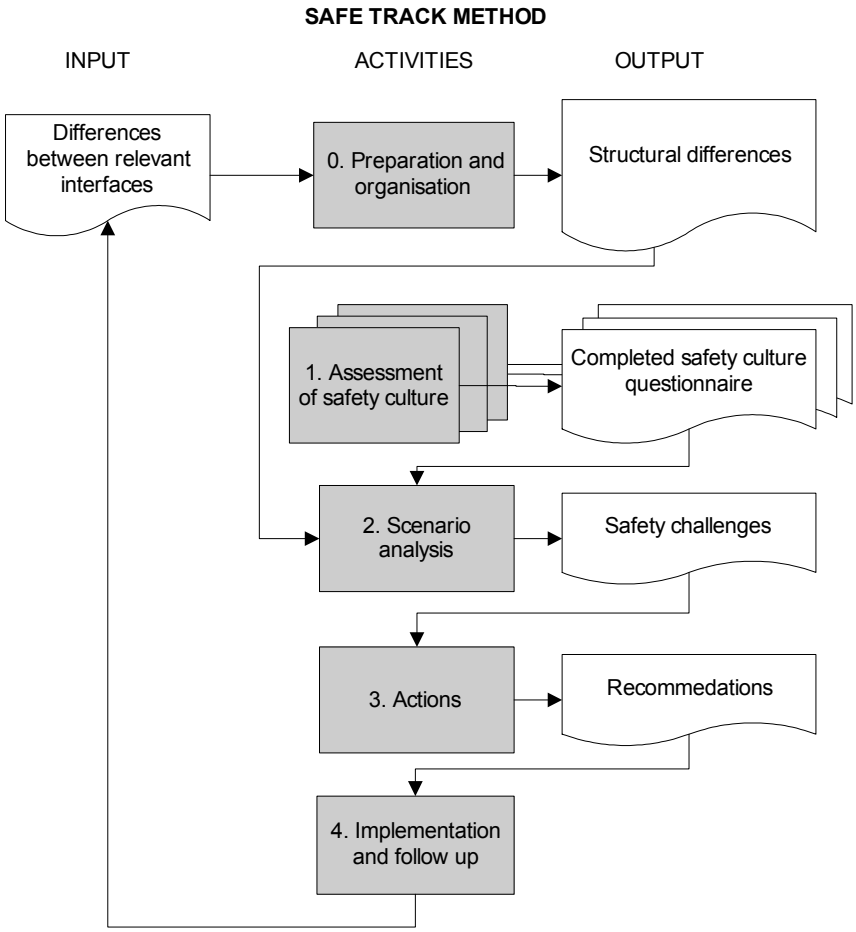


Figure 7.3 SafeTrack Activities (after Johnsen et .al, 2003b).

Then the project group has identified some Safety Critical Functions (SCF) which can aid in identification of safety problems related to collaboration and communications at interfaces. These SCF are organised in a checklist developed by the project group. Finally, in the second activity, the scenarios need to be analysed to identify challenges for safety culture at interfaces. This analyse can be accomplished by using the TSC Questionnaire. By using a Scenario Analysis the stakeholders can identify problems and general causes.

The report from the analysis and its recommendations should be allocated to relevant personnel with clear lines of responsibilities regarding follow-up. The next activity, '3', actions, implies that the recommendations should be transformed into concrete actions and that these need to be planned for. Activity '3' is closely linked to activity '4' which involve implementation and follow up. These two last

activities are the most demanding. It requires a certain level of coordination, involvement and commitment in order to manage the execution of them.

The reversing arrow in the figure shows that this is a process that continuously needs to be carried out. As the whole process strives to include persons from all organisations, and throughout the organisation, it uses the main principles of the Action Research as described in chapter 3.2.

A question that is still not answered is the question about how this questionnaire will affect the railway industry, and whether it will be used or not. Even though it was a general agreement among the participants that the questionnaire would serve as a useful tool in the railway industry, this question is impossible to answer at the prevailing point of time. As shown in Figure 4.2 *The development process* on page 28, the Track to Safety Culture Questionnaire was delivered to the project group after the workshop in Norway. As a part of the UIC-SCAI project, the project group will in near future carry out pilot tests for the entire tool. Through these pilots it is desirable to gain more knowledge about areas of utilisation, how SafeTrack actually work in the industry, and what actions that needs to be taken in order to make it more practical. It is referred to future reports of the project group to get the answer of this question.

PART FIVE:
RECAPITULATION AND CONCLUDING REMARKS

8 RECAPITULATION

8.1 Summary

The title of this thesis has been *Tool to be used to survey and improve safety culture in the European railway industry*. Its main intention has been to present the Track to Safety Culture Questionnaire, which has been developed as a tool for surveying and improving safety culture at interfaces in the European railway industry.

Safety culture is in this thesis related to interfaces as it is recognised that with increased interoperability across Europe, different cultures existing in different organisations will interface with each other and directly influence safety. Safety culture at interfaces is therefore used to express the interaction patterns that exist at interfaces; that is, how people and organisations communicate and collaborate at interfaces.

The first part of the thesis aimed at answering research question **Q-1** which is related to challenges faced by railway industry concerning safety culture at interfaces. Through nine in-depth interviews combined with safety culture theory, this question was answered. The interviews identified several challenges for safety culture, which was organised in four areas. These areas and challenges gave the basis on which the Track to Safety Culture Questionnaire has been evolved. Its applied structure is based on the four areas, and the identified challenges were used as input to the creation of 21 questions that forms the questionnaire.

The second part answered research question **Q-2** which is related to how European railway undertakings can improve safety culture at interfaces. The Track to Safety Culture Questionnaire was presented as a tool that European railway undertakings could use for that matter. Its different elements were presented in detail, areas of utilisation, obstructions for use and suggested improvements were also presented. The questionnaire's quality was ensured for through an evaluation process consisting of two workshops, feedback from three independent researchers and a Ph. D. student.

Through the evaluation process three main fields where the questionnaire could be utilised were identified. First, it was identified that the questionnaire can be applied *internal in an organisation*. Here it can serve as a diagnosing and monitoring tool, used by management to identify critical needs and to initiate effective attempts to improve safety culture. Management can also use the questionnaire as a personal assessment tool among their employees. Used with this purpose, the tool can serve as motivation for safe work practise, as it draws attention to safety issues and create awareness.

Second, the questionnaire can be used as a tool for monitoring, evaluating and identifying challenges related to safety culture *between collaborating organisations* at interfaces. The questionnaire can contribute to a common understanding about safety cultural issues. When collaborating partners become aware of safety critical issues, they can more efficiently agree upon and work together with

important factors for safety. The questionnaire is seen as useful for initiating discussions and it is believed that it can contribute to increased understanding of differences in working practise and also when language is a barrier between the partners.

Third, the questionnaire can be used in *multi-national organisations*, which have business units located in different countries throughout Europe. By using the questionnaire, multi-national organisations could identify similarities and differences between the different business units, and by this, gain better understanding on how differences in national and regional cultures affect the organisation's safety culture.

But what could prevent the questionnaire from being used?

The railway industry is a fragmented industry, based on national boundaries and operation under domestic rules and regulations (European Commission, 2001; 2003). Even though the questionnaire aims at solving collaboration challenges and safety culture challenges in these environments, the rule-based culture in some organisations could be seen as an obstruction for efficient use of the questionnaire. It is believed that if the rule-based culture becomes predominant, it may prevent the questionnaire to serves its intentions. The questionnaire is built on the idea that organisations can climb in a safety culture ladder and the rule-based culture is the middle level. If organisations are highly rule-based, and are not willing to reflect on this culture, using the questionnaire could be seen as meaningless.

Another obstacle for using the questionnaire was identified as the tendency to use the questionnaire as a competition tool between railway organisations. There are two rather important aspects to call attention to in this matter. First, if safety culture becomes a competitive factor in that organisations refuse to share their ideas and experience in building a good safety culture, working with safety culture across national and organisational borders in the railway industry may be more difficult than it necessarily has to be. If the industry as a whole desires a better safety culture, I believe that sharing of ideas, strategies for improving safety culture and encouraging each other to reach the common goal, is very important. Second, if railway organisations compete on achieving the best safety cultural score at the TSC Score Card, the main objective with the questionnaire is impaired. The main objective is presented as *creating good collaborating processes and group discussions* and competing on a number or score may therefore be meaningless. The power of the questionnaire is present in its ability to serve as a foundation for rich and valuable discussions related to safety cultural issues. Focusing on building good co-operative relations is more advantageous than competing on reaching the highest safety cultural score.

A third obstacle for efficient use of the questionnaire is "what is the most favourable safety cultural level"-discussion. If one organisation has identified its desired safety cultural level for some selected issues, collaboration with an organisation that has considered this level as an unfavourable, could create conflicts in co-operation. Rather than seeing this as fertile conditions for conflicts, organisations

should use this as an opportunity to identify where future conflicts will arise and call attention to counter measures, and use this as a basis for improving their collaborative relationship.

Figure 8.1, summarises the activities and main findings of this thesis. At the right, the four areas affecting safety culture is identified. The figure illustrates that these areas was used as input for developing the TSC Questionnaire. In the frame on the left hand side, the figure summarises the main findings from the evaluation process. In the hexagonal frame, the believed outcomes from using the questionnaire are presented. These outcomes will be further discussed.

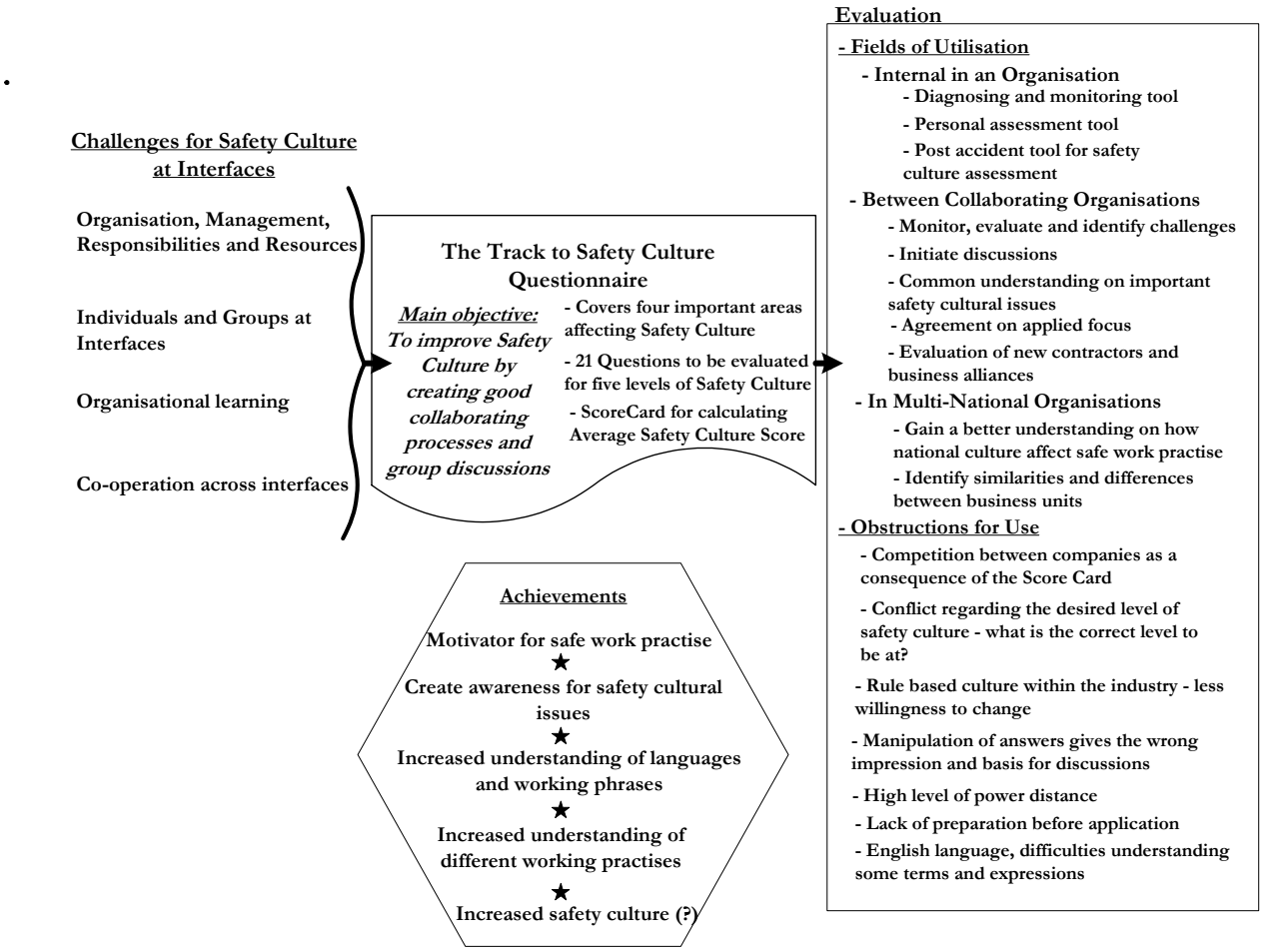


Figure 8.1 Summarising figure

In chapter 6 the intention with the questionnaire was formulated: "*The main objective with this questionnaire is to improve safety culture by creating good collaborating processes and group discussions.*" An interesting question would therefore be: Have we succeeded in making a questionnaire that fulfils the objective sketched above? As the questionnaire is in its initial phases of development, a complete evaluation of this is difficult to make. But some indications regarding this have been given through the evaluation processes.

Safety culture has by its definition been used to comprise how people interact, collaborate and communicate at interfaces. An evaluation of whether the questionnaire can contribute to an improved

safety culture or not, should therefore be done based on the definition of safety culture. This implies that an improvement of safety culture is an improvement in communication within organisations, and an improvement of communication and collaboration across organisational and national borders.

Can the questionnaire actually create good collaborating processes and initiate good group discussions?

The questionnaire is built up around 21 rather inquiring questions, each with descriptions for three safety cultural levels that illustrate the particular question. Each description consist of illustrative examples and critical examine important safety cultural considerations. These descriptions can serve as an important input to group discussions and be a starting point for rich and interesting discussions. In chapter 7.2 the overall idea for how to utilise the questionnaire was presented. I believe that by applying this idea and use the questionnaire as a basis for discussions, within or between organisations, the questionnaire can contribute to create good collaborating processes and group discussions. My belief rests on observations from the workshops. Some of the participants actually became more interested when issues in the questionnaire were discussed and they became more offensive in those discussions.

My belief also rests on the truth that in order to be good at something, one need to practise. And in order to be good at something together, it is essential to practise together. To be good at working with safety cultural issues in the European railway industry require common practise. This means that the railway undertakings need to practise together to be good at collaborating and to achieve good group discussions. To have supportive tools of good quality that can facilitate this process is important in order to reach the common goal. The TSC Questionnaire can serve as a supportive tool in this process.

So, can the Track to Safety Culture Questionnaire improve or change safety culture in the European railway industry?

Reason (1997) identified some characteristics that contribute to an informed culture; how well reporting is accomplished, a culture of “no blame”, a flexible culture and finally, a learning culture. Reason (1997) equalises safety culture with an informed culture and link organisations’ safety culture to how well the organisations treats information. Organisations that encourage sharing of information, give employees the “licence to think” and allow them to share ideas and thoughts (Westrum, 1993).

The questionnaire draws attention to all of the characteristics that Reason (1997) uses to identify an informed culture. In particular I want to emphasis the questionnaire’s ability to increase organisational learning. By involving employees in the process of building a solid safety culture, organisations are more likely to obtain a workforce that is more motivated for working with these issues. Argyris and Schön (1996) also stresses that the workforce more probably will provide valid information about their working situation and their actions, if they are involved. And only by involving the whole organisation, the organisation can practise double-loop learning and achieve long lasting changes.

Based on the revealed theory and my research in this thesis, I believe that the questionnaire can contribute to increase organisational learning if it is combined with, for instance, the principles of Action Research. By using the questionnaire in processes that promotes a high degree of participation where management encourage sharing of experiences, ideas and thoughts, I think that the questionnaire can contribute to increase an organisations' informed culture.

Today there exists no empirical material that can prove or disprove that the TSC Questionnaire improves safety culture in the European railway industry. Shell International has indicated that the use of their Hearts and Minds programme has improved safety culture in their organisation (Hudson and van der Graaf, 2002). As the TSC Questionnaire is inspired by Hearts and Minds I can only assume that TSC will affect safety culture in the railway industry.

My opinion is that the TSC Questionnaire can foster better communication and collaboration within organisations and across interfaces. The power of the tool is present in its ability to serve as a foundation for rich and valuable discussions related to safety cultural issues in the railway industry. It can contribute to a positive evolution in the organisation with a higher degree of participation and sharing of information. Based on the definition of safety culture that is used in this thesis, there is no doubt that TSC can contribute to reinforce safety culture, but whether it changes the underlying assumptions and the theories-in-use is, after my opinion, at this point of time too early to evaluate. Before this can be done, the questionnaire needs further improvements and evaluation through thoroughly accomplished pilot tests. Then its use has to be closely monitored over time when applied in an organisation or in a collaborating relationship. Not till then, it can be discussed if the questionnaire actually can contribute to changing safety culture.

8.2 Recommendations for Further Research

After writing this thesis about safety culture at interfaces it is my opinion that there has been too little focus and research in this area in the railway industry. This opinion is based on the fact that there were difficult to find literature that specifically handled safety culture at interfaces in the railway industry.

Through the process of writing this thesis, new and interesting research issues have arose. The scope of this thesis has, however, restricted the amount of issues that could be handled. The following issues are considered as interesting for further research:

- There have been done some assumptions regarding the rule based safety culture's impact on the work with safety cultural issues in the railway industry. It is feared that if the rule based culture becomes predominant, it will prevent form working with safety cultural issues in an efficient way. More research should be carried out to find out which impact the rule based culture has on the safety cultural work.
- Participants at the workshops emphasised that using safety culture as a competitive advantage in the industry, would affect the work with improving safety culture in the industry in a negative way. Research should be carried out to reveal the effect this will have on the industry and on the different organisations.
- There is no doubt that different companies have different safety cultures, and find themselves on different levels in the safety culture ladder. More research should be carried out to find out more about the impact that this will have on co-operating railway undertakings and how they can use this to identify future conflict areas.
- Today it is the operators themselves that define their own acceptance criteria. However, it was questioned at the Norwegian workshop whether today's systems are favourable when several actors are entering the markets. It was questioned whether this from now on should be taken care of by the authorities to ensure a common understanding and agreement on the acceptance criteria.
- Through the interviews it was revealed that locomotive drivers can adopt a profession culture that does not welcome participants. The most important interface was also identified to be between locomotive drivers and traffic control. It should be paid more attention to how individuals' attitudes affect co-operation across interfaces.
- Even though several areas for utilisation of the TSC Questionnaire has been presented in this thesis, more research should be done to evaluate whether it is the most proper way to survey safety culture at interfaces or not. This should be done as a part of the pilots. A research on different areas of utilisation should also be carried out, where it should be determined information about whom, where and when to use the questionnaire.
- Finally, it is referred to chapter 7.5 for suggested improvements of the questionnaire.

8.3 Self-evaluation of Scientific Approach

This discussion will be based on the notions of trustworthiness and verification as presented in section 4.5.1.

Trustworthiness is about consciousness related to possible sources of errors in the research material. While working out this thesis I was given the opportunity to utilise facilities offered by SINTEF Industrial Management and the UIC-SCAI project group at SINTEF. During the whole period I have had my workplace in SITNEF's research environment and have closely collaborated with the UIC-SCAI project group. I have had two teaching supervisors during the working process and my work is naturally influenced by their opinions and views. They are both researchers at SINTEF and play a key role in the UIC-SCAI project.

I see it as a huge advantage that I was given this opportunity. By being a part of the research environment I gained valuable information and knowledge through informal talks in the corridors and by dropping by the researcher's offices. This has been of invaluable significance for carrying out my thesis. Being so close to a research environment creates challenges related to too much nearness to the sources of information. However, I have been aware of possible traps related to this.

By involving other persons with no connection to the project I have tried to get the necessary distance. Two of the researchers who did an independent evaluation of the TSC Questionnaire (Ph.D. Tinnmansvik and Blakstad, Appendix D) have no connection to the UIC-SCAI research project. However, they have experience from the railway industry and other industries, and have used their experience to give constructive criticism for improvements. By doing this, I got a third-party evaluation of the questionnaire, an evaluation that was not influenced by self-interest or commercial interest, but that were solely evaluated on a professional basis.

In the last phases of writing this thesis I also asked two researchers at SINTEF, with different professions and background, to read through the thesis (Ph.D. Alteren and Ph.D. Rosness). My intention with this was to receive an evaluation from independent sources related to the adequacy of the thesis' scientific work and approach, and to get corrections and verification of the thesis.

Verification is defined as the extent to which the research gives the correct answers. It has been important to me to assure for the best quality and accuracy of the work I have done. Some strategic choices have therefore been made. In order to obtain the best possible basis of information, the interviews were carried out with as different persons from the railway industry as possible. After the interviews were accomplished and transcribed, the résumés were returned to each informant for their corrections and approval for further use.

A count for criticism is that all informants were Norwegians. This was a deliberate choice based on available time and resources. However, during the French workshop information from the participants' countries was brought into the discussions and compared with the information revealed in the

interviews in Norway. This showed that there was conformity among challenges in European railway organisations and the Norwegian challenges. They had the same challenges related to management, communication and collaboration across interfaces as here in Norway. Based on this it is not seen as a major weakness that the informants in the interviews were only Norwegians.

The Hearts and Minds programme and its research inspired development of a questionnaire for the railway industry. As the research done in relation to the Hearts and Minds programme is acknowledged and based on known theorists in the area of safety and culture, I have not hesitated to use their sources of information in my thesis. I do want to emphasise that I have applied this theory together with my own exploration, by combining theory with own research results. Other research material with connection to neither the Hearts and Minds programme nor to the UIC-SCAI project have been referred to in the thesis, and combined with own results where it has been natural.

By finding the right balance between distance and nearness to my research, I assume that I have been able to acquire the best from the two opposites: I have had a nearness to the research environment that has given me a favourable opportunity regarding information acquisition. At the same time, I have kept a distance requisite to answer my research questions.

9 CONCLUDING REMARKS

The Track to Safety Culture Questionnaire has in this thesis been developed and presented as a tool which European railway undertakings can use to survey and improve safety culture. The questionnaire is constructed to reflect challenges that the railway industry is confronted with. These challenges were revealed through the interviews and are related to four superior areas: (1) organisation, management, responsibility and resources, (2) individuals and groups at interfaces, (3) co-operation across interfaces, (4) and learning processes. 21 questions are constructed to reflect the challenges that railway organisations can experience within each of these areas. The structure of the questionnaire reflects a safety culture ladder in which organisations can climb, and for each question there are descriptions for three of the five safety cultural levels. Each description consist of illustrative examples and safety cultural considerations.

Through the research it has been revealed that the questionnaire has a wide area of application. It can be used within an organisation for diagnosing the organisation's safety culture level, and bringing into focus how the organisation handles safety cultural issues at interfaces. It can be used as a personal assessment tool which can create motivation and awareness for safety culture among organisational members. The Track to Safety Culture Questionnaire can also be applied between collaborating organisations in aiding common understanding on important safety cultural issues and in multi-national organisations.

The main objective with this questionnaire is to improve safety culture by creating good collaborating processes and group discussions, within and between organisations. It is believed that the Track to Safety Culture Questionnaire can foster better communication and collaboration within organisations and across interfaces. The power of the tool is present in its ability to serve as a foundation for rich and valuable discussions related to safety cultural issues in the railway industry. It can contribute to a positive evolution in the organisation with a higher degree of participation and sharing of information. Based on the definition of safety culture that is used in this thesis, there is no doubt that TSC can contribute to reinforce safety culture in the railway industry.

At the prevailing point of time, the Track to Safety Culture Questionnaire can be used as a stand-alone tool, but the need to include the questionnaire in an extended toolkit with supportive tools has been revealed through the evaluation processes. However, Track to Safety Culture is still in an early part of its development phases, and in order to make use of its potential the questionnaire needs to be further improved. With further improvements it is believed that Track to Safety Culture can be a useful tool and a positive contribution for managing cultural interfaces in the European railway industry.

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APPENDICES

APPENDIX A – THE TRACK TO SAFETY CULTURE

In this appendix the Track to Safety Culture Questionnaire is enclosed. As this questionnaire is the main contribution to this thesis, it is essential that the reader use time and effort to understand the questionnaire and its content. Chapter 5, 6 and 7 present the development process and the work that has been carried out making this questionnaire.

APPENDIX B – SUMMARY WORKSHOP NORWAY

This appendix is presented in Norwegian as the workshop and the summary was written in Norwegian. I do apologise for those not speaking Norwegian.

Referat UIC-SCAI Workshop.
Dato: 30.10.2003, sted: SINTEF Teknologiledelse, Trondheim

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Gruppeinndeling (Referent skrevet i Bold)

Gruppe 1
Tom Ingulstad, NSB

Kjetil Gjønnes, JBV

Morten Pleym, Connex

Øystein Aslaksen, Lokomotivmandforbundet

Stig Ole Johnsen, SINTEF

Camilla Bergersen, NTNU

Gruppe 2
Knut Mo, CargoNet

Steinar Olsen, NSB

Anette Christiansen, JBV

Ragnar Rosness, SINTEF

Mads Veiseth, SINTEF

Gruppe3
Atle W. Heskestad, JBV

Asle Martinsen, Flytoget

Ingmar Hemsen, BaneService

Helene Blakstad, NTNU/NSB

Malene Tungland, NTNU

Ivonne A. Herrera, SINTEF

1. ÅPNING

Generelle kommentarer

- Målet med workshopen er å få hjelp for å gjennomføre praksis metode.
- Det er like store forskjeller innad i Norge som mellom land når det kommer til sikkerhetskultur. Det er også mange forskjeller innad i egen organisasjon, relatert til sikkerhetskultur. Deltagere har forhåpninger at en skal kunne benytte metoden i sikkerhetsarbeid i egen organisasjon.
- Erfaringer fra Paris workshop indikerer problemer at interface: hvem tar ansvar og beslutning

Noen forventninger til møtet

- Få innblikk i muligheten for utveksling av konkrete saker for forbedring.
- Få innsikt i teori og metodikk til å vurdere/forstå kulturrelaterte sikkerhetsproblemer i forbindelse med grenseoverskridende trafikk + nye operatører i Norge.
- Få innspill fra de andre deltakerne på hvordan de oppfatter begrepet sikkerhetskultur

Definisjon av sikkerhetskultur

- Mange peker på holdninger når de skal si hva de legger i sikkerhetskultur
- Summen av holdninger rundt sikkerhet i hele organisasjonen.

2. TRACK TO SAFETY CULTURE: PRESENTASJON AV GRUPPEARBEID 1 OG DISKUSJON

Kommentarer under presentasjon før gruppearbeid

- Er ledelsens oppfatning i samsvar med de operative? Kan benytte spørreskjemaet til å sjekke dette.
- Hvem er det som har ”rett” til å utrykke seg om selskapet eller companiet. Skal en få innblikk i hva selskapet står for må en ikke bare ha innblikk i hva ledelsen står for men også hva de nedover i system et står for.
- Kan benytte dette spørreskjema ved å sende det ut til alle, og få det inn, eller å benytte det som en intervjuguide etc.
- Kulturer, holdninger er viktig når deg gjelder å overholde regler.
- Man har de en til fem på svarskjema hvor fem er det beste, men dette er ikke entydig, enkelte steder er det ikke bare grønn som er best
- Er spørsmålene ledende? De har hatt behov for en knaing
- Kan ikke være på engelsk, må være på på nasjonens språk. Viktig at en ikke får forskjellig mening med spørsmålene dersom en har de på forskjellieg språk.
- Blir vanskelig når ikke begrepene er skikkelig definert. Eks sikkerhetskultur
- Eksempel med ATC, i Sverige regulerer dette, svenske lokførere har mindre terskel for å ikke kontrollere farten enn de norske.

Gruppe 2: referat fra gruppearbeidet – del 1

I gruppearbeidet skulle deltageren først fylle ut spørreskjemaet. Deretter ble skjemaet og spørsmålene diskutert: hvordan kan det benyttes, hvordan bruker man resultatet, er spørsmålene relevante etc?

Generelle kommentarer

- Hvor objektiv går det egentlig an å være?
- Ikke så mange i et selskap som har kompetranse og kunnskap i et firma til å besvare de, kun de rundt bordet her
- Jernbanen er veldig regelbasert, og operativt personale etterspør også mer regler. Det er enklere å lage regler enn å bygge kultur
- Har hatt de samme opplæringsprogrammer de siste 15 årene
- Bør kanskje innkalle lokførere lokførerledere osv til et slikt møte etter en stund

Målgruppe/resultatet en får ut

- Resultatet av spørreskjema avhenger hvem en spør: Lokfører ville svart mer negativt enn de som jobber med sikkerheten og er med her i dag.
- Er det behov for to skjemaer?
- Ledelsen kan benytte skjemaet til å kartlegge hvor skoen trykker mest.
- ”Bortkastet å sende det ut i organisasjonen for de er uinteressert i dette, men nyttig for ledelsen”
- Men: viktig å få meninger fra de nedover i systemet
- Skal en benytte skjemaet ute blant operativt personale, må gjøre de om gjøre de mye mer praktiske og luke vekk vanskelige ord og begrepsapparatet.
- Mellomledere kan ha interesse av å vite hva de på toppen tenker om de forskjellige spørsmålene
- Skjemaet kan benyttes ned til terminalsjefene.

Om spørsmålene

- Mange spørsmål er veldig omfattende
- Forslag til lurespørsmål innimellom, sjekke om folk har tatt det på alvor.
- ”Spørsmålene er veldig godt laget, får vont i magen da de treffer veldig bra”
- Omfanget: Kan ikke være for omfattende og bør ikke være mer omfattende enn det er. Alle spørsmålene er ikke relevante for alle nivåene.

Inndeling av svarene

- Noen svar som ikke faller inn i rubrikker, havner av og til midt mellom
- Står nå i et grensesnitt, org har vært regelbasert, skal over til en pro-aktiv måte og tenke sikkerhet, har folk som jobber mot å komme seg mot grønn side av spørreskjema. De ute på sporet vil ha regler
- Bra med beskrivelse kun på tre av fem, hadde blitt for mye på alt, greit med fem alternativer

Utfyllings-prosessen

- Ingen konkrete spørsmål en har problemer med, men burde ha satt av mer tid til å lese gjennom å fylle ut en det en gjorde.

Scortabellen

- Ser nytten av scorcard over tid slik at en kan se utvikling. Men verdien er ikke den viktigste, det viktigste er gjennomgangen av spørsmålene
- Skummelt å benytte tallene og sammenligne med andre, blir sport i å gjøre det best mulig. Dette gjelder kanskje spesielt folk med ansvar som ønsker at det skal være slik og slik. Dette gjelder kanskje fargene også

Tileggskommentarer fra andre grupper

- Sverige og Danmark samarbeid om å ta vare på hverandres personell. Man kunne lære fra deres erfaringer.
- God struktur på spørreskjema, men noe mangler – helhetlig – gode beskrivelser
- Skulle ha godt mer igjennom spørreskjema i forkant.
- Litt ideologisk preg over metoden. Står det noe her som er relativt konkret? Et papir som sier noe om målstyrt sikkerhetsarbeid. Metoden går mellom regler og holdninger.
- Nyttig modell, innledningen og temaene sirkler vi rundt. En del av kulturbegrepet – hvis vi skal operasjonalisere – kan vi gå mer konkret, i forhold til målstyrt sikkerhetsarbeid i ulike organisasjoner. Audits/reviews delen er fint at dere har fått med.
- Kan trene på å svare de rette tingene ovenfor tilsynet.
- Beskrive ytterligheter for å fordele innad. Setter opp grenser.
- Noe som mangler: i spørsmål 10 og 11: tilrettelegging av arbeidet for de som skal sikkerhetstjenesten. Forslag: Blir arbeidsmiljøet og arbeidssituasjonen tilrettelagt for utføring av sikkerhetskritiske oppgaver? Forholdet mennesket/maskin. Tilfredsstillende temperaturer, nattarbeid, arbeidstidsbegrensninger, det som påvirker mennesket i å håndtere sikkerhetskritisk arbeid.
- Forslag om å bake inn et spørsmål rundt hvordan man håndterer målstyringen: hvordan man setter seg mål, om man er opptatt av dem og følger dem opp.

- Det er ikke nødvendigvis en tragedie å ikke være på den grønne delen av skalaen. Viktig å presisere dette i en innledning.
- Metoden er tatt fra oljebransjen. Jernbanen er en regelstyrt virksomhet som minner mer om luftfart enn oljebransjen
- Spørreskjemaet kan brukes på flere måter: (1) til internt bruk, måle organisasjonen, kjører dette på en gruppe bestående av ledelse og lokomotivførere, hvordan disse oppfatningene. (2) grensesnitt i praksis: togledelsen, for eksempel den svenske togledelsen og et av selskapene som de samarbeidet med. Terminal personalet – norsk lokfører til Sverige gjennom en svensk terminal. (3) et selskap som driver i to land (ex. Linx). TIPS: Folk med allsidige erfaringer – formidler gjerne kontakt til disse lokførerne og personene.
- Sikkerhetsopplæring, brann beredskap og det at på enkelte områder er det opp til operatøren å finne ut selv hva som er bra nok – skal dette inn i metoden?
- Hvordan kvalitetssikrer man sine egne sikkerhetssystemer? Spørsmål 14 tar opp litt av dette med forhold til myndigheter – kan utvikles litt for å reflektere problemstillingen.

Annet

- Linx som pilotprosjekt: dette er vanskelig fordi linx er en ”hybrid”. – bruk **Cargonet**. Trafikken er spesiell og begrenset – korte distanser ensartet trafikk for MTA AS/AB. Ingen samtrafikk på personell hos Nabotåget, så der blir det mest administrativt. Linx er ikke trafikk utøver. Nabotåget

Plenum

Diskusjon etter gruppearbeid

- Sikkerhetskultur er ikke endimensjonalt. Det føles som om spørreskjema er endimensjonalt: Hva er en dårlig kultur, ha er en god kultur? Er dette riktig? Det er ulik oppfatning av hva som er god nok når et gjelder sikkerhetskultur
- Hva med holdninger til regelverk i grensesnitt? Mener at spørreskjema tar hensyn til dette.
- Spørsmål relatert til ledelse i spørreskjemaet var bra.
- Savner mer om fagforeningen, og deres rolle, i spørreskjemaet.
- Hva er funksjonen til spørreskjemaet? Er det et kartleggingsverktøy? Hva skal evt en benytte et slikt kartleggingsverktøy til? Til styring?
- Kan benytte spørreskjemaet til benchmarking
- Spørreskjemaet kan benyttes i en gruppe bestående av norske og svenske lokførere.
- Problemer med kulturbegrepet. Jo lengre seminarene blir, jo lengre fjerner en seg fra virkeligheten: vi befinner oss på treeren og utfordringen ligger rundt der. Problematisk å rote seg enda mer inn i det som en kaller kultur. Jo mindre en benytter begrepet kultur, jo bedre det er. Men sikkerheten i Norge er veldig ingeniørstyrt, kommer til et vist nivå, men har behov for komme videre, trenger kanskje en kultur.
- Lokmansforbundet mener at det er et godt begrep sikkerkultur, mener at det er nyttig når en har to forskjellige grupper og kan se på hvordan de tenker forskjellig, og kan avdekke svakheter, og misforståelser, mener at det er et nyttig verktøy
- Viktig å tenke gjennom hva som kan være resultatet av de forskjellige beslutningene som taes.

Oppsummering

Spørreskjema

- Skeptisk: Tallfestingen er ikke bra, spesielt ikke når det gjelder i en konkurransesituasjon, den er livsfarlig, ta den vekk.
- Spørreskjemaet an brukes til å sammenligne organisasjoner, og gjennom det benyttes til å plukke ut et egnet scenario.

Workshopen hadde også en seanse hvor en scenarioanalyse ble presentert. Detter er imidlertid utelatt fra materialet da dette er utenfor oppgavens rammer og utrede om. Dette har ingen innvirkning på den evalueringen som er gjort i forhold til TSC.

APPENDIX C – WORKSHOP IN PARIS

MINUTES OF MEETING

Welcome

By Stig Ole Johnsen

It is important to work on issues concerning safety culture at interfaces. We need input to the methodology SINTEF is proposing.

Participants

Name	Company	Country
Laszlo Fenvyes	MAV (Hungarian State Railways)	Hungary
Laszlo Karpati	MAV (Hungarian State Railways)	Hungary
Sonia Taylor	UIC (International Union of Railways)	France
Guido Galle	NMBS/ SNCB	Belgium
Louise Ragget	Rail safety and standards board	United Kingdom
Josef Molko	ZSR	Slovakia
Ingrid Tribulova	ZSR	Slovakia
Anette Christiansen	Norwegian National Rail Administration	Norway
Stig Ole Johnsen	SINTEF	Norway
Trygve Steiro	SINTEF	Norway
Jørn Vatn	NTNU/Norwegian National Rail Administration	Norway
Malene Tungland	NTNU (student)	Norway
Camilla E. B. Bergersen	NTNU (student)	Norway

Key findings within WP 1

- Little systematic research has been done
- Safety culture at interfaces is important and safety culture can be measured and/ or understood.
- Safety culture can be improved.
- UIC can play a significant role.
- Important interfaces
- Traffic control and traffic driver
- Infrastructure manager and infrastructure producer

Expectations from the participants

- A common agreed upon method that can be measured for all players. Identify potential hazards between borders, but also different operators within the company.
- Similar regulations and directives, method will be useful for all railways. A mean of regulating safety at borders. A mean to work on safety.
- Need to get in better contacts with other companies- we need some form or structure for contact with other companies.
- Better understanding of safety culture at interfaces and get feedback on the method
- Get a method that the industry commits to and helps improving the safety.

Group discussion- Key issues

- How to succeed with our methodology in the railway industry?
- Which goal could sell the methodology?
- What are the key stakeholders to be involved to succeed with the methodology?
- What is the best process to succeed?

Group 1

Problem:

1. No common rules regarding to safety in Europe

2. UIC as a global organisation had too little attention in the past for human factors and too many on technical issues. At least up till the last years.

3. No common tool to use

4. Desire: Do not need another rulebook to put on the shelf. We need something usable, simple and understandable by all users.

Goal:

To create a proactive way of doing the things of organising interfaces.

Stakeholders:

The ones who create and owns the rules, EU and the UIC (could be an authority of safety regulation).

Every invitation should come through UIC or at least from one of the members.

Group 2:

The method is very similar to the method we use after accidents; we would like to use it with real accidents that have happened to convince people that it is useful and to achieve involvement and commitment.

How can we sell the methodology?

To make it more tangible, demonstrate its usefulness in advance of an incident. To theoretical, needs to be more practical.

Let it come to life, names of companies. To make it sexier, like a newspaper article. One or two page summary of this method and why do we need it. Demonstrating the commercial value of the method – uptake. The financial benefit, as the side effect of co-operation and not only improved communication. It could be used to favour co-operation between companies before starting up, identify problems that may arise. Both managerial and operational staff, called actors in the method.

Focus on other benefits than safety as well, like: punctuality, performance, improving efficiency, cost saving

Key stakeholders to be involved to succeed with the methodology?

Get some big names involved, such as large railway undertakings. A problem that neither Germany nor France is involved in the project. Involvement from France – UK – Belgium.

Scenario- method

Introduction of the scenario method STEP (Sequence Time Events Plotting) by Stig Ole Johnsen.

How can scenarios be used to work on safety culture? The idea behind it is that we need a common mental model to discuss. This is a starting point. Incidents can also motivate the involved people. As we have seen from this morning's discussion, safety culture is rather complex; safety culture could be more tangible this way.

Feedback on the scenario methodology

The method is understandable and it is easy to use. Easy way to explaining the incident but also to get insight in the problems. It lead to discussions and asking questions for clarification. It enables to see different angles.

Need to think more about national borders. I will have to use it on more scenarios before I conclude. Very good in describing an incident. Once the incident is described, you need to identify SCF. You need some guiding there.

It might be a danger in identifying too narrow efforts.

We need supporting tools. How should one go and find a good scenario?

Challenges concerning safety culture at interfaces

Each participant listed three major challenges regarding safety culture at interfaces. After a plenary discussion the following items were agreed on.

Grouping of the points:

1. Organisation level
2. Communication
    - Language
    - Physical communication
3. Rules and regulation
4. Attitudes
    - Critical situation affects attitudes
    - Position that I adopt in the situation
5. Different technology and standardisation

What are the actions that can be taken with regards to safety culture at interfaces?

- Attitudes: behavior of individuals at interfaces influenced by the safety culture in the organisation. A blame free culture. We will have a common language in the long run. UIC is a key institution here and a strong tool for safety in general.
- Establish a management group to define responsibility and discuss issues. We need common rules.
- We need training between the interacting groups of people involved. There are a lot of changes going on. Safety culture is not a work once and for all.
- Unify the basic organisation and some basic levels. When we have them, we can define responsibility.
- Communication and language problems. We need more language training. We do not think we will have one common language. Define language based on co-operation. Knowledge of the language is low.
- International and national regulations (How can we harmonise the national to the international standards. Coding the train delays- compatible (UIC). Regarding border crossing- we must use the same codes.
- Organisation. There should be an obligation to meet and define the responsibility both on normal and deviation situations. The one that should demand this would be the regulator.
- A lot of rules and regulations are not very user-friendly. Otherwise drivers write their own in the notebook. If there is a change, there is a risk that this is lost.
- Joint training is a very good idea. A lot of incidents can be included in the training and scenarios should be a part of the.
- Standardisation of command and phrases, at least standardisation of the most important ones in operations and emergency situation.
- Organisational issues. You come together to create a system of the cross border situation. There will be harmonisation, but there will be commercial interest that should come together and create a common safety management system. Eurostar use bilingual English

and French. This is driven by commercial interest. We do not necessary need one language.
- We need to define clear responsibilities.
- It is important to sit together and create responsibilities. We can learn from airline industry, air traffic control and international military operations.
- It would be fruitful that people play each other's roles.
- Rules and attitudes towards rules.
- How do we harmonise the attitudes? A unified concept of how the rules should be applied (minimum/ maximum). Or quite the opposite. We create groups that define the rules and how they will tackle things.
- Awareness will be a key defense against misunderstanding.

"The track to safety culture"

By Camilla Bergersen and Malene Tungland (A detailed description of this session is given below, in a separate part of this Appendix).

Group discussion on the usefulness of the questionnaire.

Plenary comments

The questionnaire is not a toolkit. It need some support regarding who to invite, how to use it and how to analyse the results.

Questionnaire:

- Monitoring tool
- Two organisations to collaborate
- Post accident
- Training toll- management tool
- When should you apply the kit?
- Assess contractors
- Will there be a software tool?
- Will there be a statistical analyse?
- How will the results be used?
- All questions cannot be answered by all, except for general managers.
- The questionnaire and the scenarios should be used in relation to each other.
- It is important to create a trick question in order to check for internal consistence.
- SINTEF will suggest starting with the questionnaire and then go on and creating scenarios.

Administrative issues

SINTEF has created a e- room (Project hotel) People who will have access to all material, can send an E- mail to Stig.Johnsen@sintef.no and they will get username and password in order access all information.

Next Steering committee meeting to be held on Wednesday 19 in Paris

RESULTS FROM THE EVALUATION SESSION AT THE UIC - SCAI WORKSHOP CONCERNING THE 'TRACK TO SAFETY CULTURE'

General comments on the tool

Most important the questionnaire should be part of a complete toolkit, and therefore be supplemented by more tools. This is something all the participants at the workshop agreed upon. It should not only consist of a questionnaire but a whole range of tool, including what measures to implement to reach a higher level of safety culture. The toolkit has to comprise the whole life cycle, and follow the evolutionary process of an organisation. The toolkit should include among other things: help and guidelines for what to do, where and when to do it. Also a solution and remedies should be proposed.

Who should answer the questions? And should everyone answer all questions? Different questions could be asked to different organisational levels. The top management should be able to answer all questions, but this is not the case for the workforce and middle management/supervision. One suggestion is to make two groups of questions, one group for management and one for workforce. It could be interesting also to see if these two groups have the same opinion about the situation. The guidelines mentioned above should include instructions concerning who and how many that ought to fill out the questionnaire.

Another wish was to randomise the alternatives to avoid that respondents will tend to go to the right side since this is known to be the best answer. It has been a "design" decision to do that when using the questionnaire within a company or between companies to aid in developing the "best" culture.

With randomisation of the answers the questionnaire could be used as an evaluation tool of a third party and limit cheating. This would give a more correct picture of the organisation. This is a use of the questionnaire that the UIC SCAI project could not finish within the defined scope.

There should be a column for comments for the respondent. This way he or she could make comments when filling out individually before group discussion. Another advantage would be the possibility to add details, which would also ensure understanding and serve as a guarantee for quality.

The questionnaire looks a lot like the Cultural Maturity Model used in UK. Which also is a model for evaluation of culture, but the use of the results are restricted.

One comment is that there should be an even number of questions that naturally would be 20. Like the game 20 questions. In addition this would ease the calculation of the final sum.

All abbreviations need to be taken out or written out and explained. This would simplify it for the reader and avoid misunderstandings.

What is missing? What happens next?

- How do we use the results of the methodology?
- Feedback – how do we use it?
- Focus on individual actions or organisational changes?

Questions for further discussion:

- Is the generative culture necessary the safest safety culture?
- Is it bad for safety culture that different groups are at different levels?

Usefulness and Relevance

There is a general agreement that the questionnaire would serve as a useful tool. It could be used a basis for evaluation of risk at interfaces, use it on the other party to ensure that they fulfil demands and that they prioritise and take safety considerations seriously. It is also to be considered to relevant to safety performance, (TS) references to the survey that finds an empirical correlation between level of safety culture and safety performance.

The Track to Safety Culture is seen as a good tool to foster awareness. It could draw attention to safety culture in Railways but also help in reaching a common understanding of the terms that are used.

It could initiate discussions between organisations to find out if they are at the same level of safety culture. The important issue is that they understand each other and that they agree on the important factors. Two companies can be at the same level of safety culture even though the cultures express themselves in different ways. At the same time two organisations can be on different cultural levels and agree on which factor are the most important and how safety could be ensured in the best way. This will aid understanding of different organisations, included own organisation.

There is some doubt (AC) that the answers given in the questionnaire are always to be considered as valid. The answers may vary from time to time even if nothing has changed. Will the same answer be given in two months?

To make it both more relevant and useful there should be a trap question, to find out whether the respondent is a liar (GG). This could be a direct question, which tests correspondence. This is a technique used in personality tests.

Are the alternatives realistic?

Yes, no specific comments. The alternatives give a good picture of the railway industry; they are recognisable and correspond to safety level of the industry.

It's important to stress that the alternatives given is generic solutions – not the only answer. If the users of this tool see the alternatives as the only solution, the focus will be on achieving the favoured level, rather than focusing on the overall processes.

Use

As mentioned it could be used to evaluate new actors, when hiring a new contractor and in all kinds of selection processes. If this tool is to be used when signing contracts and start-up of business alliances it would be favourable to make it more extensive. A greater number of questions would not be seen as an obstacle. The time spent on filling out the questionnaire would in any case be considered as minimal compared to the importance of the decision.

Internally in an organisation, the TSC could be used to diagnose an organisation, by telling on what safety culture level the organisation finds itself. This could identify needs and effective measures to be implemented to improve safety culture. This implies help for the organisation to improve its safety culture in the most effective manner and guidelines for decision making (ALARP).

Internally in an organisation it could also be used as a personal test. This will motivate for safe work practice as well as create awareness.

In the future the TSC could also be used by an independent body to manage challenges at interfaces. Could UIC have such a role? One solution would be to have a central authority within the EU, i.e. an international inspectorate with cross-border responsibility.

Comments on the questions

The four most important questions

The participants were asked to give an overview of four questions that they meant where of high importance to the questionnaire. Below their answers are presented:

L. Ragett	3, 6, 13, 15.
J. Vatn	2, 16, 18,20
G. Galle	1, 3, 10, 18
A. Christiansen	See Q1 as very important, no ranging beyond that
J. Molko	10, 16, 20, 2
L. Fenvyes, L. Karpati	No unimportant questions – all of them are important.

As we can se some questions are seen as more important than others, among these are question 1, 3, 10, 16 and 20.

The four least important questions

In the same ways as above, the participants also were asked to identify the four least important questions.

L. Ragett	9, 11, 14, 17, 21.
J. Vatn	

G. Galle	Q2 is not that important. All questions are seen as relevant, but if one were forced to skip one it should be number 4.
A. Christiansen	All questions are seen as relevant, but if one were forced to skip one it should be number 4.
J. Molko	
L. Fenvyes, L. Karpati	No negative questions

The participants mention different questions when forced to pick out specific questions. None of the questions seems to be commonly agreed upon to be completely irrelevant, none of the questions are repeated among their answers.

Ranging of the alternatives, do the alternatives correspond to the given level of culture?
Vatn: Stresses that there can be different opinions about what constitutes a generative culture. For instance it doesn't have to be solely negative to blame individuals nor does it has to be only positive to have a non-blame culture, which can lead to pulverisation of responsibility. There is doubt about the premises for the ranging of the cultures.

Comments on specific questions:

Question	Comments
Q1 and Q5:	These questions are too closely linked and they should be more separated. The order of the questions could be mixed so that they did not appear in the present order, and other questions came in between (Before this workshop, these questions were question Q1 and Q2).
Q3:	This is a key question: Alternative "generative" is unrealistic (no funds will be allocated based on risk assessment): Allocating fund based on a well defined model. Alternative "rulebased": There is no ranking strategy for the guys at the sharp end – how do they prioritise when they have to choose between alternatives in a critical situation?
Q4:	Is difficult and only possible to answer by top management (G.Galle). JBV is not aware.
Q9:	This is difficult to answer for the worker level. (LR) Move the first sentence from rule based to generative, change it to be "within railway industry".
Q10:	This question was not answered by MAV, this because there are no new entrants on the Hungarian railway network, neither private nor foreign actors.
Q11:	With the descriptions given for the ideal culture, there would not be any need for any unions. Denial culture and rule based culture are too similar – make them more

different.

Q12: This question was not answered by MAV, because there are no foreign railway undertakings operating in Hungary. (LR) Reformulate: "Is there willingness to …"

Q13: This should be reformulated to something that needs to be decoded by Steiro…Are the arrangements that are made likely to… It is more a question of the quality of the arrangements or the level of co-operation. Every company has made arrangements (Galle).

Q14: Unnecessary question

Q16: This should be split into two questions, one within companies and one between companies, i.e. across companies. In the alternative for the Ideal culture the word co-opting is used. This is a difficult word – use collaborating instead.

Q17: Focus on training rather than resources. CRM is not used in railways; use the concept as an advice.

Q18: This should be split in two questions and there should be two options to evaluate for; one for domestic and one for international. The alternatives: we do our own investigation, we read each others reports, according to regulations we make up a group with participants from each organisation (international group investigation).

Q21: Not for worker level.

Suggested new questions:

Rules and regulation – management use the rules to cover up for their managerial approach – rules are a minimum, rules are improvised, and rules are unnecessary in that they are constantly assessed in order to make them ore practical (Now presence as Q7).

Emergency situations - How do your organisation plan for emergency situations? We have nothing, we examine accidents, we plan for unplanned situations – we constantly look for new potential situations (Now presence as Q8).

APPENDIX D – EVALUATION FROM RESEARCHERS

Before the workshop in Paris, three researchers with different backgrounds were asked to critically evaluate the contents of the tool, and to comment on the existing design. After the return from Paris, a Ph.D. student was asked to give her evaluation of the tool, as she is familiar with the Norwegian railway industry. This was done in order to ensure for the most feasible tool to be presented at the Norwegian workshop at October 30, 2003.

Below, a bright résumé is given for each evaluation.

Ph.D. Jørn Vatn (September 19, 2003)

Mr. Vatn emphasised that it was of high importance that the focus were on the main intentions with the workshops that is to evaluate the tool in content and use, and not to evaluate a special safety culture. To ensure a good tool, thoughts about the application of the tool had to be addressed as soon as possible. Mr. Vatn specially focused on how the tool should be used in other countries, especially with the authority gradient in mind. In Norway people are open and independent, and our respect for other people is related to them as persons and their knowledge, not their title. In other countries it is rather the opposite. This aspect is, pursuant to Mr. Vatn, of high importance and necessary to address in early stages of the development of the tool.

Mr. Vatn also stressed the importance to reveal the principal questions as an a priori understanding of the questions is vital to the application. Related to this Mr. Vatn suggests that different weighting of the questions should be applied as some questions are seen as more important than others.

Related to the gradation of the different cultures, i.e. from pathological to generative culture, it is not given that for each question that the generative culture is the best and desirable culture. For some organisations can a pathological culture possible be a better safety culture than the generative culture for selected issues. Mr. Vatn questions how this taken into account in the weighting of the questions.

Mr. Vatn suggests that in further work with the tool it is necessary to use statistically approved methods to assure the quality of the TSC. This involves methods to assure non overlap of questions, the weighting of the questions and the reliability and validity of the tool. He also stressed the importance of being aware of whether the suggested tool is a measure tool or an improvement tool, or if it is both, to take the necessary steps to ensure the reliability and validity of the tool.

Ph.D. Ranveig Kviseth Tinnmansvik (September 2003).

Mrs. Tinnmansvik was asked to give an evaluation on content and structure in the early phases of the development. Her evaluation is presented below.

1. *Identify who is to fill out the scheme.*

   Is the scheme to be filled out by individuals or in groups? By the management or operative personnel?

2. *How to range the alternatives.*

   With the range now used, you can risk that most people will tick of the center column. This will make your tool worthless. I suggest that you use a 5 points scale. This will distribute the answers, and add more value to the results.

3. *Questions.*

   I miss a question that reflects the culture in some organisations to take care of each other, to help out and to correct each other if necessary.

Mrs. Tinnmansvik also gave feedback on particular questions. These are given below.

Q-1: In the description of the ideal culture the term double-loop learning is used. I think this term fit better under question 19.

Q-12/13: The sketched alternatives are too similar. I understand the difference between the two questions when reading the questions, but not when I am reading the alternatives.

Q-16: In the generative culture you have used the sentence: "*Cultural differences are seen as an advantage as well as a challenge."* Reformulate this to include that cultural diversity is positive and not a negative challenge. Focus on the possibility to make those different cultures to co-operate in the most feasible way, and that this could gain the organisation more than to try to create one culture throughout the organisation.

Q-18: I would suggest that you include the term *underlying causes* in the description of the generative culture.

Q-19: Concerning experience feedback – is this just for accidents or in general? I will suggest that you use this term and angle it to be used in general, i.e. to use experience feedback throughout the organisation.

Q-20: In the description of the generative culture, include the term *Best practice.*

M.Sc. Mads Veiseth (August/September 2003).

Mr. Veiseth was asked to give an evaluation on content and structure. In the following a bright résumé of his suggestions is given:

1. *How should the tool be adapted?*

   A short introduction to how the tool should be adapted is necessary. This includes information on where to use it, how to use it, how often and by whom.

2. *About the alternatives.*
   Some of the extremities, that are the pathological and generative culture, are extremely in their formulation. I will suggest that you loosen this up if possible.

3. *Academic language.*
   By whom should this tool be adapted? I think that the language is too academic in its nature. Some of the users probably do not know what is meant by a pathological, calculative or generative culture. Unless it is desirable to introduce this terms to the industry, I suggests that you find terms that can substitute the most academic words. Have this in mind in further development.

4. *About the design.*
   Do something to facilitate for the reading of the tool. Do this by using bold lines, different fonts and colors. Additionally I will suggest that you make an illustrative figure in the introduction chapter that describes how to fill in the scheme.

5. *How to range the alternatives.*
   With a scale from 1 to 3 as now used, you can risk that most people tip the central field, that is the column that gives the score 2. In order to prevent this, use for instance a 5 points scale, that probably will distribute your answers better and thus contribute to a more applicable tool.

Mr. Veiseth also suggested some changes to specific questions. These suggestions are related to some of the items above. Below the suggestions are given in more detail:

Q-2: The description of the generative culture is an overstatement.

Q-3: The description of the generative culture is an overstatement.

Q-5: The description of the pathological culture is an overstatement. The same yields for the generative culture – can actually someone manage this?

Q-15: The term *infrastructure* can be misleading if you mean the organisational infrastructure. Most railway persons associate this term with physical equipments as tracks and signal systems.

Q-18: A typical example of how the extremities are overstated (pathological culture).

Ph. D. Student Helene Blakstad (October 10, 2003).

Mrs. Blakstad gave an evaluation of the tool together with Mr. Stig Ole Johnsen, one of my teaching supervisors. Mrs. Blakstad gave the following feedback.

1. *Define precisely the main focus with the tool.*
   It is necessary to define precisely that the main focus with the tool is interaction at interfaces, and that the scheme should be used to work with this rather than to be just a pure tool for organisational learning.

2. *All the questions and their descriptions should be related to interaction at interfaces*
   Mrs. Blakstad suggests that all questions and descriptions need to contain something related to the purpose of the tool, which is interaction at interfaces. If this is not possible for all questions, these particular questions should be considered and maybe taken out of the tool. For instance, Q5 "Communicating HSE issues…": This question should be related to HSE issues at interfaces, i.e. that someone says something about what happens at interfaces, is there good communication concerning incidents at interfaces?

3. *Not to be instructive concerning railways.*
   There is necessary to tell the users that the scheme is picked up from the oil industry – we have to be clear about our sources. However it's important to stress that this tool is developed to fit to railway challenges in cooperation with UIC and other railway undertakings. Additionally we can emphasis that experiences from railways can give important impulses to the oil industry, and that this could contribute to development of a more generic tool that can be applied abeam different industries. This is important to stress related to marketing.

4. *Description on how the tool should be used between organisations.*
   To steps can be described:
   INITIAL: For instance, describe how the scheme can be filled out to reflect own organisation related to inside challenges. This can be used to focus on what the organisation and the individuals can work with related to interfaces.
   GENERATIVE: Then the tool can be used for open comparison between companies in order to address how they act and where they think differently.

5. *Training*
   Training related to interfaces has to be a part of the tool.

6. *Use of the term HSE.*
   We have to reflect on the use of the term HSE. In railways it is common to distinguish between the terms safety and HSE. Evaluate the use of HSE and see if it can be used or needs to be exchanged with another term.

APPENDIX E – INTERVIEW GUIDE

This guide is made in co-operation with Malene Tungland.

A. General/Opening Questions

1. Could you give a description of your work tasks?
2. Could you give a brief description of your organisation?
3. Collaboration and interaction between regulatory authorities, infrastructure manager and other railway undertakings
4. What kind of work experience do you have with safety work within the railway industry?

B. Management, Commitment and Participation

5. In your opinion, what affects workers commitment to safe work practice?
6. Is there a rewarding system for good safety work?
7. How would you describe the different professions in railways? Could you please describe the different cultures within each of these professions?
8. In what way will different professional cultures influence on safety work?
9. How are the professional cultures in your country compared to those in the rest of Europe?
10. Do you think that tradition for communicating safety varies with country and national culture?
11. How will the way the industry is organised influence the management in their safety work?

C. Challenges at interfaces

12. Do you have specific experience with safety critical issues related to cross border traffic?
13. Which particular challenges do you see in managing safety work related to cross border traffic?
14. Have you experienced specific operational safety issues in cultural interfaces?
15. How does your organisation adapt to handle safety cultural interfaces?
16. How can one facilitate for good safety work when dealing with cross border traffic?

D. Policy and Strategic Objectives

17. Do you see any problems in handling goal conflicts between HSE and competing concerns like profitability, effectiveness, and operational demands?
18. Have your organisation formulated a policy for handling safety culture?
19. Do you see any problems that can arise in co-operation between companies with different safety policies?

E. Organisation, Responsibilities and Standards

20. What problems would you expect to arise with an increasing level of privatisation and a greater number of small operators?
21. What challenges do you think the Norwegian infrastructure manager will meet in relation to new entrants?
22. Is there a standardised educational system in railways?
23. Is there a training system for cross border traffic?
24. Do you think that there will be any need for a standardised training program for the European railway industry?

F. Planning of HSE-work

25. Would it be favourable to standardise work and emergency procedures throughout the European railway industry?
26. To what extent do the workers feel responsibility for rules and procedures?

G. Implementation and Monitoring

27. Is there a standardised reporting system?
28. Will there be any need for standardised report routines?
29. How do you imagine that such a common report system can be used in further work?
30. Can the use of a common reporting system get in conflict with corporate interests?
31. Can different routines and systems for accident investigation affect common safety work?
32. Will there be any need for standardisation of accident investigation?
33. Is there a difference in how blame is assigned in different countries?

H. Audits and Reviews

34. Do you use a standard for auditing? Will it be favourable to cooperate on this?
35. Would it be appropriate to do benchmarking on safety performance?

I. Finishing questions

36. Feedback question on the structure of the interview
37. Anything else you would like to add? Has anything been left out

APPENDIX F – SUMMARISING TABLES FROM INTERVIEWS

Through the nine in-depth interviews lot of information was produced. Unfortunately it was impossible to present all aspects of this material in this thesis. I have chosen to enclose my notes from the interviews in this appendix, so that those who are interested can find supplementary information.

The interviews are presented in tables, where the main entries are presented for each question. The informants are organised into six categories. This way of presenting the material, makes it easy to compare what each category has answered for each question. This was done to ease the analysing process.

It has been used an orally language in the tables as this tables are based on a partly transcription of the interviews. The observant reader will see that not all categories have answered all questions. This is clearly marked where it occurs. The reason for this is that the interviews were adjusted for each informant as the interviews were carried out. Not all questions were suitable for all informants.

I hope the material will be of use.

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
Could you give a description of your work tasks? (Question 1)	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.
Could you give a brief description of your organisation? (Question 2)	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.	- These answers are omitted to ensure total anonymity of the informants.
Collaboration and interaction between regulatory authorities, infrastructure manager and other railway undertakings (Question 3).	- Undefined roles as a result of the restructuring of the Norwegian railways in 1996.	- Undefined roles - A conflict of interest can arise as the industry is divided into independent business units.	- The interpretation of the collaboration has been steered by myths about absent knowledge about railways. In particular between operators and infra-structure management.	- Today's structure is adjusted for competitive tendering. - The old structure was more favourable to deal with safety.	- Today's structure is suitable. - Favourable that the regulatory authorities has the superior control.	- Clearly defined roles are necessary.
What kind of work experience do you have with safety work within the railway industry? (Question 4)	- Have worked with auditing earlier. - Worked in railways since 1997.	- Conductor - Safety Advisor - Worked large scale accidents related to fire	- Have worked with railways since 1962.	- Been a guide for other locomotive drivers - Know about safety systems in Nor and Sweden	- Not with railways, but in other industries.	- Worked with railway safety in five years, but have worked with safety in other industries.
In your opinion, what affects workers commitment to safe work practice? (Question 5)	- Management attitudes - Safety ensured by the operative units	- Training - Attitude campaigns - Organisational structure - Personal perceptions of usefulness.	- Management and their focus - Training	- Culture for taking care of each other - Feedback when discovering mistakes	- Management attitudes - Quality of safety management systems	- Rules - Dialogs and discussions - Media - Oblige the workers to do risk analysis
Is there a rewarding system for good safety work? (Question 6)	- Reporting of unwanted events need to be stimulated. Not a common culture for this.	- Commendation from your superiors. - HSE rewards to stations with god performance over the last three years.	- No, you got satisfaction of good results at the periodical test (every 3rd year).	- No, just that you feel professional safe and comfortable. - Rewarding systems can result in negative competition between workers.	- I am not familiar with this.	- We do have a bonus system related to economical results. Safety performance is a important part of this.
How would you describe the different professions in railways? Could you please describe the different cultures within each of these professions? (Question 7)	- Labour unions have affected safety work as they have used safety as an argument for achieving benefits.	- More conflicts among professions earlier. - The most important interface is between the locomotive driver and traffic control.	*- The informant did not really answer this question. The answer is therefore omitted.*	- Every one has the same goal and the same regulations as a base for work.	- Traffic control is one of the most important intersections – most of the communication has its origin here.	- Locomotive drivers working for the major operators can adopt a profession culture that not welcome other participants
In what way will different professional cultures influence on safety work? (Question 8)	- Labour unions have affected safety work as they have used safety as an argument for achieving benefits.	- Clarifying roles are of importance. - Disperse of responsibility can create lack of ownership to safety. - The competition for scarce resources can create friction in the organisation.	- Organisational stability and safety has been less favourable as a result of today's system.	- Lack of knowledge about other professions work can cause conflicts of interests.	- We do not experience such problems as we have implemented an organisational structure that takes care of these problems.	- Safety has been used as a substitute motive in discussions

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
How are the professional cultures in your country compared to those in the rest of Europe? (Question 9)	*- This question was not asked to this informant.*	- Assume that they are similar.	*- This question was not asked to this informant.*	- Assume that they are similar.	- Assume that the Norwegian and Swedish cultures are similar.	*- This question was not asked to this informant.*
Do you think that tradition for communicating safety varies with country and national culture? (Question 10)	*- This question was not asked to this informant.*	- *The informants had not enough experience to answer this question.*	*- This question was not asked to this informant.*	- Communicate safety issues inside the train with other colleagues. - No meetings are arranged.	- Experience has shown that there are differences in how safety is communicated across national borders.	*- This question was not asked to this informant.*
How will the way the industry is organised influence the management in their safety work? (Question 11)	- Important to focus on how the organising is put into practice, rather than to focus on the actual organising process.	- Short command lines. - The goal oriented approach and the distribution of responsibility can result in that safety falls out. - The organising has become difficult to handle as the industry is divided into separate units.	- It is not the regulatory authorities that have changed the safety work. It's the management.	- There is unsatisfying communication between organisations; this exists only through Synergi and the organisational lines.	- The reorganising of the Norwegian railways in 1996 has resulted in increased safety compared to the situation prior to 1996.	- Management is obliged to influence the line management to practice their safety responsibility. In the management group there is a good communication and exchange of experiences.
Do you have specific experience with safety critical issues related to cross border traffic? (Question 12)	- Technical differences - Different regulations - Shorter distance between the signals in Norway than in Sweden.	- Different signals – visually their alike, but have different meaning. - Confusion in communication on Swedish side.	- Never had any safety problems.	- Different signalling systems. - ATC is more established in Sweden than in Norway.	- Never experienced any safety problems.	-Different signal systems -Different regulation -Have used a pilot through Sweden.
Which particular challenges do you see in managing safety work related to cross border traffic? (Question 13)	- Different training programs - Emergency communication - Handle the complex interfaces between infrastructure manager, traffic control and the operational units. - Have complete overview of risk and considerate contributions.	- Management has to set an example - Prioritise training - Implement a reporting culture	*- This question was not asked to this informant.*	- Different language - Different signalling systems and technology - More actors to deal with, which contribute to a higher risk level (NSB). (Another informant claimed that they knew who to deal with (Linx))	- Different signalling systems - Training - Emergency training	-Earlier there have been national companies that have existed to serve national interests; these companies can now work against new and foreign companies. -Differences in rules and regulation and in technology.
Have you experienced specific operational safety issues in cultural interfaces? (Question 14)	*- This question was not asked to this informant.*	- I have no experience related to this.	*- This question was not asked to this informant.*	*- This question was not asked to this informant.*	- I have no experience related to this.	- Undefined requirement to operating staff - Different business culture
How does your organisation adapt to handle safety cultural interfaces? (Question 15)	- There is a lack of foundation in the regulations related to culture - We do not have the competency to deal with i.e. audits and safety culture.	- Traffic safety seminars to exchange safety experience.	*- This question was not asked to this informant.*	*- This question was not asked to this informant.*	- I have an apprehension of that the culture are quite similar between Norway and Sweden.	- We collaborate with established companies that know the systems.

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
How can one facilitate for good safety work when dealing with cross border traffic? (Question 16)	- The infrastructure manager needs a modern safety management system as they automatically will fulfil the role as a premise provider for the industry (in Norway).	- Superior co-operation - Common training and education - Accident and incident reporting in Synergi. - Exchange of information - Common rules and rule competence - Common language	- Common education and training.	- Common rules and signal systems - Good communication and co-operation related to identify problem areas.	- Accomplish a emergency scenario and analysis that includes both countries - Need training and education, also in emergency handling.	- Common rules - Common competency systems
Do you see any problems in handling goal conflicts between HSE and competing concerns like profitability, effectiveness, and operational demands?(Question 17)	- *This question was not asked to this informant.*	- There is an constant trade-off - Important that the organisation demand safety	- *This question was not asked to this informant.*	- No	- If you think safety is expensive – try an accident!	- An organisation can risk to be forced to work on a low budget at the sacrifice of safety.
Have your organisation formulated a policy for handling safety culture? (Question 18)	- No (please see answer to question 15).	- In our safety management system and locally in our operating plans.	- *This question was not asked to this informant.*	- *This question was not asked to this informant.*	- In our employee manual and in instructions. Here we have superior goals and policies (based on ALARP).	- Internal organisational development processes that include determination of desired business culture. Safety is an important part of this.
Do you see any problems that can arise in co-operation between companies with different safety policies? (Question 19)	- Challenge: It's the organisations themselves that develop their own acceptance criteria for safety. We need a common understanding of desired safety level.	- Different standards and acceptance criteria. - Different ambitions. - Conflict between the train operators and traffic control; different level of regulation for each operator.	- *The informant did not really answer this question. The answer is therefore omitted.*	- No, no conflict as long as the companies sticks to the regulations.	- If the ALARP goals are different. - Discussions are then necessary to agree upon a common level.	- Yes, that will cause problems.
What problems would you expect to arise with an increasing level of privatisation and a greater number of small operators? (Question 20)	- Competence can be erased after some time. - Less transparent relations between operators and contractors.	- Increased demand for profit. - Difference between large and small undertakings concerned to safety - Increased demand for access to infrastructure - Standardisation of infrastructure	- Have to be more strict concerning arrivals (need to adjust to aviation – those who are delayed have to wait)	- Increased demands for profit which will be at the sacrifice of safety - A risk for minimising education and training	- None. The regulatory authorities need more resources and have to become more unambiguous.	- We welcome competition. This will foster organisational development and sharpen demands for safety.

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
What challenges do you think the Norwegian infrastructure manager will meet in relation to new entrants? (Question 21)	- More demanding to safeguard safety. - To keep hold of new operators and their contractors.	- Need to demand for safety and emergency planning. - How to distribute capacity	- Language problems	- Higher demands for profit - More pressure from independent operators for getting priority on the track.	- Challenges related to changing from an administrative culture to a service culture.	- To qualify new entrepreneurs and actors and to ensure that they are treated equally. - To control that rules and regulation are kept - To still be aware that safety is first priority and not profitability.
Is there a standardised educational system in railways? (Question 22)	- No, just the NSB School for locomotive drivers in Norway.	- Just the NSB school - Working on new routings for education in these days	- Local training when arriving at foreign stations.	- No, only the NSB School exists. - No standardised reading material.	- Just the NSB School.	- Training of own employees. - Locomotive driver education only at the NSB School.
Is there a training system in cross border traffic? (Question 23)	- *This question was not asked to this informant.*	- No, need local education - Need to satisfy the other country's demands.	- No	- Yes, it's an additional education. - A simplified education in the other country's signal and safety systems.	- We have developed our own educational plans for locomotive drivers driving in new and foreign countries.	- Need to satisfy the other country's demands.
Do you think that there will be any need for a standardised training program for the European railway industry? (Question 24)	- *This question was not asked to this informant.*	- Yes, today foreign locomotive drivers need special licenses to drive in Norway. - We need common demands competency	- Need common systems for education and training.	- Education and training can not be similar as we have different systems. - Need a system for approval so we can assure that the educational level is satisfying.	- Yes, at least between Norway and Sweden.	- *This question was not asked to this informant.*
Would it be favourable to standardise work and emergency procedures throughout the European railway industry? (Question 25)	- *This question was not asked to this informant.*	- Yes, in an emergency situation it's necessary that everyone knows how to act and who to contact. - A disadvantage is that procedures are reactive; you deal with a historical risk perception rather than the future.	- *This question was not asked to this informant.*	- Emergency procedures are important and should be standardised.	- Yes, it's important to standardise as much as possible. But since the systems are different it's not possible to develop identical standards.	- At least emergency procedures need to be standardised. - Work procedures concerning traffic and communication can be standardised, but other work procedures has to be a part of the competition
To what extent do the workers feel responsibility for rules and procedures? (Question 26)	- *This question was not asked to this informant.*	- A large extent - As long as the workers perceive the procedures as meaningful – they are followed.	- *This question was not asked to this informant.*	- *This question was not asked to this informant.*	- I have an impression of that our employees in Norway and Sweden feel responsibility in a large extent.	- Large responsibility for safety rules.
Is there a standardised reporting system? (Question 27)	- Yes, Synergi.	- Yes, Synergi	- Yes, Synergi	- Yes, Synergi.	- We have our own system.	- Differences between countries.

Question	Regulatory Authorities	Infrastructure Manager	Traffic control	Locomotive drivers	Railway undertakings	Infrastructure Producer
Will there be any need for standardised report routines? (Question 28)	- That would have been favourable. - Need to agree upon how to manage such a system as the authorities will get capacity challenges if they were in charge.	- That would be favourable as it gives common under-standing - Collecting and making information common is practical.	- Yes.	- Yes, to ease reporting.	- This is a good idea as it can result in the best way of reporting and that the reporting is standardised.	- Yes, that would be an advantage. - Stick to one system - Increase reporting - Larger statistical material
How do you imagine that such a common report system can be used in further work? (Question 29)	- *This question was not asked to this informant.*	- Use statistics to identify trends and problem areas.	- I don't see how this can be used, as in time of an accident the existing administration has to do their job at their distance.	- As a common central for experience where one can learn from each other.	- Favourable to record different types of accidents.	- *This question was not asked to this informant.*
Can the use of a common reporting system get in conflict with corporate interests? (Question 30)	- *This question was not asked to this informant.*	- It might. How do we choose the system? Synergi is not necessary the best system.	- *This question was not asked to this informant.*	- Yes, a conflict between safety and economical considerations	- No, either you protect safety or you don't. All investigation is public – there should not be any competitive problems related to this.	- Yes in some areas. Conditions related to work processes and quality deviations.
Can different routines and systems for accident investigation affect common safety work? (Question 31)	- *This question was not asked to this informant.*	- Yes, if the collaborating countries have not agreed on how to solve accident reporting, there will be a problem.	- Is it possible to have a international commission of inquiry?	- *This question was not asked to this informant.*	- I don't know.	- *This question was not asked to this informant.*
Will there be any need for standardisation of accident investigation? (Question 32)	- *This question was not asked to this informant.*	- Yes to learn from other countries.	- This would be difficult as the prosecuting authorities are a part of the accident investigation team.	- *This question was not asked to this informant.*	- Yes it would be favourable.	- *This question was not asked to this informant.*
Is there a difference in how blame is assigned in different countries? (Question 33)	- *This question was not asked to this informant.*	- Yes this is conditioned by culture.	- *This question was not asked to this informant.*	- *This question was not asked to this informant.*	- Not familiar with this.	- *This question was not asked to this informant.*
Do you use a standard for auditing? Will it be favourable to cooperate on this? (Question 34)	- Yes, ISO19011	- Yes, ISO and also the Railway Regulations.	- *This question was not asked to this informant.*	- *This question was not asked to this informant.*	- I am not familiar with this - Yes it would be favourable with co-operation.	- Yes, an ISO standard.
Would it be appropriate to do benchmarking on safety performance? (Question 35)	- I have not considered this. But if the industry can agree upon a common way of doing this – it would be interesting.	- Yes, but you have to assume that the companies use the same tools. - This will foster demands for safety. - If benchmarking will be useful you have to measure the same things. Measurement on different distances will be useless.	- *This question was not asked to this informant.*	- *This question was not asked to this informant.*	- I have never considered safety as a competitive advantage. I do not know if this is possible.	- We have this in our business plan but we have not adapted it systematically yet.
Feedback question on the structure of the interview (Question 36)						