CHAPTER 3

Is It Possible to Prevent Unforeseen Events?

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Abstract: An unforeseen event may be defined as something that happens suddenly and unexpectedly. Such events are seldom the result of an organisation's operational planning, but they can be side-effects of such planning. An unforeseen event may have either positive or negative consequences. This chapter aims to discuss if it is possible to prevent unforeseen events. The major focus is on analysis and prevention of unforeseen events with negative consequences, such as accidents, catastrophes and acts of terror. Such events often take place in complex systems, and failures of appropriate organisational interaction and communication among participants with complementary competence in such systems may contribute to unforeseen events. Risk-analysis methods and tools based on energy-barrier models, causal sequence and process models, as well as information-processing models are presented and their applicability to the prevention of unforeseen events is discussed. This also includes the Bow-tie approach, as well as other approaches which take into consideration organisational factors and social interaction (*samhandling*). The conclusion is that unforeseen events can be prevented. However, in the aftermath of the implementation of safety and security measures, it is not possible to know which events they prevented, or to obtain knowledge about their efficiency. An additional strategy for prevention of unforeseen events with negative consequences is proposed.

Keywords: *Samhandling*, interaction, emergency-preparedness, training, risk analysis, organisational learning, unforeseen.

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Introduction

This chapter aims to discuss if it is possible to prevent unforeseen events. The major focus is on analysis and prevention of unforeseen events with negative consequences, such as accidents, catastrophes and acts of terror. Such events often take place in complex systems, and failures of appropriate organisational interaction and communication among members with complementary competence in such systems, may contribute to unforeseen events. Risk-analysis methods and tools based on energy-barrier models, causal sequence and process models, as well as information-processing models, are presented and their applicability in the prevention of unforeseen events is discussed. This also includes the Bow-tie approach, as well as other approaches which take into consideration organisational factors and social interaction (Norwegian *samhandling*). The conclusion is that unforeseen events can be prevented. However, in the aftermath of the implementation of safety and security measures, it is not possible to know which events they prevented, or to obtain knowledge about their efficiency. An additional strategy for prevention of unforeseen events with negative consequences is proposed.

An unforeseen event may be defined as something that happens suddenly and unexpectedly. Such events are seldom a result of an organisation's operational planning, but they can be side-effects of such planning. An unforeseen event may have either positive or negative consequences.

Unforeseen events with positive consequences are perceived to contribute to improvements in quality of life, well-being and happiness. We prefer them and like them to happen and consequently, preventing such events is not an issue. However, the consequences can also be negative and precautionary action is often demanded to mitigate these. Kvernbekk, Torgersen and Moe (2015) restrict the concept of 'unforeseen events' to events only leading to negative consequences. Accordingly, this chapter's focus is on unforeseen events with negative outcomes, such as accidents, catastrophes and acts of terror.

To reduce the severity of consequences when an accident, catastrophe or act of terror has occurred is, of course, a high-priority community task. High priority of emergency preparedness and crew training may improve the handling of foreseen as well as unforeseen events. It aims to reduce the level of loss and damage and stabilise the situation after such events. It is necessary for society to give priority to loss reduction. However, this is not relevant when discussing the prevention of unforeseen events.

A starting point for further discussion could be to conceptualise events with negative consequences as being more or less unforeseen. Events may be similar to those which have occurred on previous occasions, but the exact point in time for the future occurrence could be difficult to predict. It is perceived to be an unexpected event when it happens, because nobody had foreseen this occurring. When it appears, the severity of the consequences may be the same as the previous occasion, but it may also be that the consequences differ somewhat from those anticipated by examining previous experience. To separate such events from unforeseen events, they may be defined as 'unexpected events'. What characterises these events is that it is possible to prevent, as well as stabilise, their consequences by emergency preparedness, crew training and other countermeasures aimed at loss reduction.

A truly unforeseen event would be one that has never happened before. Ordinarily there will not be any past experience about the characteristics of the specific event or the causal factors that may have contributed to its occurrence. Consequently, it would be impossible to give examples of such an event before it happens and there is also very little knowledge about the probability of occurrence and severity of consequences if it should occur. Is it possible to identify and prevent events even though there is no way of imagining what they could be?

The suitability of risk analysis methods for identifying future unforeseen events

In the prevention of accidents, catastrophes and acts of terror, the main approach has been to examine and learn from the past through accident investigation. Examining 'causal' factors of past accidents and catastrophes by applying some type of accident analysis method may make it possible to put countermeasures in place to thwart these factors, preventing the same type of accident from happening in the future.

While accident investigation only aims to examine causal factors in accidents that have already taken place, risk analysis also concerns the analysis of potentially-harmful hazards, irrespective of whether or not an accident has already taken place, based solely on the existence of potentially-harmful forms of energy or other possible factors which may have negative consequences if they get out of control.

Several data sources in addition to, or in place of, past accidents may be necessary to conduct a risk analysis (Rausand & Utne, 2009). This includes technical data about the amount of potentially-dangerous chemicals and forms of energy, available devices on machines, etc. Operational data, as well as data on risk sources, reliability and maintenance routines may also be included. Exposure is taken into consideration when assessing the 'level' of risk as part of such an analysis. Other data sources may be meteorological data, data on the possibility of natural catastrophes and the possible environmental consequences of an accident or catastrophe. Social conditions and political issues may also be important when analysing the risk of acts of terror.

A problem that emerges when dealing with unforeseen events is that opportunities of learning from past experience may be scarce compared to the prevention of accidents which occur more or less repeatedly. Could it be that risk analysis methods and tools are primarily aimed at examining the 'level' of risk when a potentially-harmful risk source has already been identified and that they are less suited to identifying new and unknown risks?

Risk analysis methods may be divided into: *causal sequence and process models* (Heinrich, 1959; Weaver, 1980; Gibson, 1961; Primrose, Bentley, van der Graaf & Sykes, 1996; Rasmussen & Svedung, 2000); *human reliability and information-processing models* (Hale & Glendon, 1987; Rasmussen, 1981; Leplat, 1984; Hale & Hale, 1970, Swain & Guttmann, 1983); and *energy-barrier models* (Haddon, 1980; Reason, 1994, 1997; Primrose, Bentley, van der Graaf & Sykes, 1996). A general problem with the available risk analysis tools is that they are only perfunctorily associated with a sound theoretical basis. Theoretical perspectives, accident models and practical risk analysis tools are often confusingly mixed-up. Models are defined as "theories" and risk analysis tools as 'models'. The majority of tools are based on models that do not satisfy the demands for designation as a theory. Due to these problems, the current discussion will incline towards discussing risk analysis without distinguishing clearly between theories, models and tools.

Process and causal sequence models

In process and causal sequence models, accidents, as well as other events leading to negative consequences, are perceived to be 'end results' or negative outcomes of a sequence of events. Thus, these models place emphasis on events happening in a chain of events, where causal factors and effects are defined by their place in a temporal and time-space continuum of events and conditions.

In the domino approach (Heinrich, 1959), an accident is perceived to be the end result of a temporal chain of events consisting of the following dominoes: social and environmental factors, personality, risk behaviour, an event with negative consequences, and injury or loss (as the end result). If one of the dominoes preceding the injury falls, those following it will also fall. The domino theory forms the basis for risk analysis tools based on modelling the process leading forward to a loss of control and injuries.

Several core analytical techniques or tools have been based on a process model approach. Event and Causal Factor Charting (ECFC) is a tool for charting the sequence of events in a graphical display. Conditions, as well as primary and secondary event sequences 'causing' an accident or catastrophe, are examined. Event and Causal Factor Analysis (ECFA) takes this method a bit further, to determine the causal factors by deductive reasoning, identifying which events and conditions were necessary for an injury to occur. Root Cause Analysis (RCA) is a causal sequence model which is also defined as a core analytical technique. So-called TIER diagrams are often used as part of the analysis to identify root causes, to draw decisive conclusions about why the negative event happened. (DOE, 1999; see also Sklet, 2002)

Process and causal sequence models have been criticised because organisational factors in accidents have not been taken into consideration. The first to address this was Weaver's (1980) modified domino model. In this model, direct causal factors are separated from operational errors.

Introducing the latter type of errors recognises the role of management and organisational factors in a chain of events. SHE-management models and analysis methods have further developed the focus on such factors. Another critique of the domino theory was the focus on one, single, temporal chain of events, excluding the possibility of examining communication processes and social interaction. Benner's (1975) process theory takes into consideration that there could be several participants and parallel, temporal chains of events. It focuses on communication and social interaction as causal factors in accidents and events with other negative consequences.

The STEP analysis tool (Hendrick & Benner, 1987) is based on the idea that several participants and actions in temporal and time chains of events should be the subjects of analysis. Analysis is not restricted to a single linear sequence, as is the case in core analytical techniques. It takes into consideration that several activities can take place at the same time. This also makes it possible to examine the role of social interaction and communication in an organisational setting.

MTO analysis is a tool which constructs an events and causes diagram, integrating change analysis and barrier analysis in a temporally-organised chart of events and causes. A checklist of basic failures includes organisational factors, management, technology deficiencies, work management, social interaction and communication, as well as issues related to instructions and procedures, education and competence, and environmental factors (Bento, 1999).

Process models and risk analysis tools based on such models employ a temporal conception of events on a timeline, leading forward to a loss of control and injuries. An event preceding the next is conceived to be part of the 'explanation' of the forthcoming event. Using such a conception, the timeline understanding of events may easily become mixed up with causality, in a way that does not fulfil experimental requirements for inferring causality. However, causal factors can be conceived from a theoretical as well as a pragmatic point of view. From the pragmatic perspective, a causal factor is conceived to be one which gives the power to control the risk source through manipulation (Rasmussen, 1990). A thorough definition of causality is not the subject of the current discussion.

Process model-based analytical tools seem to be well-suited to analysing accidents, catastrophes and other events leading to negative consequences, to prevent identical or similar events happening in the future. The process, as well as the end result, with positive or negative consequences, has to be known in advance. For analysing unforeseen events and the role of communication and social interaction, core analytical techniques seem to be inadequate. However, what is interesting about several of the process models and analytical tools is that they link accidents, catastrophes and other events with negative consequences to the interaction of technical, organisational and social factors. Some of these models and analysis tools, such as STEP analysis, seem to be suitable for examining the role of social interaction and communication.

Human reliability and information-processing models

In this group of approaches, injuries and loss are perceived as the result of 'human error', caused by limitations in human information-processing capacity. The theoretical foundation is provided by psychological information processing theories (e.g. Deutsch & Deutsch, 1973; Neisser, 1967, Kahneman, 1973). A 'mismatch' between system demands and individual behaviour is perceived to be the core causal factor in human error.

Rigby (1970) conceives of human error as behaviour exceeding the limits of tolerance within the system in which the person operates, i.e. a 'deviation' from the norms of the system. Swain and Guttman (1983) define human error as an 'out-of-tolerance action', in which the limits of tolerable performance are defined by the system. In this approach, errors are understood to be natural outgrowths of an unfavourable combination of people and the situation in which they act.

In Human Reliability Analysis (HRA), Swain and Guttmann (1983) define human error as an act in which a person fails to either carry out something correctly, do something as expected, or do something in time. Incorrect human outputs are separately categorised as errors of omission and errors of commission. Errors of omission occur when someone either omits one step in a task or the entire task. Errors of commission comprise selection errors (e.g. reversals and wrong commands), errors of sequence, errors of timing (too early or too late), and quantitative errors (too little or too much).

The THERP analysis tool (Swain & Guttmann, 1983) is based on this perspective. Estimation of the probability for deviation in task performance consists of defining all the possible fault conditions, mapping tasks associated with these conditions, estimating the probability of human error, evaluating the consequences of these acts, and proposing countermeasures. The definition of human error is a functional evaluation of the consequences of behaviour. Human error is conceived in the same way as technical failures. Thus, the human 'component' may be overloaded and fail in the same manner as technical or mechanical components''.

Human reliability analysis has been criticized for the following reasons: The approach is normative. It does not take into consideration the complexity of human behaviour. The empirical basis which analysis is based on is insufficient and the approach fails to take into consideration that the same causal factors may cause errors of omission as well as errors of commission (Hale & Glendon, 1987). The approach contributes to an explanation but not to an understanding of the role of human error in accidents and catastrophes. The core focus of analysis is on information-processing capacity;communication and social interaction are not taken sufficiently into consideration in analysis, neither as causal factors in accidents nor causal factors in accident prevention. It is also less suitable for explaining acts of terror.

A more comprehensive model, proposed by Hale and Glendon (1987), integrates elements from several other models. It includes LePlat's (1984) model of safe behaviour, which is based on Rasmussen's (1981) three levels of cognitive functioning, as well as Surrey's (1968) two-level model. Human behaviour can either be skill-based, rule-based or knowledge-based. Skill-based behaviour is automatically activated in a situation based on observation. Rule-based behaviour is based on interpretation. It is controlled through rules and instructions. Knowledge-based behaviour is based on goals and plans to reach goals. Through training, knowledge-based behaviour may become rule-based and rule-based behaviour may become skill-based. Surry (1968) introduces a two-level model distinguishing between the build-up of potentially-hazardous risks and the loss of control. In his model, human perception, interpretation, decision-making and action are analysed separately in each of the two steps. Hale and Glendon (1987) integrate these steps into their model, which distinguishes between input, throughput, and output. In this model, the input phase consists of hazard identification through the three levels of cognitive-based behaviour (no warning signs, warnings, and identification of danger). The throughput phase identifies whether or not there is a need for precautionary action. If the process of hazard identification has failed, the danger will not be controlled and the real risk may continue to be present, or the level of real risk may increase. Whether or not the danger is brought under control depends on the results of the output phase, i.e. whether or not responsibility is taken for the implementation of countermeasures, whether or not the necessary procedures for how to carry out safety measures are known to those responsible for implementation, and whether or not precautionary and mitigation measures have been carried out. In addition to the two loops presented, the model also contains several other loops.

The model places the lack of identification of deviations in the input phase. In the control of danger, either warning signs of danger or hazard identification must be successful to bring the danger under control. A lack of problem identification may be the core reason that an event with negative consequences is deemed 'unforeseen'. This model is classified as a systems approach to the control of danger. It specifies cognitive information processes, individual-level decisions and behaviour. However, neither communication, interaction and social interaction nor contextual factors are specified at the same level of detail. Specific contextual factors, e.g. situational, organisational and community-related factors that influence individual behaviour, are not taken properly into consideration. Hale and Glendon's (1987) model explains very well why accidents can be unexpected and even unforeseen, although this was not their primary intention.

Energy-barrier models

The Bow-tie method (Primrose, Bentley, van der Graaf & Sykes, 1996) is one of the most increasingly-accepted and best methods for analysing risks (Crerand, 2005; see also Ruijter & Guldemund, 2016). It can be classified primarily as an energy-barrier model. However, temporal aspects are also given attention. It combines several other analytical methods and approaches previously known within risk analysis. To understand the strengths and limitations of this method, it needs to be discussed in the light of preceding energy-barrier models and approaches to which it relates.

In energy-barrier models (Haddon, 1980), an injury or an event with other negative consequences is perceived to take place when energy is transferred to the human body. When the energy is above the tolerance threshold of the body, this causes an injury. Injuries can be prevented, either by placing barriers directly on the energy source, separating the energy from the human, or enhancing human resilience, e.g. using personal protective equipment. In barrier analysis, the hazards, the target of the hazard, as well as the barriers have to be identified. The barriers can be physical as well as communication and management-related.

Analysis methods based on the energy-barrier model are suitable primarily when hazards can be identified (DOE, 1999; see also Sklet, 2002). In barrier analysis, the hazard or potentially-damaging energy as well as the possible target have to be identified. Physical and well as management barriers are considered; the latter is more difficult to identify than the former. After having identified the barriers, probable causes of barrier failure and their consequences are investigated.

Change analysis aims to examine all deviations in a system that cause negative outcomes, by comparing an accident-free situation with an accident and identifying the differences and their consequences. Accident Analysis and Barrier Function analysis are methods of analysis which examine ineffective, non-existent and effective barrier functions. In this type of analysis, the organisational context as well as the technical systems are taken into account when analysing past accidents to propose effective countermeasures. The BORA analysis method is another tool for analysis of barriers, especially suited to the offshore oil and gas extraction industry (see Rausand & Utne, 2009, for a thorough description of this analysis method).

The logical tree model (Johnson, 1980) is also based on the assumption that potentially-harmful forms of energy are causal factors in accidents.

Such events could be prevented by countermeasures, which consist of barriers that prevent energy from reaching the human body, for example. MORT (Johnsen, 1980) as well as SMORT (Kjellén et al., 1987) are logical tree models, based on the identification of specific control factors and management-system factors. Causal factors are identified using generic questions.

These methods are all practical tools for analysing how to prevent injuries and damage. Energy-barrier models focus primarily on the period following a 'deviation' in a sequence of events. The period before the deviation is not perceived to be a relevant subject for analysis. In the case of unforeseen events, hazards as well as their targets are usually unknown. These risk analysis methods are not well suited to dealing with such events.

Energy and barrier models are often interchanged with process and causal sequence models. Change analysis is also partly a process model. The same applies to Accident Analysis and Barrier Function analysis. The TRIPOD and Bow-tie models can also be classified as energy-barrier and process models, as well as causal sequence models.

The 'Swiss cheese model' (Reason, 1990) is the approach which lies behind the TRIPOD as well as the Bow-tie model (Alizadeh & Moshashaei, 2015). Reason (1990) distinguished between active (tokens) and latent failures (types). Active failures are errors and violations with an immediate negative effect or consequence, usually committed by front-line operators, crews and traffic controllers etc. In Reason's model, these types of failures include unsafe acts and inadequate defences in interaction with local events. Latent failures, on the other hand, are management actions and decisions that have no immediate 'effect'. They may lay 'dormant' for a period of time, only becoming evident when combined with factors such as active failures, technical faults or atypical system conditions (Reason, 1990). Latent failures include fallible decisions, line management deficiencies and psychological precursors of unsafe acts. Unsafe acts are slips, lapses and violations. Psychological precursors of unsafe acts include factors such as time pressure and lack of operator-safety motivation (Reason, 1994; 1997).

In a risk-management system based on this approach, the first information loop is the reporting of accidents, injuries and other events with negative consequences. The problem is that this type of information, in most cases, is provided too late for proactive measures. The second loop consists of identifying and observing unsafe acts at the lower supervisory level of an organisation or a system. According to Reason (1990), the most effective loop systems are those that identify line management deficiencies (loop 3) and psychological precursors of unsafe acts (loop 4). In the prevention of accidents and catastrophes, it is more efficient to focus on these loops, i.e. on 'types' rather than 'tokens.' Thus, in the complete TRIPOD model, organisational failures are conceived to be the main causal factors because they may contribute to breaches in barriers during operational disturbances (Groeneweg, 1998).

This method identifies basic risk factors for latent failures. An effective safety-management system consists of eliminating or reducing the effects of the latent failures identified in the model, thereby preventing psychological precursors, human behaviour that is 'out of tolerance' with the system, as well as operational imbalances.

The Bow-tie method, which has been used extensively in the offshore oil and gas extraction industry and several other industries (Pidgeon, May, Perry & Poppy, 2007), combines fault tree analysis, causal factor charting, and event tree analysis (Lewis & Smith, 2010). It is related to the TRIPOD in several ways. However, it is debatable whether or not it is a step in the right direction when compared to the emphasis placed on organisational and social factors in the TRIPOD, in relation to the capacity to understand latent failures in complex and unforeseen events. The Bow-tie analysis diagram shows the threats, hazards and consequences and aims to identify barriers or control measures, as well as recovery measures. Pre and post events are analysed. Barriers show mitigation activities (Pidgeon et al., 2007).

Kvernbekk, Torgersen and Moe (2015) present a modified and extended Bow-tie model (see also Chapter 1), especially suited to analysing unforeseen events. In addition to being an energy-barrier model, the Bow-tie method is also a process model, where the interval between registrations of 'warning signs' prior to an undesirable event is perceived to be important for prevention as well as the success of recovery. However, what characterises unforeseen events is that the potentially-dangerous hazards leading up to the event are not identified. How it is possible to identify early warning signs of non-identified hazards needs to be thoroughly explained.

To prevent unforeseen events, according to the Bow-tie model, it is necessary to focus on warning signs of potentially-hazardous energy that could get out of control, i.e. active failures. This type of indicator is related to the chain of events leading to loss of control. Typically, they take place on a timeline temporally close to the event with negative consequences, which means they are active failures. The chain of events will be specific and unique for each case or occurrence. Directing efforts at identifying active errors as a prevention strategy will not be effective unless identical events happen repeatedly. Therefore, it should also be explained why priority should be given to early identification of active failures in the identification of unforeseen events.

Fortunately, major accidents and catastrophes rarely happen and they are unique events. The same is true of acts of terror. Unforeseen events are also characterised by failures that are unique for each single event. It could be argued that when the temporal line of failures is unique, risk analysis methods which focus only on active failures and 'tokens' will not be suitable tools for examining unforeseen events.

Contrary to 'tokens,' 'types' are latent failures caused by fallible decisions at society and managerial level. What is typical for these types of failures is that each of them may cause several different temporal chains of actions. By focusing on 'types' instead of 'tokens,' it is possible to prevent many different action chains which may have negative outcomes. Countermeasures aimed at preventing such failures may prevent many different action chains and active failures. After the implementation of such countermeasures, it will not be exactly clear what types of unforeseen events they have prevented. Therefore, it will also be impossible afterwards to learn anything about which events that have been prevented.

The core aim of the current paper is to answer the question of whether or not it is possible to prevent unforeseen events with negative consequences using risk analysis to identify hazards and warning signals of forthcoming injuries and losses. The answer to the question is yes, it is possible, but efforts have to focus on latent failures and types. As shown, several of the core analytical methods (perhaps even the majority), along with other methods which do not take social interaction into consideration, have limited interest as analytical tools when aiming to analyse rare and unforeseen events. However, analytical tools that include examination of social interaction and parallel temporal chains of events also have limitations when it comes to understanding the types of events in focus in this chapter. The appropriate accident and risk analysis methods may contribute to prevention of the unforeseen; however, learning from past experience is not possible, because knowledge about what has been prevented cannot be obtained using these types of analysis.

Discussion and conclusions

When investigating accidents, catastrophes and acts of terror, risk analysis may focus on latent failures and human error. After identifying the causes of failures and errors, prevention measures can be implemented.

In Figure 3.1, this is entitled the 'first route' to safety and security. This model is based on a basic understanding of organisational culture, branching out from 'cultural content', which is the latent, non-observable part, and 'cultural manifestations,' which form the observable part of

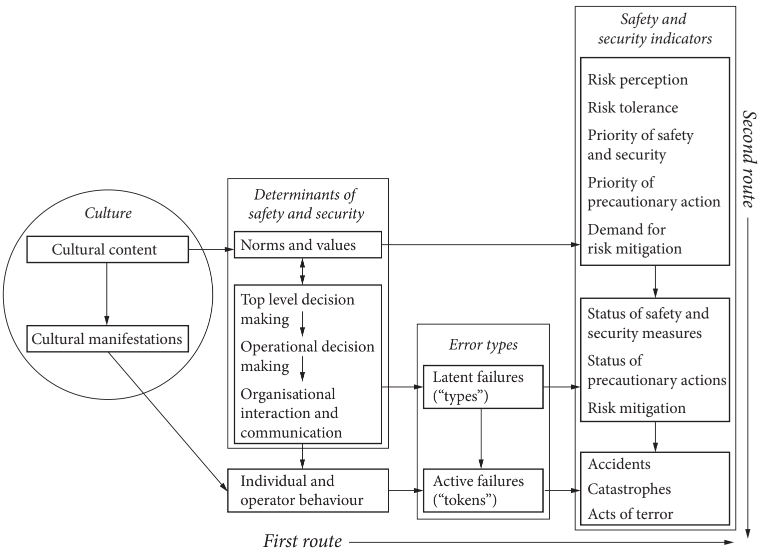

Figure 3.1 A heuristic model for understanding events with negative consequences.

culture (Schein, 1990). Reason (1998) also relates the Swiss cheese model to safety culture. Part of 'cultural content' are norms and values. These influence decisions and can cause latent failures, which are 'cultural manifestations' that can be observed and analysed. All available accident analysis and risk analysis methods are based on the 'first route'. This is mainly a temporal route based on accident and risk analysis approaches.

However, a 'second route' could also be proposed (Figure 3.1). Fortunately, accidents, catastrophes and acts of terror do not happen often. Because they cause attention when they occur, they may also be perceived to be more frequent than they really are. The 'second route' in prevention of negative events is, accordingly, to explain why negative events occur so rarely. Most of the time, events with negative consequences do not happen, which makes it of interest to know why. Unlike the majority of risk analysis methods and tools, the 'second route' is not concerned with analysing specific events that have either happened or could happen in the future.

The interesting question is not why accidents and other negative events take place, but rather, why they take place so rarely. What can be done to keep it that way? The 'second route' is a non-temporal route based on a set of indicators connecting accidents, catastrophes and acts of terror to indicators of social interaction, i.e. norms and values, risk perception, risk tolerance/acceptance, priority of safety and security, and priority of precautionary actions. It may be based on knowledge obtained using survey methodology aimed at examining associations between organisational factors and social interaction. These factors are also connected to individual-level behaviour, the status of safety and contingency measures, and precautionary actions, as well as risk mitigation measures. Research carried out previously has shown these factors to be positively associated with accidents in industry as well as in transport.

The psychometric qualities (reliability and criterion validity) of several measurement instruments aimed at measuring all these factors have previously been examined and found to be related to accidents and catastrophes (e.g. Iversen & Rundmo, 2012; Nordfjærn, Jørgensen & Rundmo, 2011, 2012; Norfjærn, Şimşekoğlu, & Rundmo, 2012; Rundmo 1992; Rundmo, 1994a-c; Rundmo, 2000; Rundmo & Iversen, 2004; Rundmo & Moen, 2006; Rundmo, Granskaya, & Klempe, 2012). Low scores on these measurement instruments indicate an unsatisfactory safety and security level, and high scores indicate a satisfactory level.

It is interesting to note that measurements of the 'second route' can be done independently of any specific events or risk sources possibly involving potentially-hazardous forms of energy. The main focus of accident and risk analysis is on factors causing failures in single accidents and analysis of other negative events. The focus of prevention efforts should be on the opposite. To prevent negative unforeseen as well as foreseen events, the most effective countermeasure is to continue doing what has previously been shown to successfully ensure that unforeseen events with negative consequences do not happen. To focus on success indicators could be especially advantageous when the aim is to prevent unforeseen events.

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