# The role of safety professionals in organizations – developing and testing a framework of competing safety management principles

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**Abstract:** Safety professionals have a key role in influencing the safety of an industrial organization. Relatively little research attention has been paid to this professional group. Many safety professionals apply the principles that underlie their field of technical expertise or refer to lay theories and folk models of human behavior. Recent conceptualizations of organizations as complex adaptive systems have put further challenges in our understanding of safety professionals' work. What is the role of a safety professional in a system that is inherently unpredictable, as complex adaptive systems theories proclaim? In light of our increased understanding of the complexity and dynamics of safety-critical organizations is there a need to rethink the role of safety professionals? The paper will focus on the underlying principles that the safety professionals rely on in their work. The study design is a longitudinal study of nine safety professionals in three different safety-critical organizations. A model of eight distinct management principles is tested and mechanisms that influence the formation of each professional's role are identified. The potential tensions between the different principles will be discussed as well as the influencing mechanisms in defining which principles are emphasized and which not.

**Keywords:** Safety management, safety culture, expertise, human factors.

## 1. INTRODUCTION

Safety professionals, or safety experts, have a key role in influencing the safety of an industrial organization. All larger organizations have professionals who focus all or most of their work time on safety related issues. In Finland, even the small and medium sized companies with more than twenty employees have to have at least a mandatory industrial safety delegate to represent the personnel and an industrial safety officer. Despite the number and significance of safety professionals, relatively little research attention has been paid to this professional group. Thus, organizational safety professionals' work practices are poorly understood. One reason for this can be that safety professionals are a disintegrated group (e.g. in terms of education) that applies similarly disintegrated safety science [10] in practice. This makes it difficult to distinguish what is a safety professional and what such a professional needs to know and do. The role and knowledge requirements of safety professionals are complicated by the fact that they need to work in complex organizations with often conflicting expectations and goals. Sometimes the object of the organization's core task itself contains many uncertainties and potential hazards. Changes in the work environment can bring new uncertainties and change the risks the organization faces in its work. Furthermore, the various types of safety, such as process safety, occupational safety, and fire safety all have their special characteristics as well as certain similarities to other types of safety.

There are some guidelines available for what safety professionals should know. For example, the graduation competencies specified by the American Society of Safety Engineers [2,3] include the following abilities: (a) anticipate, recognize, evaluate, and develop control strategies for hazardous conditions and work practices; (b) demonstrate the application of business and risk management concepts; (c) demonstrate an understanding of the fundamental aspects of safety, industrial hygiene, environmental science, fire science, hazardous materials, emergency management, ergonomics, and/or human factors; (d) design and evaluate SH&E programs; (e) apply adult learning theory to safety

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training methodology; (f) identify and apply applicable standards, regulations, and codes; (g) conduct accident investigations and analyses; and (h) apply principles of safety and health in a nonacademic setting through an internship, cooperative, or supervised experience.

In order to understand the work of safety professionals, we need to understand what 'safety' is. The classical safety management paradigm views organizations as machine like entities and emphasises procedural adherence, strict quality control, clear distribution of liabilities, and supervision of workers as the way to manage safety. Disappointments in the classical safety management paradigm together with the evolvements in several scientific disciplines have led to a view on safety as something more than the negation of risk. Safety can be viewed as an emergent property of the functioning of the entire sociotechnical system. This means that safety professionals' work should also be understood in the context of the entire sociotechnical system. Recent conceptualizations of organizations as complex adaptive systems [6, 11, 13, 18, 20] has put further challenges in our understanding of how should safety professionals work in a manner that they would contribute to the overall safety, or even the overall effectiveness of the system. What is the role of a safety professional in a system that is inherently unpredictable, as complex adaptive systems theories proclaim? Is there a need to rethink the role of safety professionals, safety experts and safety managers alike, in light of our increased understanding of the complexity and dynamics of safety-critical organizations?

As a result of the above mentioned issues it can be hypothesized that many safety professionals apply the principles that underlie their field of technical expertise or refer to lay theories and folk models of human behavior and safety. The object of these professionals' work also probably varies, from individual attitudes and behavior to collective practices, technology or organizational arrangements such as rules and procedures. The paper will focus on the underlying principles that the safety professionals rely on in their work, and the associated practices in a longitudinal study of nine safety professionals' work. The potential tensions between the different principles will be discussed as well as the influencing mechanisms in defining which principles are emphasized and which not.

## 2. METHODS

"Safety makers" research and development project started in June 2013 and lasts until Autumn 2014. The project aims to provide new understanding on organisational safety professionals' work practices and to develop a model of organisational safety expertise. The project includes three case organizations in different safety critical fields (nuclear waste processing, petrochemical, construction) and a total of nine safety experts whose work will be studied for the duration of the project. All nine experts were interviewed with a semi-structured scheme during Autumn 2013. Interviews lasted 2-3 hours and provided a rich picture of the daily work practices and different work orientations of the nine professionals. Interviews were taped and transcribed.

A workshop was arranged in November 2013 where these work orientations and the underlying principles were elaborated. A preliminary conceptualization of safety management principles created in several case studies of safety management in the nuclear and health care domains [17] was tested with the workshop participants. The four participants filled a framework describing the principles, and four of the five non-attending professionals returned the exercise later by either email or paper format. The results of the exercise were also discussed in the management group of the project. Two additional workshops will be arranged during the project, and a final interview round of all nine safety professionals will be conducted in autumn 2014. The results presented in this paper are thus preliminary.

## 3. PRELIMINARY SAFETY MANAGEMENT FRAMEWORK

Based on our previous work [15, 16] we have defined a safety management framework [17]. Table 1 describes the eight identified principles of managing safety. Underlying idea in the framework is to see safety-critical organizations as complex adaptive systems with inherent features such as emergence, self-organizing and non-linearity [5, 11, 12, 14]. Another underlying idea is that the principles are

competing, or even partly in conflict [4, 13], and the managers and professionals have to find the proper way to balance these in daily work.

**Table 1: Brief description of the principles, based on [17]**

| Principle | Description |
|---|---|
| 1.Promote safety as a guiding principle | Managers need to promote safety as a shared guiding principle according to which situational decisions are made. This means that safety needs to be a shared value in the organization |
| 2.Facilitate interaction | In order to guarantee organizational cohesiveness and enough order for the system to both act in a structured manner and yet be flexible when needed, leaders have to facilitate interaction, build connections and build an environment which supports interaction. |
| 3.Facilitate novelty and diversity | Needed to change and develop the organization. Novelty will lead to self-organized order, potentially contributing to the system's survival. However, in addition to disorder and variance safety-critical systems need other means of encouraging self-organizing (see next principle). |
| 4.Create capability for self-organizing | Since a complex adaptive organization cannot be controlled in the traditional top-down sense, capability for self-organizing depending on the situational demands is needed. In complexity science self-organizing is both a hallmark and the key adaptive mechanism of complex adaptive systems but also something that depends on the other characteristics of the system such as competence and situation awareness. |
| 5.Promote efficiency as a guiding principle | Managers need to optimize the efficiency of organizational activities and promote efficiency as a shared goal. This requirement manifests often as a conflicting demand for safety or thoroughness [9] but also as a question of different time-frames [1]. |
| 6.Set objectives and prioritize | Even though complex adaptive organizations cannot be managed in the traditional meaning of the term, leaders in safety critical organisations still need to set objectives and prioritize. This is another paradoxical consequence of complexity: the need to simplify and prioritize some issues over others. |
| 7.Monitor system activities and boundaries | Complex adaptive organizations need explicit monitoring of system activities and their boundaries since they are constantly changing and since the change can also endanger safety if it happens unsupervised. |
| 8.Create standard operating procedures and define system boundaries | Complex adaptive organizations need explicit boundaries since there are no natural all-inclusive boundaries between the various overlapping human systems. In safety-critical domains there is a need for analysis of risk and development of different types of rules and procedures to minimize risk and define the so called safe operating zone [8]. |

Safety managers should acknowledge that the above-mentioned principles are somewhat contradictory but still necessary for overall system functioning. This requires balancing and trade-offs between the different requirements. For example, striving to guide and constrain behaviour by rules and procedures (8th principle) is important, even if rules may not work 100 percent in practice. When combined and balanced with the capability to self-organize (4th principle), the rules can act as resources for situational action [17].

## 4. RESULTS

### 4.1. The underlying principles of safety professionals' work

The underlying idea of the study was that embedded in the role of the safety professional are certain principles of how to manage safety. We utilized the framework described in Table 1 to inspect whether the safety professionals identified different principles upon which their work is based on.

Eight professionals filled a three page exercise where on the first page they were instructed to think about their work and write down what they seek to change, affect or maintain in their work. Then they were asked to have a look at the second page where a figure depicting the eight principles was illustrated. They were asked to divide 100 points to the eight principles based on how their practices during the past 12 months corresponded with each principle. They were also asked to write examples of work tasks that contributed to each principle. Finally, the professionals were asked to evaluate the framework: did they consider it useful, where there principles they did not understand, or were there some important principles missing. In order to help the exercise, the third page included a brief description of each principle in line with Table 1.

Table 2 describes the scores given by the eight safety professionals on the safety management principles. It is interesting to note that five of the eight principles are chosen by one (or more) of our eight professionals as best describing his or her current work tasks, with 'promoting efficiency', 'setting objectives' and 'standardizing' being the only principles that none of the professionals chose as their main job.

**Table 2: The scores of seven safety professionals on the eight principles and their definition of the object of their work.**

| I | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | Influence |
|---|----|----|----|----|----|----|----|----|-----------|
| 1 | **25** | **25** | 10 | 5 | 5 | 10 | 10 | 10 | Attitudes, adherence to rules & procedures, safety management [mindset] |
| 2 | 14 | 7 | 18 | **25** | 7 | 7 | 22 | 0 | Taking into account one's own and colleagues safety, safety observations. Awareness of and preparedness for major hazard risks. [understanding & mindset] |
| 3 | 10 | 10 | **30** | 15 | 10 | 5 | 5 | 15 | Enhance consciousness, motivation and competence of the line organization. Questioning existing practices and seeking new. [mindset, understanding & practices] |
| 4 | 20 | **25** | 10 | 15 | 0 | 0 | 10 | 20 | Attitudes, anticipating, increasing collaboration, visibility of safety issues, seeking ways to improve safety [mindset, practices] |
| 5 | 10 | **30** | **30** | 5 | 0 | 5 | 10 | 10 | Enhance information and consciousness on rules, safety level, risks, best practices. Change practices to be safer, more effective and efficient. To hinder wrong information, practices etc from spreading. [mindset, understanding & practices] |
| 6 | 18 | 12 | 15 | 5 | 0 | 7 | **30** | 13 | Attitudes, information, systems, efficiency trade-offs, resource allocation [mindset, structures, practices] |
| 7 | **20** | **20** | 5 | 5 | 10 | 15 | 10 | 15 | Shaping attitudes, hindering risk taking, facilitating small group work with line supervisors [mindset, practices] |
| 8 | 0 | 10 | 20 | 10 | 0 | 0 | **40** | 20 | making learning from incidents more effective, informing the organization about issues affecting safety [practices, understanding] |
| M | 14.6 | 17.4 | 17.3 | 10.6 | 4.0 | 6.1 | 17.1 | 12.9 | |
| SD | 7.9 | 8.9 | 9.2 | 7.3 | 4.6 | 5.0 | 12.3 | 6.5 | |

The mean scores in Table 2 indicate that the principles of 'facilitating interaction', 'facilitating novelty' and 'monitor activities' received the highest scores. On the other hand, the scores on the principle of monitoring activities had the highest standard deviation, indicating that the principle is highly significant for a few professionals and totally non-significant for a few.

Table 2 also includes each professional's response to the question on the first page on what they seek to change, affect or maintain in their work (last column 'influence'). The text on red color in brackets

is our analysis of the responses into four content categories based on whether they seek to influence structures, practices, mindset or understanding. The classification is based on [16]. One interesting observation from Table 2 is that those professionals who emphasized that their object of influence includes understanding and knowledge of the personnel also seemed to focus more on the principle of facilitating novelty. Professionals 2, 3, 5 and 8 focused in their work on increasing understanding of the personnel, and they indicated 18 %, 30 %, 30 % and 20 % of their work, respectively, on the principle three (facilitating novelty). They also were the four highest scores on principle three.

The point of the exercise was not to evaluate the appropriateness of the work roles, but a couple of the experts spontaneously commented that they had shifted their role as their organization became more mature in safety issues in their respective fields (in this case, fire safety and occupational safety). Standardization was mentioned by them as the first principle in their early work: creation of basic instructions and procedures to cover the typical risks.

**Table 3: Examples of the type of activities associated with each principle**

| Principle | Example 1 | Example 2 | Example 3 |
|-----------|-----------|-----------|-----------|
| 1.Safety as a guiding principle | Safety 'campaigns' | info briefs | Own example and daily discussions. |
| 2.Facilitate interaction | Encouraging personnel at all organizational levels to raise up safety deficiencies they have spotted | Training, guiding, mentoring and advising | |
| 3.Facilitate novelty | Participation in development projects | Utilization of accident investigations and defining corrective actions | Reassessment and development of old work practices |
| 4.Create capability for self-organizing | Development of fire training. | Crisis management training | Situation specific guidelines based on local circumstances |
| 5.Promote efficiency | Making schedules for training and implementations | "This is line organization's central goal that does not need support from the safety organization" | |
| 6.Set objectives | Action plan and its review rounds | Defining safety goals with the management group and the safety team | Defining the key safety actions in order to allocate resources to them |
| 7.Monitor system | Auditing | Inspections and measurements | Monitoring trends |
| 8.Standardize | Requirement specifications | Guiding different workplaces to act with the same rules. | Updating safety rules based on new information |

The written evaluation comments were quite few. The workshop participants considered the framework promising and innovated different ways of using it in their work, e.g. in mentoring and recruiting new safety experts and in reflecting on the contents of one's own work. Some points were raised however about the framework:

Interestingly, during the discussion, the most questioned dichotomy was the 'promote safety' versus 'promote efficiency' dichotomy. As illustrated in Table 2, half of the professionals did not consider efficiency promotion as being part of their work at all. On the other hand, one of the professionals also questioned the role of 'safety promotion' as a separate principle, since he considered that everything he does is safety promotion, but only the means vary according to the other principles. Thus, he approached the entire framework from the perspective of safety promotion and considered whether it

is done by standardization, setting objectives etc. One professional also mentioned that safety promotion is not part of their task description.

Also, in the workshop there were interesting discussions about the role of creation of *new* rules and standard operating procedures. Does that belong to standardization or facilitating novelty? Some professionals considered that their work involved facilitating novelty because they were creating rules for tasks for which no safety rules existed. While this activity aims at standardization according to the framework, it does illustrate the importance of considering the organization's development stages when evaluating the principles. And it also shows how the principles can manifest in different ways in the different development stages of the organization: Standardizing an activity where no standards exist is a change and all change creates novelty, even if only for a brief time. Thus, making new rules was identified as one activity that transcends the stability-change dichotomy, but to the direction of stability. Officially removing standards from previously standardized activity would be a step in the opposite direction along the stability-change continuum.

A final point that was raised concerned the nature of acute tasks. A few professionals pointed out that helping the line organization in acute problems is one of the major tasks of the safety department, but that does not seem to fit directly into any one of the principles. Also some of the interviewees pointed out that much of their work is focused on acute challenges, or 'fire-fighting' like activity (see above). Thus, acute tasks can also be a symptom of deeper challenges in the organization's culture, organizing of work or even in the way safety professional's carry out their own work. At the same time, the fact that the line organization contacts safety professionals for help can be considered a good sign.

## 4.2. Roles, trade-offs and challenges of the safety professionals' work

Many of the professionals emphasized the guiding and supporting part of their work. "My role is to guide, advise, direct." Another distinguishing aspect in safety professionals' jobs was autonomy. Many of the interviewees emphasized that the working practices and even the object and objectives of one's own work are very much left to the individual expert to decide. One interviewee described their work: "I am quite much myself responsible for what I do, where I participate and how I use my time. I think that is quite typical for an expert role. And I quite much define policy on how things should be, and I am also asked about that."(H8) Another expert described the formation of their role: "It is quite much so that I myself propose that 'how about I could do this', and often the response has been that 'yes, that is exactly why we probably hired you'. So my doings have always been quite self-organized."(H3)

On the other hand, the role of the safety professional was also felt as a difficult one: "My role is to demand. And to demand more than has been previously done. And that is quite a bothersome role … I am always the one saying that 'this was good, but you missed this and you could have done that, and you did not really do very well in this' … I am a nasty piece of work."(H8) Interviewees spontaneously brought up plenty of other challenges related to their job. Many of these challenges manifested as trade-offs or tensions between various interest groups, ways of organizing, goals, ways of working, or different types of safety. These challenges seemed an inherent part of the role of the given expert. For example, one professional contemplated a safety development project that faced some resistance at the work site: "In hindsight, this [safety related project] should have been done here [at the work site]. But everyone who is working here at the site is so busy that they do not have time for this kind of development work. And that was precisely the reason we originally gathered this team from safety experts at the corporate level to drive the development forward."(H3) Another interviewee in one of the companies (H8) criticized the matrix structure of their company by stating that they do not have a proficient counterpart in the line organization, and that can lead to challenges. The line organization easily forgets to involve the expert organization, or the safety function, and informs about technical and safety related decisions only when they have been made. Another professional raised a similar issue from the other perspective by stating that one of the major risks for the safety department is that it gets distanced from the daily work, it becomes its own clique (H4). In such a situation responsibility for safety could be perceived by the line organization as residing in the safety

department. One safety professional described their rationale for combining several areas of safety into same department: "[by combining the different areas to the same department] I wanted to avoid conflicts and downplay, but that of course requires that I am able to balance these things. Traditionally, this [process] safety side couldn't care less about occupational safety issues, and the fire stuff considers the [process] safety a moon science. I think there has not previously been a genuine effort to understand each other."(H9)

The role of the safety professional was also perceived in relation to the top management and their business goals. "I do not think one could be a safety expert in a company if one is just a troublesome person for the business or to the personnel. … One can never get 100 percent safety; one has to have a sense of proportion here." (H9) One professional (H5) described the risks related to achieving high safety as being related to having competent people, getting money from the corporate management to get the necessary resources including the people and having enough time to achieve the work safely. Many professionals emphasized the importance of interaction with the top management and that the top management's commitment to safety is very important in giving the safety professionals preconditions for doing their job. Some also expressed the view that safety managers should report directly to top management. "My view is that safety manager should not be accountable to the line organization. If we have a safety manager that is working under a line manager and not under the corporate level CEO, there is a strong possibility for conflicts of interest."(H6) Another expert from different organization echoed this by stating that "we try to get along with the line organization … [our role is] a guiding decision making … advisory consulting"(H1) Thus, safety professionals seem to balance between the top management and the line organization, trying to align with both but also keep the necessary independence from them.

**4.3. Mechanisms influencing the formation of the professionals' roles**

Based on the interviews, three influencing mechanisms were defined that have shaped the safety experts' work roles: personal orientation and abilities, safety skills and knowledge, and the organization (core task, hazards, culture, current safety level). These three factors together shape how the expert builds his role and on what kind of principles they base their work practices as illustrated in the previous sections. Figure 1 illustrates the mechanisms.
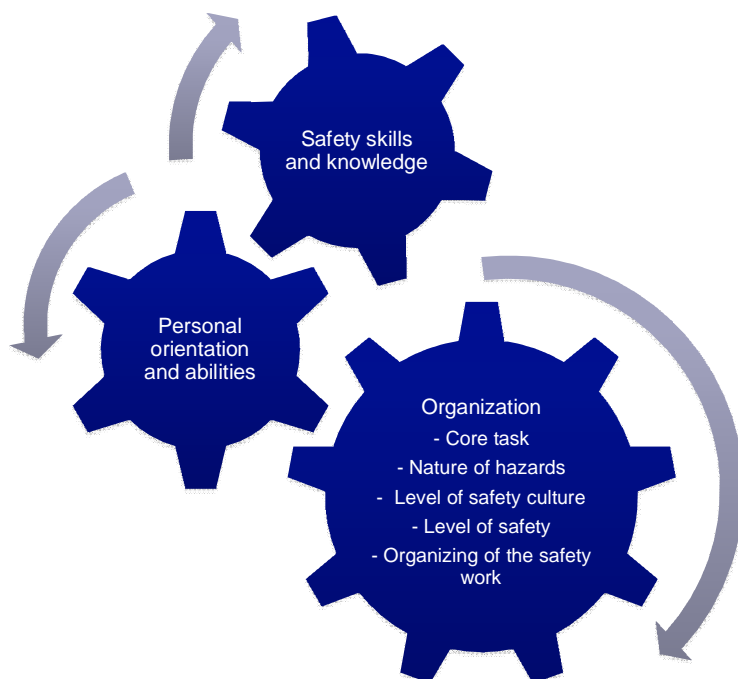


**Figure 1: The mechanisms influencing the formation of a safety professional's role**

The roles and practices of the safety professional seem to be an emergent result of the three different mechanisms. Changes in any of those affect also the roles. It is important to note that some of these changes can be brought by the professionals themselves, for example, development of safety culture or safety work, or development of the actual safety level. In a similar sense, development of the professional's skills and knowledge will probably affect how they will carry out their work and what are the critical things they want to focus on. The interplay between these various mechanisms is an important topic for future studies.

Some interview comments about the formation and development of the roles:

"At first, writing instruction was a big part of my work, since there were none [in my specific area]."

"In [the previous company where I worked] the situation was unfortunately so that the corporate management couldn't care less [about safety]. On the other hand, the good thing was that I could do whatever I liked and no one came to give me any orders. … I asked a few times from the management and they said do whatever you like, so that did not motivate much to ask again." (H6)

"When I came to the [company] we were almost immediately supposed to carry out a management audit, and I tried to find the action plan [for safety] … how one can evaluate without the action plan. There was none. The CEO then quickly took heed and we started planning an annual planning system for [different safety issues]" (H5)

Table 4 summarizes how the different mechanisms influenced the formation of professionals' work roles.


## 4. CONCLUSION

Managing safety in a complex adaptive organization is inherently contradictory activity and it always requires balancing between various tensions, competing demands and irresolvable dichotomies [12, 14]. Safety professionals have a key role in successfully balancing between competing demands, but that role is not an easy one. As shown by the variance in the underlying principles and personal orientations, there are various ways of defining oneself as a safety professional. At the same time, the safety professional should be adaptive enough the redefine their role as situations change (e.g. the safety level of the company, the risk profile).

Safety professionals deal with one organizational goal, safety, and this can something cause goal discrepancy between safety professionals, line managers as well as line operators. Their way of managing safety not only affects safety issues, but also other managers' possibilities and constrains for managing their goals. This in turn feeds back to the safety manager.

Management and leadership in a complex adaptive safety critical organization is inherently distributed in nature [11, 19]. Thus managers need to accept and build on the idea that other human agents in the systems are also safety leaders. Safety professionals are leaders even without the formal authority or subordinates. As some interviewees pointed out, they may even be better safety leaders if they do not have the line accountabilities (and the line authority, the other side of the coin).

**Table 4: Summary of the influencing mechanisms defining safety professionals' work roles**

| Mechanism | Identified issues |
|---|---|
| **Safety skills and knowledge** | Former education and former work were prominent in shaping the current safety knowledge. Very few general "safety skills" were identified. Understanding the hazards that relate to the work the organization is doing was considered important and requiring contextual knowledge of the particular characteristics of operation and local conditions at the sites. Some associated safety knowledge with understanding quality aspects, whereas others differentiated between these two areas. |
| **Personal orientation and abilities** | There was a large variance in the personal orientations of the professionals. Some emphasized that they like being generalists working with many people, and some liked to focus on fewer details and go deeper into some issues. The personal orientation seemed to play a key role in whether or not the role seemed "natural" for the professional. Many professionals emphasized that they enjoyed working with people, and some pointed out that being a safety professional is also a question of character; conscience, courage and sense of justice. |
| **Organization:** | |
| Core task | The business of the organization was considered as a starting point for the safety work. |
| Nature of hazards | The nature of the hazards was considered important to understand for the safety expert. Especially process related hazards were differentiated from occupational hazards. Fire hazards were somewhere between these two, potentially affecting both. |
| Safety culture and the level of safety work | The level of safety culture manifested as management expectations and also in having (or not having) certain basic safety management tools and practices (instructions, risk analyses etc.). When the basic requirements were in place the work of the professional usually shifted towards development of work practices, and support and guidance to the line organization. |
| Safety level | Most interviewees emphasized that the role of the professional is very different when the safety level is low. However, few people explicitly articulated the special requirements of the safety professionals' role in high safety level companies. |
| Organizing | Organizing of safety work in respect to the line organization was considered an important issue. There were both pros and cons in being situated in the matrix; there was a need to get line involvement in safety work, but on the other hand there were fewer production pressures when safety experts did not report to the line managers. |

Eoyang and Holladay [7, p. 19] point out that organizational goals are "interdependent pairs" where "a movement along one pair to resolve one challenge can lead to radical transformation along another pair". They give an example from product development and its attempt to balance between three interdependent pairs; quality and speed, quality and cost, and cost and speed. Moving toward quality in the quality-speed continuum will also affect costs, distorting the quality-cost continuum and thus affecting also the cost-speed continuum [7, p. 20]. Each decision concerning the pairs reshapes the landscape for all future decisions. Eoyang and Holladay propose that 'well-informed trial and error' is the only viable strategy in finding an optimal solution to all the relevant interdependent pairs. Being well-informed means 'understanding the pairs that are essential to success, understanding how they relate to each other, and having the knowledge and skills required to make the wise moves' [7, p. 20]. The value of the framework proposed and developed in this paper is in pointing out the tensions inherent in the solutions that are chosen, and the mechanisms that influence how these choices are

made. In safety critical contexts the emphasis has to be on "well-informed", but there is also a need for acknowledging the role of trial and error in any adaptive human action, safety management included.

**Acknowledgements**

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