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SAFETY MANAGEMENT SYSTEMS - DEFINITIONS, CHALLENGES FOR USE AND RECOMMENDATIONS FOR IMPROVEMENTS.

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ABSTRACT

In high-risk organizations much effort has been made to standardize procedures in order to streamline human action, to decrease risk and increase productivity. The purpose of using IT-based Safety Management System is to code and share best practices, create corporate knowledge directories and to create knowledge networks for organizations. In the risk and safety literature, these management systems are given various names and definitions. The aim for this paper is to give a review of relevant safety literature and come to a unifying definition of what an IT-based Safety Management System is, describe the purpose of such systems and challenges with using Safety Management Systems.

In the various definitions used in the research literature, we find certain common features: computer based superstructures, or umbrellas, containing procedures, descriptions and checklists on how different tasks should be performed, and what kind of safety standards different tasks require. Usually these procedures are disseminated throughout the organization via an internal computer network, an intranet, where (hopefully) all employees can access the necessary documents.

A central argument in this paper is that the concept of interpretation has been neglected in the safety literature, and that Safety Management Systems should be analysed as a part of an organisations communication. The Safety Management System is constructed at an executive level in the organization and distributed to the lower levels, and at the lower levels, it must be interpreted by the users. There is no guarantee that it will be interpreted as intended. In the development and implementation phases Safety Management Systems in professional organizations the emphasis has often been mainly on the technical requirements, but more attention should be given to the social and cultural facets of knowledge management

Keywords: Safety Management System, communication, procedures, interpretation, culture.

SAFETY MANAGEMENT SYSTEMS REVIEW

In the energy industry, and in other industries operating in a hazardous environment, there has been a development towards controlling the daily workflow through various forms of management systems. Within the various industrial organizations the management systems contains different things. In some organizations they mainly contain procedures for operations at the sharp end, whilst in other organizations the management system also contains procedures on blunt end operations, such as administrating over-time, hiring new staff and ordering new equipment. Also the research literature stems from various academic disciplines, with organizational science and safety science as the two most predominant ones.

In both the the academic literature and in the industry these systems are given different terms, with Safety Management System, Information System and Knowledge System as the most common ones, although someone also uses the terms Knowledge Management System and Information Management System, or even Managing Information System. These terms are somewhat overlapping, but also different. There is no clear consensus within the research literature as to exactly what the different terms means. Hence, two different researchers might use the term Safety Management System in a slightly different manner. The papers reviewed usually don`t go deep into discussions about definitions. The approach is more pragmatic, with focus on advantages and disadvantages with using management systems, and on why the workers so often aren`t using the management system the way it was intended. Papers within the organizational research often focus on the communication aspects, while the papers within the safety research focuses more on the purpose of the management system, which is to reduce the number accidents and unwanted incidents in industries where the effects of accidents can be catastrophically, like air traffic control, nuclear power plants and gas and petroleum production.

The aim for this paper is to through a review of relevant safety literature come to a unifying definition of what an IT-based Safety Management System is, describe the purpose of such systems and challenges with using Safety Management Systems. A central argument in this paper is that the concept of interpretation has been neglected in the safety literature, and that Safety Management Systems should be analysed as a part of an organisations mediated internal communication.

DEFINITIONS OF MANAGEMENT SYSTEM

In the various definitions used in the research literature, we find certain common features, whether they are labelled Management System, Information System or Knowledge System. They are all IT-based superstructures, or umbrellas, containing procedures, descriptions and checklists on how different tasks should be performed, and what kind of safety standards different tasks require. Usually these procedures are disseminated throughout the organization via an internal computer network, an intranet, where (hopefully) all employees can access the necessary documents.

Knowledge Management System

This term is mostly used within organizational theory. Knowledge management refers to identifying and gathering the collective knowledge in an organization, and hence, a Knowledge Management System is by Alavi and Leidner defined as a “class of information system applied to managing organizational knowledge” (2001, 114). They further explain that knowledge management systems are IT-based, and are developed to support the organization in creating, storing and retrieving knowledge. Building on Davenport and Prusak (1998), they state that knowledge management is about making knowledge visible, to develop a knowledge-intensive culture and to build a knowledge infrastructure, which they state is not only a technological system, but a web of connections where people are given the space and the time to interact and collaborate (Alavi and Leidner 2001). The notion that these systems are not merely technological systems, but socio-technical systems, is shared by many researchers. A related term from safety science is Active Knowledge Support in Integrated Operations (Norheim and Fjellheim 2007), defined as “a socio-technical system for knowledge transfer between drilling projects, trough documented experiences, best practices, and expert references” (ibid, 2). This definition is linked to petroleum industry, but is applicable to other industries as well, as it is point out at the general idea is to provide decision makers with the best available knowledge, and to facilitate for feedback to capture new knowledge and to delete obsolete knowledge.

Information System

In the research literature there doesn`t seem to be a general agreement what an Information System is, but in the organizational literature it is often given similar definitions as Knowledge Management System. One definition is “an open system capturing, contribute to the cognitive tasks in a social/organizational setting” (Avgerou 1987, 135). This is a rather broad definition, and Avgerou goes further to discuss how an information system is embedded in a social and organizational environment, hence establishing the idea that an information

system involves more than just building a complicated software system (Avgerou 1987). One might define Information Systems by its purpose, which is to "support and augment organizational knowledge and enhance knowledge management activities by the individual and the collective" (Alavi and Leidner 2001, 115). They too point out that although this is computer mediated communication, an Information System must be rooted in and guided by an understanding of the nature and types of organizational knowledge in order to succeed. Information system has also been described as social systems which rely on information technology for their function, and in where technology is never more than a component (Land and Hirschheim 1983, cited in Avgerou 1987). In other words, an information system is not merely a computer system, and can be linked to the previous mentioned notion from the safety literature of a knowledge management system as a "socio-technical system for knowledge transfer" (Norheim and Fjellheim 2007).

Safety Management System

An often cited definition within the safety literature is that safety management relates to the actual practices, roles and functions associated with remaining safe (Kirwan 1998). A similar definition of safety management is that it is "the policies, strategies, procedures and activities implemented or followed by the management of an organization targeting safety of their employees" (Vinodkumar and Bhasi 2011). Safety Management System is hence a formalized way of dealing with these practices, roles, policies and procedures. Safety Management System is defined in various ways in the safety literature. Some definitions are rather formally descriptive, for instance "an organisation's formal arrangement, through the provision of policies, resources and processes, to ensure the safety of its work activity" (El Koursi, Mitra and Bearfield 2007, 4), or, more generally, as "a manifestation of the organization`s safety culture" (Fernández-Muñiz, Montes-Peón and Vázquez-Ordás 2007).

A Portuguese study within the organizational research a slightly different term is used, but the definition is similar: A Occupational Health and Safety Management System is here defined as "a set of tools that enhance safety risk management efficiency related to all the organization`s work activities" (Santos, Barros, Mendes and Lopes 2013, 29). They describe it as a self-regulatory regime and as a tool to promote and develop health and safety conditions, in which the purpose is to ensure that all work performed in the organization is in accordance with legal obligations. Another definition from the safety literature points to the place of the Safety Management System in the organization; as an integrated mechanism of the organization, and to the purpose of the system; to control the hazards that can affect workers' health and safety (Vinodkumar and Bhasi 2011). A similar definition stems from the United Kingdom Civil Aviation Authority (UKCAA). They define Safety Management Systems as a "methodology by which a company manages safety throughout its organization, utilizing a systematic approach to ensure that all parts of its business are addressed and that all risks are identified and subsequently managed" (UKCAA 2002, as quoted in Chen and Chen 2012). The International Labour Office defines Safety Management Systems as "a set of interrelated or interacting elements to establish safety policy and objectives, and to achieve those objectives" (ILU 2001, as quoted in Bottani, Monica and Vignali 2009, 155). To sum up these various definitions we can gather that Safety Management Systems are IT-based superstructures containing procedures, descriptions and checklists on how different tasks should be performed according to official regulations, safety standards and corporate values. They are socio-technical systems of which the purpose is to support the organization in creating, storing and retrieving knowledge.

THE PURPOSE OF A SAFETY MANAGEMENT SYSTEM

It is easier to find a consensus in the literature when it comes to describing the purpose of the various management systems, which is of course to reduce accidents and risk by standardizing the work procedures, though the phrasing differs. Santos-Reyes & Beard label it "The Systematic Safety Management System (SSMS)", but the purpose of it is similar; to maintain risk within an acceptable range in the operations of any organization (Santos-Reyes and Beard 2009), which is basically the same as to help the organization identify and manage risk effectively (Koursi, Mitra and Bearfield 2007). Several researchers also underline another purpose of Safety Management Systems, which is to help the organization meet the regulatory requirements (Hale, Heming, Catfhey and Kirwan, 1997; Koursi, Mitra and Bearfield 2007; Antonsen, Almklov and Fenstad 2008; Chen and Chen 2012). There is also a general agreement that Safety Management Systems is a means to change safety management from being reactive to being proactive (Liou, Yen and Tzeng 2008), and anticipating hazardous situations before they occur, and not just acting after an accident has occurred, or phrased differently; to protect against human error (Dien 1998; Dekker 2003; Antonsen 2009). There is also the matter of defining legal responsibility if incidents should occur (Antonsen, Almklov and Fenstad 2008). Antonsen (2009) describes how the interest for Safety Management Systems came as a consequence of the increased focus on the organizational conditions for safety in the 1980s. An important assumption was that accidents are mainly caused by human error or failure. Hence, the way to decrease the chance for human error and making the organization operate safer is by

creating management systems that specifies objectives, distributes responsibility, plans, organize and controls according to safety precautions (Antonsen 2009, 9). This is not only a matter of coordinating between tasks, but also the accumulation and diffusion of organizational experience, and to turn tacit knowledge into explicit and shared knowledge (Haavik 2010).

In any organization there will always be tacit knowledge, and much effort is made in order to turn tacit knowledge into explicit and shared knowledge, and to make invisible work processes visible and transparent. If those who actually perform the work are the only ones who knows how it is done, the ability to account for this invisible work and the tacit knowledge that accompanies it, can strengthen the organization`s performance significantly (Haavik 2010). However, tacit knowledge can be so complex that it is difficult to articulate in a way that makes sense, and many professions demand a certain experience in order to be able to make complex considerations (Sohlberg 2009). This is not to say that tacit knowledge needs to remain tacit. Tacit knowledge is "the personal knowledge that is learned through extended periods of experiencing and doing a task, during which the individual develops a feel for and a capacity to make intuitive judgments about the successful execution of the activity" (Choo 2001). This type of knowledge can also be made explicit and brought forward to other workers who lack the experience, which the management system is an attempt to systematize. This way the separating lines between tacit and explicit knowledge will be moved, so that knowledge that was tacit yesterday is explicit today (Sohlberg 2009). So, the purpose is to increase safety by decreasing the chance for human error and by making sure that regulatory requirements are met at all times, but also to define legal responsibility if incidents occur, and to build a stronger organization by accumulating organizational knowledge.

SAFETY MANAGEMENT SYSTEM AND PROCEDURES

IT-based Safety Management Systems contains a lot of procedures covering various work operations. Procedures are often constructed on the basis of analysing accidents and other unwanted incidents, but also on the already established routines, and on legal demands set by the authorities. Procedures delivers formalized methods for carrying out tasks, such as checklist, task list, action steps, instruction manual, fault- finding heuristic, forms to be completed (Bellamy et al 2010). Procedures are usually seen as protective mechanism against human error, but can also be seen resources to facilitate situational decision making.

In the research literature much focus has been on managing maintenance activities in hazardous environments, where routine tasks need to be performed under changing circumstances. Humans make mistakes, so rules and procedures are designed to control these human characteristics, and hence improve the reliability of humans and organizations, particularly in safety-critical organizations (Reiman 2011).Thus, procedures might become rather restrictive. However, several researchers have pointed out that people do not always follow procedures (Lawton 1998; Dekker 2003; McDonald 2006; Antonsen 2009; Reiman 2011). Dekker (2003) gives an account for two different models of thinking about procedures. The first model is where procedures are seen of as the best thought-out and safest way to carry out a job. According to this model, safety comes from people following procedures in as a simple rule-based activity. In the second model, procedures are seen as resources for action. The do not specify all circumstances to which they apply, and in dynamic workplaces procedures can help people to structure activities across similar but subtly different situations (Schuman, 1987, as referred to in Dekker, 2003). Doing this successfully can be a "substantive and skilful cognitive activity" and safety is a result of "people being skilful at judging when (and when not) and how to adapt procedures to local circumstances" (Dekker, 2003, p. 235). The challenges with using IT-based Safety Management Systems are quite similar to the challenges of using procedures, and includes time pressure, lack of flexibility, a sense that there are better and quicker ways to get the job done, but is also linked to the workers image of themselves as professionals. A lack of flexibility and information overload can also lead to situations where the workers are not able to interpret the procedures and adjust them to the situation at hand.

CHALLENGES WITH USING SAFETY MANAGEMENT SYSTEMS

Several researchers argue that management systems have helped to reduce accident rates by the principle of prevention (Santos et al 2013), while others stress that the literature in this area is lacking, and that there is little research evidence that safety management practices are related to safety performance (Vinodkumara and Bhasi 2010). Any Safety Management System in itself says little about how policies and procedures are carried out in the field (Mearns, Whitaker and Flin 2003), and Safety Management Systems do not always improve the results of safety because they are centred exclusively on the technical requirements and on obtaining short-term results (Weinstein 1996). Clearly, any organization needs to share experiences and best practices, and to administrate this in an effective way, but to get the acceptance from management and staff to use the tools in practice demands a lot of energy from managers and staff who will have to change their working patterns and habits, without losing

tempo on the daily operations. Safety Management Systems are based on the assumption that people will follow the procedures most of the time, but why do workers so often avoid using the Safety Management System?

The worker`s ideals of professionalism

In a study of UK railway workers motives for rule violations, Lawton found that a well-intentioned desire to get the job done often resulted in deliberated deviations from the written rules. The most important reasons for non-compliant behaviour was a quicker way of getting the job done, but also self-imposed or external pressure to get the job done more efficiently (Lawton 1998). This may also have symbolic value for the workers` image of themselves as professionals. Not only deadlines, but also peer pressure and professional expectations can make violations become compliant behaviour. When unofficial action yields better, quicker ways to do the job, it also functions as a sign of competence and expertise. Being able to outsmart hierarchical control and compensate for higher-level organizational deficiencies or ignorance becomes a part of one's professionalism (Dekker 2003; Hollnagel 2004; 2009; Reiman 2011). McDonald (2006) notes how the technicians doing aircraft maintenance justified their violation from procedures by reporting there were 'better, quicker, even safer ways of doing the task than following the manual to the letter' (McDonald 2006, 161). The technicians often see this as a part of their professionalism, and as something that compensates for organizational dysfunction. Rules and procedures can be a source of tension for the personnel, afraid of losing their professional identities as skilled craftsmen and becoming "a small cog in a big machine" (Reiman and Oedewald 2006). They often value the use of one`s own judgement and being confident in one`s own abilities to solve problems, and not just following rules (McDonald 2006). This can be seen as a version of the tradition of valuing common sense over paperwork. Borys (2009) found that paperwork became a ritual for the workers, something they did to abide to the company`s rhetoric about safety, but thought that their own common sense was more significant in order to keep them safe. Managers, on the other hand, valued the paperwork related to risk-awareness because it gave them evidence that workers have thought about risk (Borys 2009).

It would be profitable to establish a link between using formal work description and the ideals of professionalism. A Norwegian study showed how a group of aircraft line maintenance technicians valued procedures, rules and regulations as guides for work practice, but at the same time, they distrusted them, and sought to adapt their practises depending on the situation (Pettersen and Aase 2008). Applying procedures successfully across situations demands skill, and can be integrated in the ideals of professionalism. Being skilful at judging when and how to adapt procedures to a given situation or circumstances is what safety results from (Dekker 2003). Adaption and interpretation of rules is often considered part of the work (Reiman 2010), not only as a part of the worker`s sense of professionalism, but also it is quite necessary because of the sheer volume of rules and procedures they need to navigate through, and because procedures cannot apply to just about any situation that might occur.

Information and procedure overload

There is a general agreement in the research literature that rules and procedures are useful guides for safe behaviour, but there is also a concern that it might be counterproductive to have too many rules and too detailed procedures. A jungle of procedures does not allow the operators to develop an underlying plan of their own but rather lead them into focusing only on micro-difficulties (Grote et al 2009). If the operators get too caught up in the tiniest of details, they might lose grasp of the bigger picture of what is going on. It is impossible to have procedures to anticipate all the situations and conditions that might occur, so there will always be situations where best practice relies on the judgment of the operator (Sutcliffe 2011). A related problem is that over time an organization will create a large number of rules and procedures, so that the sheer amount can make it difficult to choose which rules and procedures to activate for a specific scenario. For instance, after accidents or unwanted incidents, it can be tempting to introduce new procedures or change existing ones, as a highly visible reply to demands from regulatory authorities that some kind of action be taken (Dekker 2003; Antonsen, Almklov and Fenstad 2008). The desire to make the procedure as realistic as possible, and to have procedures to match any situation, contributes to an increasing number of procedures to the point where is becomes a jungle, creating difficulties in deciding which procedures to apply (Alavi and Leidner 2001; Antonsen, Almklov and Fenstad 2008). Similar to an information overload scenario, a procedure overload can discourage workers from searching through the jungle of knowledge (Alavi and Leidner 2001), and an ever expanding Safety Management System will make navigating difficult.

Lack of flexibility

Safety Management Systems and procedures contains a lot of "do not". They are often designed with the intent to prohibit actions that may create hazardous situations, and as a result have a tendency to become increasingly restrictive (Antonsen 2009). Extensive rules and procedures might be at the expense of flexibility, so it is important to balance the need for standardization and the need for flexibility (MacDonald 2006; Grote et al 2009; Sutcliffe 2011). In a context of limited resources, multiple goals, and time pressure it can sometimes be impossible to follow all the rules and get the job done at the same time (Dekker 2003). Some studies also indicate that the workers will more often violate procedures that are seen as overly detailed restrictions (Antonsen, Almklov and Fenstad 2008). Standardization can also lead to an over-reliance, meaning that the workers trust the standardized procedures blindly and never question whether this really is the best way of doing the job (Grote et al 2009). The question of just about how detailed procedures need to be can probably never be given one general answer. It depends on the nature of the tasks involved, among other things. Tasks that are performed rarely, or are quite complex or require coordination between several units in the organisation, will usually need more detailed descriptions than routine tasks that the workers are quite familiar with, which can be governed by more general functional requirements (Antonsen, Almklov and Fenstad 2008). Strongly regulated organisations are likely to benefit from it safety-wise if they manage to create some space for individual decision making. Reiman refers to Bourrier`s (1996) demonstration of how ever expanding procedures did not support individual decision making on behalf of the workers, and that local adjustments of rules and regulations is necessary for organizations to effectively pursue their goals (Reiman 2010). If workers only follow rules, and are not able to decide when the procedures should be adapted according to a specific context, they can get blamed for their inflexibility (Dekker 2003). Safety Management Systems and procedures are resources for action, but cannot dictate their own application or guarantee safety. They are not ever likely to be sufficient for creating safety, but need to be adapted by people with sensitivity to context. The clue then is not simply telling people to comply, but to help them develop skills to know when and how to adapt (Dekker 2003).

DISCUSSION

What the various definitions have in common, is that they describe the Information System, Knowledge System or Safety Management System of a company as a IT-tool that contains descriptions and procedures on how certain task should be performed, checklists, safety regulations, and to secure that these are available for all units in an geographically dispersed organization. It is usually regarded as a sub-system of the total organizational management, and the purpose is to control the hazards that can affect workers' health and safety, to avoid incidents that may harm the environment or the company`s economy, and to enable the organization as a whole to learn from experiences. Of all the various terms used, Safety Management System seems to be the most common one, and is also the term that best connotes what it is actually meant to be. Safety Management Systems are socio-technical systems containing procedures, descriptions and checklists on how different tasks should be performed according to official regulations, safety standards and corporate values, and supports the organization in creating, storing and retrieving knowledge. In some organizations they mainly contain procedures for operations at the sharp end, whilst in other organizations the management system also contains procedures on blunt end operations, such as administrating over-time, hiring new staff and ordering new equipment. Also the research literature stems from various academic disciplines, with organizational science and safety science as the two most predominant ones.

Safety Management Systems are living systems and are never completely finalized in their making, but should always be open for evaluation, adjustment and changes. Ideally they should always be developed on the basis of new experience, in order to replicate success. Three ingredients are particularly important for a successful match between procedures and practice: There should be feedback from the lower to the upper tiers of the organization, the adjustment of procedures should be based on the views of those directly involved, and the time interval between worker feedback and implementing changes should be as short as possible. In existing system one must study the interaction between human and system to find to identify various problems and deficiencies.

Safety Management Systems in professional organizations have in several cases been unsuccessful because in the the development and implementation phases the emphasis has often been mainly on the technical requirements, while more attention should be given to the social and cultural facets of knowledge management (Cox and Cheyne 2000; Alavi and Leidner 2001; Rai, Maruping and Venkatesh 2009; Vinodkumar and Bhasi, 2011). For instance, Antonsen (2009) showed how seamen saw practical sailing experience as the backbone of safety. They were frustrated by being forced to work by formal procedures and checklists, and interpreted it as a sign of distrust from the management who did not appreciate their professional expertise (Antonsen 2009). Similar findings emerged from a study of two maintenance organizations in Australia, where managers focused upon collecting paperwork associated with the safety program, unaware that the front line workers valued their own

"common sense" over formal rules, making the paperwork a ritual they performed only to appease a rhetoric about safety (Borys 2009). In a study of a petroleum producing company using an IT-based Safety Management System, it became clear that several of the electricians and mechanic working on the offshore installation, simply did not like computers and would rather avoid it; they preferred to simply go out an "do the job" rather than reading documents on a screen first (Wold & Laumann, 2015). One of the challenges with using IT-based Safety Management System is that they typically contain a lot of do-not, and hence become very restrictive. A related challenge is that over time an organization might create a large number of rules and procedures, so that the sheer amount can make it difficult to choose which rules and procedures to activate for a specific scenario, and that navigating in the jungle of Safety Management System becomes difficult and time consuming. A jungle of procedure does not allow the workers to develop an underlying plan of their own but rather lead them into focusing only on micro-difficulties. It is impossible to have procedures to anticipate all the situations and conditions that might occur, so there will always be situations where best practice relies on the judgement of the worker. This has relevance for how the workers see themselves as competent professionals. The workers often prefer not to use the Safety Management System because they thought there was a quicker and better way of doing the job, which also functions as a sign of competence and expertise.

Safety Management Systems must be interpreted

In both the organizational literature and the safety literature the matter of interpretation has often been neglected. Though several authors stress the human component, it is usually in the perspective of how to get the human workers to use the technology in a better way. Interpretation of technology is usually not discussed, and although most authors define the management system as "IT-based", they don`t discuss it as a mediated message that comes to life in the interface between human and technology. The tendency is to regard Safety Management Systems and the procedures as tools. As tools they don`t require any interpretation, just a little bit of training, and then the worker will be more efficient at using the tool the more experienced he or she is. Dekker (2003) points to one aspect of interpretation; Procedures do not specify all circumstances to which they apply. Hence, people at work must interpret procedures with respect to a collection of actions and circumstances. However, this is only one aspect of interpretation.

Any Safety Management System, no matter how it is constructed, is communication. It can be convenient to pretend that this is one-way communication, but it's not, because the user interprets the information in the Safety Management System and turns it into knowledge, adding his or her prior knowledge and experience. The cognitive strengths of humans must be emphasized, but also how operators interact with management systems and procedures. Not only shall machines be designed to suit the physical abilities of the expected user, but instructions and procedures shall be designed to fit their mental abilities; the cognitive, informational end emotional processes in the human being.

Reiman (2011) argues that research should aim at developing methods and approaches for evaluating the functioning of the maintenance organizations holistically, taking into account the individual, social and organizational elements.

One way of doing this and to stress the importance of interpretation is to analyse the IT-based Safety Management System as a system for communication. Any information that is communicated must be interpreted before it makes any sense to the receiver (Morley 1992; McQuail 1997). While interpreting the information, the receiver turns the information into knowledge, adding his or her prior experience (Wold & Laumann, 2014). The safety literature tends to implicitly use a linear transfer model of communication, where every message is understood as intended, but in reality this is not the case. Information is constructed according to the prevailing values and attitudes of the management in the organisation, and then communicated through various forms of media, in this case an IT-based Safety Management System, although other media is also being utilized, like radio, e-mail, flyers, posters, group meetings and face-to face talks. The individual operator in the organization will interpret the communication and accept, negotiate or reject it (McQuail 1997; Hall 1980, 2002). In the communicative exchange there can be various degrees of understanding or misunderstanding and this will depend on degrees of symmetry or asymmetry established between the positions of the executives and the operators within the organization. In other words: The Safety Management System is constructed at an executive level in the organization and distributed to the lower levels, and at the lower levels, it must be interpreted order to make sense. There is no guarantee that it will be interpreted and understood as intended. Sometimes it is something as banal as that the management uses different words and grammar than the workers are used to, or they understand the same words differently, but it can also be related to more profound background factors, like education, working situation, and their basic understanding of the world in general end the organization in particular.

Cultural distortions in communication

In any culture, also a business culture, there will be some values and ideas about the world that is more or less taken for granted. Certain codes in a specific language community or culture are so widely distributed that they appear as naturally given and not as cultural constructs (Hall 2002, 132). The set of values and forms of expression shared by the people are just as important to the behaviour of the members of an organization as its formal goals, structure and tasks (Bouwman et al 2005). This has a great deal to do with the structural difference in the position between the sender and the receiver of a message, or, as in our case, between staff at different levels in the organization. What are called "distortions" or "misunderstandings" arise precisely from the lack of equivalence between the two sides in the communicative exchange (Hall 2002, 131). The individuals of a professional organization are assigned tasks within a specific hierarchical structure, which usually roughly consists of a top management level, a staff, a middle management level and a work floor. It is plausible to assume that there will be asymmetry between the codes of "source" and "receiver" – in other words, the top level of the organization might not share the same codes as the lower level, or the lower level might understand and interpret these codes differently. Another factor is that the different levels of the organization are not necessarily in perfect harmony with each other. Resentment towards the leadership will influence the interpretation. In some cases they can have similar interests. For instance, a profitable result for the organization is usually in everyone`s interest, but there are also situations where they can have different interests. People with different roles in the organization might have different frames of reference. The individual member of the organisation will interpret any mediated message in light of his or her previous knowledge and experience, and frames of references. Professional organizations have often tried to create a corporate identity to unify the different levels in the hierarchy, and to create an organizational common sense in order to avoid misunderstandings. It will be useful to consider how some frames of references are shared by the entire organizations, and at the same time, how each level of the organization might have specific frames of references which are unknown at the other levels in the organization, and how different subcultures within the organization operate with different frames of references.

Future improvement

For future improvement IT-based Safety Management Systems must focus more on the areas of human factors and the associated developments on health and safety (Cox and Cheyne 2000). Human factors revolves around the central importance of the user, and the goal of human factors is to enhance performance, increase safety and increase user satisfaction. This includes the communication and cognitive processes involved in using the system. If human factors methods and principles are applied as early as possible in the development of a system, in predesign analysis, technical design, and final test and evaluation, many of the human factors deficiencies will be avoided before they are inflicted on systems design (Wickens, Lee, Liu and Becker 2004). The use of software technology cannot be studied isolated from its environment. The organizational context is crucially important. The formal descriptions, procedures and standardizations are artefacts and should be treated as such (Grote et al 2009). However, sometimes it becomes routine not to follow the standardized procedures. New technology in the workplace might be seen as something interesting to learn, and as something that makes the work procedures easier, but can also be seen by the workers as a threat to ones status if tasks are changed or "taken over" by automation, or one might feel that it is difficult and just adds to the work load.

Good procedures and work descriptions are needed in any organization operating in hazardous environments, and these must be organized in a management system where they can be easily located and retrieved for a large number of workers. It is important that the procedures and work descriptions don`t get too detailed or too extensive, as it may lead to that the worker gets too hung up in the tiniest of details and loses the overall understanding for the task and the context. If procedures get too detailed, it will stop the workers from thinking on their own. This thinking is always a resilience factor, as it is impossible to create procedures that can foresee any situation. More research is needed here to investigate exactly how detailed procedures should be. It can be fruitful to differentiate between different types of procedures. It might very well be that procedures for more extreme or accident situations should be more detailed than procedures for more ordinary work situations. Qualitative situation analyses could be a useful research method here.

People at work must interpret procedures with respect to a collection of actions and circumstances that the procedures themselves can never fully specify (Dekker 2003). There will always be situations that require the worker to evaluate different alternatives and make a choice. Reiman (2010) argues that maintenance has too often been considered as mostly manual labour requiring little or no mental work. This is probably why the matter of interpretation has been neglected in safety research. A central subject for further research should be how the workers interpret and understand the procedures and the Safety Management System, on how their interpretation affects how they use the Safety Management System.

Procedures and Safety Management Systems are usually developed by management and experts who are not involved at the operational level. A key challenge here is to involve the workers in the development of the procedures and Safety Management System. These must be constructed so that they increase ownership of work, and not decrease ownership of work. One should utilize the competence and experience of the workers when developing the procedures and the workers should also have the opportunity to give feedback on how useful the procedures and the management system are. The communication that a Safety Management System constitutes is mainly a linear communication from the upper tiers of the organization to the lower. There should be feedback travelling the other direction as well, so that that adjustments or procedures can be based on the views of those directly involved. It is also important that the time interval between worker feedback and implementing changes is as short as possible. A Safety Management System must not be installed instead of training. In-house training is essential in order to get the workers to use the Safety Management System as intended, and for the workers to see why it is important.

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