A study of experience feedback from reported unwanted occurrences in a construction company

Abstract

An interview study in a major Norwegian construction company was conducted to analyse learning from reports of unwanted occurrences (RUO). Systems for reporting unwanted occurrences are one of the most important tools in systematic safety management to ensure efficient experience feedback that will improve safety performance. The interview study identifies two major obstacles to efficient learning from reports of unwanted occurrences 1) under-reporting at the sharp end, and 2) reports are not analysed and applied to improve the safety performance. The reasons for under-reporting are the same as those identified in previously published studies on under-reporting, with one exception. The interviews show that many workers are flexible and choose to correct the situation right there and without documenting the occurrences in order to perform both effective as well as safe work. It is paradoxical that those at the sharp end prefer to put things right and continue the work in a safer manner without spending time reporting, at the same time as the HSE management wants all unwanted occurrences to be documented for learning purposes. A root cause for the identified obstacles is a conflicting objective between production and safety.

1. Introduction

The accident statistics for the Norwegian construction industry are much higher than the average for other industries in Norway (Mostue et al., 2016). This situation is the same in most countries (Häkkinenn and Niemelä, 2015; Hola and Szóstak, 2015; HSE, 2017). The risk picture is characterised by temporary organisations, a dynamic context and hazardous work involving high energy potential. Safety in the building and construction industry is generated by several different actors during different project phases. Decisions by the client and designers in the early project phases have a major impact on safety performance in the production phase (Behm, 2005; Frijters and Swuste, 2008; Jørgensen, 2013). Additionally, systematic safety management in the production phase is required to ensure barriers against loss.

Experience feedback is a basic principle in systematic safety management, where information about safety performance is used as input to decisions to improve safety and prevent accidents from happening (Kjellén and Albrechtsen, 2017). One key method of providing experience feedback is to use a system for reporting unwanted occurrences. Systems for reports of unwanted occurrences (RUO) are common and widely used by organisations in order to learn from unwanted incidents, near-misses, unsafe conditions and unsafe acts so as to prevent such occurrences in future. Observed unwanted occurrences are reported, registered in a database and analysed to provide a basis for development and implementation of countermeasures. The purpose of this paper is 1) to describe experience feedback based on RUOs in a large Norwegian construction company and 2) to identify and discuss obstacles to effective experience feedback.

2. Reporting and learning from unwanted occurrences

2.1 Experience feedback and reporting of unwanted occurrences

Safety management is based on the principle of experience feedback, i.e. the process by which information about the results of an activity is fed back to decision makers as new input to modify and improve subsequent activities (Kjellén, 2000; Kjellén and Albrechtsen, 2017). The purpose is to use information about experienced or expected safety performance as a basis for decisions that prevent accidents. Kamsu Foguem et al. (2008) have a similar interpretation: experience feedback is a process whereby experience at an operational, tactical or strategic level is disseminated in such a way that the knowledge is used to improve the organisation's performance. Experience feedback thus aims at learning and improvement in the organisation, i.e. double-loop learning (Argyris & Schön, 1996), as opposed to single-loop learning where an unwanted occurrence is handled without further learning in the organisation.

Experience feedback in practice is explained in Kjellén and Albrechtsen's (2017) model for safety information systems, see figure 1. Safety performance data are collected by looking to the past (RUOs, investigations), the present (inspections, audits) and the future (risk assessment). The data collected are registered, analysed, distributed and used as support for decisions to implement countermeasures. The safety information system is thus a necessary sub-system for decision-makers in the line organisation.
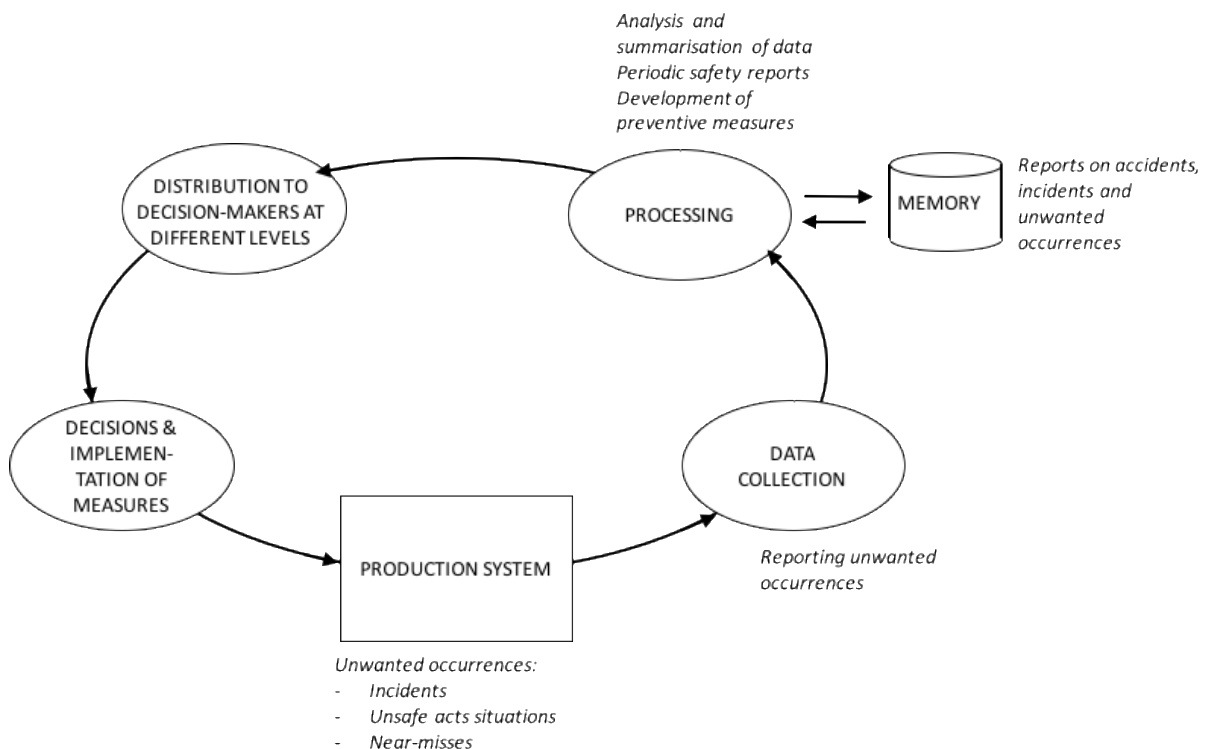
Figure 1: A model of a safety information system (Kjellén and Albrechtsen, 2017). Exemplified by reports of unwanted occurences in italics.

A well-functioning system for experience feedback contributes to and maintains a good safety culture. Reason (1997) argues that a good safety culture is an informed culture, i.e. those who manage and operate a system has knowledge about the conditions that in sum make up the safety of the system. An informed culture is based on reporting, fairness, flexibility and learning. A reporting culture is dependent on the willingness of workers at the sharp end to report, which means that it depends on a culture of fairness and trust. In such a situation, workers are encouraged to contribute with safety-related information, at the same time as there is a clear distinction between what constitutes acceptable and unacceptable conduct. A learning culture entails the presence of both the willingness and skills to draw the right conclusions from the information system as well as to implement necessary measures. Such a culture is essential to enable efficient data collection and use of the safety information system.

A typical RUO system is described in figure 2. Unwatned occurences (accidents, near misses, unsafe acts and unsafe conditions) are reported by a worker, line manager or safety delegate either on paper or electronically. The report is the quality assured and recorded in a database. Analysis of the single report or collections of reports is then used as decision-making support for different means (counter-measures, safety performance statistics, input to risk assessments etc.)
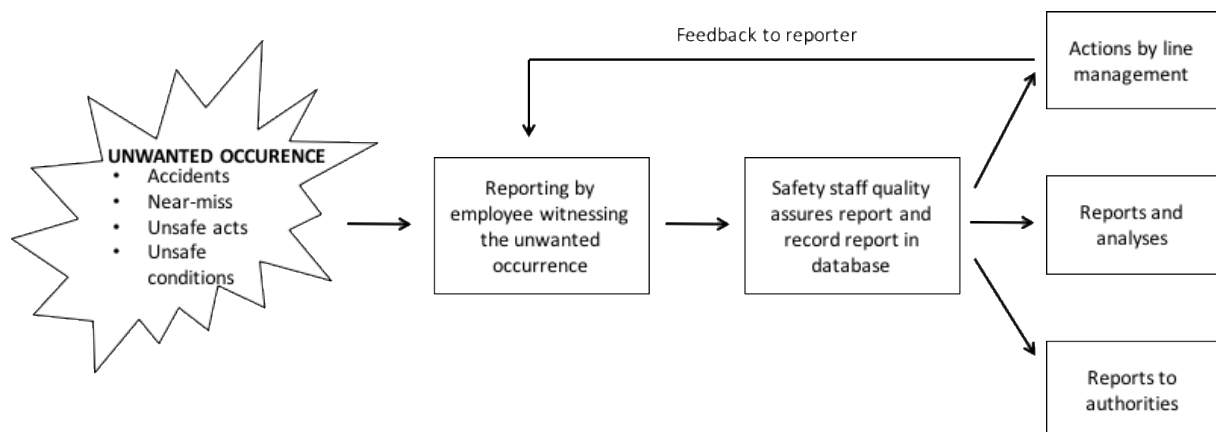

Figure 2: System for reporting of unwanted occurrences (Kjellén and Albrechtsen, 2017)

Unwanted incidents, near misses and unwanted conditions must be reported by workers at the sharp end in order for the RUO system to work. The reliability of reporting (number of reports in relation to the actual number of occurrences) has proved to be a problem in many different industries (Oltedal and McArthur, 2011; Storgård et al., 2012; Probst and Graso, 2013). Under-reporting is the result of a combination of different personal, organisational and technological factors. Van der Schaaf and Kanse (2004) propose four main categories of personal factors that explain under-reporting: fear of being blamed and disciplinary reactions; acceptance of occurrences; no perceived benefits of reporting; and practical issues like having the time to report and the user-friendliness of the

reporting system. These categories are supported by empirical studies, e.g. Storgård et al. (2012); Windsvold Prang and Jelsness-Jørgensen (2014).

There is more literature about organisational and technological causes of under-reporting than about personal causes (van der Schaaf and Kanse, 2004). Commitment and support from top and middle management are key factors for improving reporting reliability (Nielsen et al. 2006; Storgård et al., 2012; Windsvold Prang and Jelsness-Jørgensen, 2014). Vague or inadequate feedback from top or middle managers, on the other hand, has an adverse effect on reporting reliability (Reason, 1997; Sanne, 2008; Oltedal and McArthur, 2011; Storgård et al., 2012; Windsvold Prang and Jelsness-Jørgensen, 2014). Organisations that avoid focusing on guilt and blame, and emphasise openness and trust instead, will have a higher degree of reporting reliability (Reason, 1997; Oltedal and McArthur, 2011; Storgård et al. 2012). Rossignol (2015) shows that actual reporting practice is related to solidarity between colleagues. Other organisational factors that influence reporting include: unclear reporting procedures (Windsvold Prang and Jelsness-Jørgensen, 2014); lack of training and instruction (Sanne, 2008; Oltedal and McArthur, 2011); the user-friendliness of the system, including how comfortable the users are with electronical reporting systems (Reason, 1997; Storgård et al. 2012; Windsvold Prang and Jelsness-Jørgensen, 2014). Workers who do not perceive that they can influence their own working situation, are less likely to report (Sanne, 2008). Studies of the maritime industry in Finland, Norway and Sweden have shown that reporting reliability is weakened by lack of communication between ships and the onshore organisation, in addition to lack of safety awareness in the onshore organisation (Oltedal and McArthur, 2011; Storgård et al. 2012).

There is also a clear relationship between the pressure to produce and under-reporting (Oltedal and McArthur, 2011; Probst and Graso, 2013). Increasing pressure to produce more generates more negative attitudes to reporting and more under-reporting. This is demonstrated by Collision (1999), who shows that assessing and rewarding safety performance based on the number of reports produced give rise to mechanisms that contribute to underreporting and downgrading the severity of incidents.

A study of contractors in the offshore petroleum industry (Kongsvik et al., 2012) shows that reporting can give rise to challenges because measuring safety performance in terms of the number of reports influence tender evaluation. The study shows that reporting among contractors depends on external factors: the main operator's efficiency demands and poor follow-up and lack of feedback on reports. Similarly, Underhill and Quinlan (2011) and Bråten et al. (2014) show that hired personnel have less reporting reliability and reporting willingness than full-time employees.

2.2 Development and sharing of knowledge

Safety management and experience-based feedback are linked to quality management and knowledge management. The goal of experience feedback can only be achieved by first acquiring practical knowledge and experience and then translating it into explicit knowledge that benefits the whole organisation. Tacit knowledge is experience-based knowledge created here and now in a specific and practical context. It consists of cognitive and technical elements that refer to a person's mental image of reality combined with the person's technical skills. Explicit and rational knowledge,

on the other hand, consists of knowledge found in books. While explicit knowledge is stored and can be presented to others, tacit knowledge is primarily personal knowledge that can be seen in what a person does (Nonaka & Takeuchi, 1995). Argyris & Schön (1996) distinguish between how things should be done and how they are actually done. They believe that acts carried out at the sharp end are based on both expressed theory such as rules and norms, and theory in use, i.e. how the work is actually done. The former is related to explicit knowledge, while the latter is related to tacit knowledge. This means that both individual and group behaviour can be changed by improving both their explicit and their tacit knowledge (Argyris & Schön, 1992).

Nonaka & Takeuchi (1995) describe basic processes whereby tacit knowledge is converted to explicit knowledge and vice versa. Through these processes, knowledge is converted from individual knowledge to shared knowledge that can be utilised by the whole organisation. Nonaka & Takeuchi (1995) propose four basic processes whereby knowledge is converted, which have many similarities with the use of RUO systems:

- Externalisation takes place when tacit knowledge is made explicit, for example when an unwanted occurrence is observed and reported by a worker at the sharp end.
- Combination takes place when explicit knowledge is combined with other explicit knowledge, for example when a reported unwanted occurrence is compared with other reported unwanted occurrences in an effort to identify similarities.
- Internalisation takes place when explicit knowledge becomes tacit knowledge. The point is to see the importance of making practical use of knowledge through converting the explicit to practical, effective and correct actions.
- Socialisation takes place when tacit knowledge is spread as tacit knowledge to other members of the organisation, who learn over time through seeing what others do. In RUO systems, socialisation means that knowledge is transferred from reports to tacit knowledge, which in turn will have an impact on the safety performance of individuals and groups.

Knowledge-sharing is an important part of developing an organisation's know-how. A well-functioning RUO system depends on knowledge about unwanted occurrences being shared by personnel at the sharp end, and on the ability to draw conclusions from the reports that are in turn shared with decision makers and personnel at the sharp end (Reason, 1997). A review article by Riege (2005) shows that there are many different and interwoven obstacles to knowledge-sharing; see Table 1. He distinguishes between individual, organisational and technological obstacles to knowledge-sharing, influenced by different perspectives and disciplines. Several of these obstacles can be recognised in the above-mentioned underlying causes of under-reporting of safety-related information.

Table 1: Obstacles to knowledge-sharing (Riege, 2005)

Individual obstacles	Organisational obstacles	Technological obstacles
Lack of time to share knowledge and lack of time to identify other peoples' need for knowledge	Unclear or inadequate strategies and knowledge management goals	Lack of consistency between information and communication systems and the way people work

Fear that sharing can undermine job security	Inadequate management in that the benefits and value of knowledge sharing are not clearly communicated	Inadequate integration of information and communication systems in the way people work
Little faith in own knowledge being of importance to others	A lack of formal and informal arenas for sharing and generating knowledge	Communication flows are impeded by lack of technical support or system downtime
Predominance of explicit knowledge over tacit knowledge in knowledge-sharing	Lack of infrastructures to support knowledge-sharing	Unrealistic expectations among employees with respect to what information and communication technology can and cannot do
Hierarchies and formal power	Lack of incentive systems to promote knowledge-sharing	Resistance to the use of information and communication systems due to lack of knowledge and experience
Lack of mechanisms for utilising previous mistakes to improve learning outcomes	Priority is not given to preserving the knowledge of highly competent and experienced personnel	Lack of training in new technology for information and communication and their use
Lack of time and interaction between the knowledge source and recipient	Competition between organisational units	Inadequate communication and demonstration of the advantages of new systems compared with existing systems
Inadequate writing and communication skills	Given information flow directions	
Lack of social networks	Limited possibility of sharing knowledge due to working environment and workplace design	
Experience, age, gender and educational differences	Sharing practice impeded by organisational structure	
Lack of trust due to previous abuse/misuse of information	Too large or complex organisational units that impede knowledge-sharing	
Lack of faith in the accuracy and credibility of the knowledge		
Different cultural and ethnic backgrounds, including language background		

3. Method

To approach the purpose of the paper (i.e. to explain experience feedback by use of RUO-systems), the article is based on an explorative study based on qualitative research interviews. Such interviews provide in-depth understanding and insight into the informants' subjective perceptions relating to the reporting of unwanted occurrences and learning from them (Kvale, 1997; Repstad, 1998; Tjora, 2013). Research interviews are by nature are explorative and flexible to the context and will provide an understanding of how RUO-systems are applied including shortcomings and merits. Analysis of the qualitative interviews made it possible to interpret the basic processes explaining experience feedback by RUO systems and obstacles to effective experience feedback. Results of qualitative research should not be treated at generalized facts, but gives insight in the phenomena studied thus providing indications about how the world functions.

A total of thirty, semistructured in-depth interviews were conducted of members of the line organisation and executive staff in five different project organisations consisting of three infrastructure projects and two building projects. The selected group of informants consisted of the site manager, HSE manager, operations manager, supervisor, team leaders, workers and safety representatives as shown in Table 2. Team leaders, workers and safety representatives are all operating at the sharp-end. These sharp-end operators are those who experience, observe and report incidents. The other job categories are members of the project management group, which receive and analyse RUOs and make decisions based on the reports. In that way, the research design provides different perspectives on the use of the RUO system which is valuable for insight into experience feedback in the projects.

Table 2: Overview of the number of informants in job categories

	Job category	Number of informants
Members of the project management group (N=19)	Site manager (SM)	6
	HSE manager	2
	Operations manager (OM)	7
	Supervisor	4
Sharp-end operators (N=11)	Team leader	6
	Safety representative (SR)	3
	Workers	2
	TOTAL	**30**

The sampling method applied in the study is typical case sampling which is one type of purposeful sampling (i.e. participants are selected based on pre-selected criteria based on the research question) (Suri, 2011) Typical case sampling focuses on normality/typicality which is suited to the purpose of the study presented in the paper. Typical does not mean that the sample is representative in the sense of probability sampling. Rather, typical here implies that the samples provide insight into normal work activities. The construction company was thus asked for a set of projects where the use of RUO-systems could be explored. The participating projects were selected by the HSE manager for the respective regions, who contacted ongoing projects requesting their participation. The criteria for selection were that the project was in production; not small-sized; that they had a system for reporting unwanted occurrences; and that the RUO-system was intended used for decision-making. For each project that was selected by the company the researchers asked for interview with sharp-end personnel and representatives from project management (see table 2). Type of job categories among informant varied between the five projects, but for each project both sharp-end personnel and project management were interviewed.

An interview guide was prepared in advance, based on the findings of an in-house questionnaire survey during winter 2013–2014 that focused on unwanted occurrences and the RUO system. The overall topics addressed in the interview guide were: the purpose of reporting unwanted occurrences; own reporting; and learning and change of practice based on reported occurrences. All the interviews were conducted in a separate closed room at the site and lasted for about one hour. A recorder was used during all interviews. In front of each interview the rational and purpose of the study were presented to the interviewees, including that interview data was anonymized and that participation was voluntary.

In analysis of qualitative data transcription, analysis, conclusion drawing and verification are interwoven before, during and after data collection (Miles and Huberman, 1994). This iterative approach was utilized in the current study. For example, during data collection and transcription, possible ideas and questions were recorded, which later were tested on the data material. The interviews were transcribed and then converted to Hyper-Research, a software tool for analysing qualitative data. In this software the interview data was coded and later categorized. This approach aims to generate contextual codes developed by use of the data material rather than from theory, hypotheses or planned topics. The focus is on what the informant says, not on what he/she was talking about (Tjora, 2012). After the coding, codes of relevance to the research questions must be categorised and placed together, whereby the categories structure the outcome of the study (Tjora, 2012). The categorized data was analyzed by switching between the whole picture and details by (Leiulfsrud and Hvinden, 1996): (1) testing the registered ideas during data collection, transcription and coding; and (2) using detailed data material as pieces in a jigsaw puzzle. Consequently, the analysis is based on Straus and Corbin's (1998) principles of grounded theory by coding and categorizing data looking for patterns. The aim of this approach was to map and inquire into patterns of the data material; reasons for this pattern; and contrasts of the patterns. In this paper, we present and discuss the following categorized of coded data:

- "Purpose of reporting"
- "Under-reporting"
- "Blaming and scapegoats"
- "Processing of reported unwanted occurrences and feedback"
- "RUO-system as decision-making support"

Together, these categories provide patterns that explain the use of RUO in experience feedback. The purpose of the study is not to generalise, but to gain an insight into different discipline groups' experience of reporting unwanted occurrences in preventive safety work. However, the literature review on reporting of unwanted occurrences in chapter 2 provide validity to the results which strengthen the transferability of the results to other construction projects and also other industries.

If the number of informants is too great, it will be difficult to peruse and interpret each individual interview (Kvale, 1996). In the present case, 30 in-depth interviews can seem rather too much, but if we consider the number of informants from each discipline group, the number is no greater than it must be in order to answer the questions. On the question of how many informants are required, Kvale (1996) proposes that interviews should be conducted with a sufficient number of informants to

find out what one needs to know. This is supported by Corbin & Strauss (1998), who argue that data should be collected to a theoretical saturation point and to a point where the same answers recur, something that also proved to be the case in the present study. Although there was a varying number of informants in each group of job category, the members of each group were rather consistent in what they said.

4. Results

All the informants shared the understanding that the purpose of reporting unwanted occurrences was to learn from the occurrences. Several of them stressed the importance of reporting and the value of having such a system in place, but admitted that, when it came to their own reporting, they seldom or never wrote a report. This section contains a presentation of what the informants believe affects reporting and learning from unwanted occurrences.

4.1 Under-reporting

The interviews show a clear pattern whereby management and executive staff believe that unwanted occurrences are under-reported, while workers at the sharp end of operations believe there is less under-reporting. At the same time, the informants recognise that it is minor occurrences that are under-reported, since the close-knit nature and transparency of the line organisation makes it difficult to conceal major and more serious occurrences. This is confirmed by others; minor recurring occurrences such as protruding nails or the absence of toeboards are not reported, only conditions that are perceived as potentially dangerous. One supervisor says that fixing things without reporting has become a habit, particularly among those who have worked for some years. This is confirmed by a younger safety representative. He stresses that people do not just pass by, they fix things before they walk on. One site manager points out that there should be more than ten times as many reports considering the number of hours worked. A team leader pointed out that it was best to nip the problem in the bud even if it is never put down on paper, and explained the situation as follows:

> *'… after all, the point is to deal with the situation. It is no less dangerous if it is put down on paper'* (Team leader #5)

All informants acknowledge that there are a large number of unreported occurrences that could have been reported. Among other things, this is explained by the unwanted occurrence being seen as 'normal'; by seeing no purpose in reporting it; by the system being laborious; and by reporting entailing 'fuss'. One site manager points out that some discipline groups in the project did not consider dangerous conditions to be unwanted occurrences and only reported incidents once they had occurred. Likewise, they did not consider deviations to be unwanted occurrences as long as they fixed them. Despite several attempts, the management had not succeeded in changing this perception.

In the opinion of one operations manager, this had a lot to do with culture, and there were big differences between what different discipline groups considered to be unwanted occurrences. He told the following story:

> *'… When the chief safety representative was on a round to top up the supply of plasters, he found that all the plasters were gone even though he had not been informed of any injuries. I*

think people do not think of a bleeding finger as an unwanted occurrence; they just plaster it and continue as if it were a normal occurrence' (Operations Manager #2).

One site manager believed that this had to do with attitudes that were handed down and internalised and confirmed that there were differences between different discipline groups. Another site manager believed that under-reporting is not intentional; either people do not see how serious an occurrence is, or they intend to report it later or think it will be reported by someone else. One operations manager pointed out that many workers simply do not like to write. One team leader had experience of a project where there was no reporting because people thought it looked better 'on paper' – the fewer unwanted occurrences, the better the conditions.

4.2 Blaming and scapegoats

Other factors that affect reporting are the experience of blaming and finding a scapegoat. It appears that the concept of 'grassing' (i.e. blaming others) is still widespread. With one exception, all the site managers and half of the operations managers believe that the reporting of unwanted occurrences is still considered 'grassing' by the line organisation. One site manager admitted that he reported as few unwanted occurrences as possible as he was afraid that it would be considered harassment by the workers. Another site manager recounted an occurrence that was caused by poor marking and securing of a shaft. The occurrence was not reported as it was thought that the marking and securing had been unintentionally overlooked. There is an attitude that you should not report your mates:

> *'… We want to receive all the reports, but you are up against the feeling that – No, I cannot write a report that involves him because he is a mate'* (Site Manager #3).

None of the other operations managers and none of the workers at the sharp end of operations are of the opinion that reporting is considered 'grassing' by the undertaking's own employees, but several of them point out that this is sometimes the case among subcontractors' personnel. This has given rise to conflicts on several occasions, and meetings have been called to explain the purpose of the RUO system.

Another factor that appears to affect the degree of reporting is how serious reported unwanted occurrences are followed up. One team leader believes that serious occurrences are sometimes under-reported because of the way in which they are followed up by management, that they are downgraded because the consequences can be disconcerting:

> *'… The question is whether management perhaps feel that there is too great an apparatus involved in reporting serious occurrences – that they try to downgrade the severity of the occurrence … Perhaps it would be better to first do a round of the site, instead of gathering the whole head office round a table. I do not feel that we need 15 people to consider the occurrence to start with… So, it is possible that there is some under-reporting in relation to the severity of the occurrence – for the longest possible time you try to maintain that it was less serious than was actually the case … These things could be related, perhaps one should look at the burden on those who raise the matter'* (Team leader #5).

This is confirmed by others. One site manager expressed it in the following words:

> *'Because, as I was saying, there is so much fuss around an injury… We report almost as if people have died, don't we? – investigating the injury and the full hullabaloo'* (Site Manager #6).

Several people from one of the projects reported an episode where the employees felt as if they were being interviewed by the police following a serious occurrence. One operations manager points out the danger of people preferring not to report the most serious occurrences, and questions the method used in subsequent investigations:

> '… We are told not to look for scapegoats, but when four men at the opposite side of the table want to know what happened, it is hardly a walk in the park. What is intended and how it is experienced are most likely two different things.' (Operation Manager #2).

The same point is made by a supervisor. He believes that the management system itself is presented as infallible, so that the end result is always to find a scapegoat on the site. One safety representative made the following comment:

> 'No, most likely they will find a scapegoat. I think that is what the workers on site believe. But that is probably not the intention, perhaps. I think people feel that those higher up in the system disclaim their responsibility' (Safety representative #3).

4.3 Processing of reported unwanted occurrences and feedback

The registration and processing of occurrences in the RUO system is felt to be time-consuming. Responsibility for registration and processing of reports in the RUO system is most often delegated to the project's HSE manager or safety officer. In minor projects, these tasks are assigned to another position, for example to the supervisor or site manager. Even for those with inadequate training in how to use the system, the time it takes to register an occurrence is seen as more of a challenge than the actual use of the system. The task is described as demanding in terms of both time and resources. One project had hired extra personnel to key the reports into the system, while the HSE manager was responsible for processing the reports.

One site manager, who also filled the role of safety officer, admitted that little priority was given to the registration and processing of minor occurrences:

> '… In general, I completely support the system – and on this site, every report is considered at the work team and team leaders' meetings. What I neglect to do is to key all the reports into the RUO system… Finding your way through all the pull-down menus of own employees, subcontractors, hired and skilled masons and joiners etc. – I have no chance to get this done during a busy workday … If I had a person who was dedicated to the task, like they have in major projects, then I would get it done' (Site Manager #6).

The same is confirmed by a supervisor in another building project, who admitted that they fix the unwanted occurrence and neglect to report it. Most management informants state that HSE work is adversely affected by the fact that they are pressed for time. Among other things, this is reflected in inadequate feedback on reported unwanted occurrences.

One HSE manager points at that the way managers receive and respond to reported unwanted occurrences has significant consequences for the degree of reporting. One team leader explained this as follows:

> 'Reporting of unwanted occurrences is fine, provided that there is follow-up. Direct feedback is necessary if the boys are to see this as meaningful. If they don't see it as meaningful, they stop reporting. That's how it is.' (Team leader #5).

He goes on to point to the challenge of finding a forum for providing adequate feedback. He told us about a project where all reports of unwanted occurrences were played back on a large screen in the lunch room, so that they were continuously available to everyone. He stressed that if unwanted occurrences are to be reported, then feedback must also be provided that reaches everybody. This view is supported by the majority of informants who believe that feedback is decisive if the credibility of reporting is to be maintained. The situation appears to be different in real life, however. One site manager expressed it in the following words:

> 'I believe people appreciate being taken seriously. Because what you hear in many cases is that people get no feedback on the reports they submit. They are told to write all these reports, but then they never know what is being done to handle the situation or why. That is when they fail to see the point' (Site Manager #3).

The degree of feedback varies. A couple of site managers claim that they seek to provide feedback on all reports at the morning meeting on the following day, while others acknowledge that feedback is more infrequent. One safety representatives answered the question as follows:

> 'Feedback practices have been rather poor in my opinion. HSE issues are supposed to be addressed for 15 minutes, but this is not always the case. It is supposed to be on the agenda every two weeks – in other projects it has been once a week and we have reviewed all RUOs…' (Safety representative #1).

This is confirmed by one team leader in whose opinion feedback has been inadequate in the infrastructure project of which he is a part, and he knows of many RUOs that he has never been informed about. This is confirmed at the other end. One supervisor feels that there is too much nonsense being written and admits that he scraps the notes that he finds meaningless. In his opinion, the employees should start talking to each other rather than write RUOs about each other.

At the same time, a couple of site managers point out that it is expected that measures will be implemented when occurrences are reported, something that is not always easy to accomplish. One of them describes RUOs as a means of exerting pressure, whereby employees report the same thing until management complies, often concerning new tools and equipment. On the other hand, they recognise that the degree of reporting improves when employees see that reporting helps.

4.4 The RUO system as decision-making support

The interviews indicate that little use is made of the RUO system at the project sites. Two site managers mentioned that the system is an important database that can be used as a reference work, but only one admitted to using it occasionally in connection with job safety analyses (JSA). None of the operations managers who were asked knew whether the RUO system was used locally in decision-making. The site managers recognise the RUO system as something used by central management, with the information being disseminated in meetings at the district level. A monthly HSE report is produced for distribution to the projects, but this is not widely communicated. One site manager expressed it in the following words:

> 'I am sure there is much good work being done in the RUO system, but I believe there is a job to be done to reach the grassroot level. I can't offer a solution, but I can say that it is a problem' (Site Manager #3).

One example of a decision by central management that was made on the basis of the RUO system is an order to use goggles and gloves in a region, an order that was received with mixed feelings. One of the problems with this order is that gloves can represent a risk in certain situations, and it was claimed by some that no proper risk assessment had been carried out before issuing the order. The order also required the workers to change gloves for different types of operations. One site manager simply remarked that such a change of gloves would never happen. Everybody agrees that safety is important, but nobody agrees that orders are the road forward. One operations manager expressed this as follows:

> *'Sometimes such decisions from above can take you by surprise, and they are not always accompanied by an explanation of why they are issued. People might accept them more readily if they had been given an explanation of why the rule was introduced' (Operation Manager #5).*

One supervisor remarked that central management is constantly shoving things down the throats of those who work on projects. He felt that there were a few too many central managers who demanded reports about all sorts of things and then made decisions that had negative consequences for those who worked in the field. He also claimed that too many of the guidelines from central management are not suitable for small projects, where they lack the manpower and resources to follow up in the same way as large projects do. Regardless of the importance of HSE, the project needs to make money:

> *'Nobody is bold enough to say so, but at the bottom of our hearts we know that we are measured in terms of the money we bring in' (Supervisor #4).*

5. Discussion

The purpose of reporting unwanted safety occurrences is to create a basis for learning and development in an organisation with the goal of improving safety. The information that the organisation gathers through systematic reporting of unwanted occurrences is to be used by decision makers at all levels, in order to modify decisions already made and make new decisions (Kjellén, 2000). This is in accordance with the principles behind organisational learning, for example Nonaka & Takeuchi (1995), who emphasise that organisational knowledge is created when tacit knowledge is converted to explicit knowledge; see Figure 2. The interviews suggest that certain factors stand in the way of effective learning from unwanted occurrences in the project organisation in that no shared explicit knowledge is created through sharing knowledge about such occurrences. Two obstacles that impede communication and, hence, the sharing of knowledge emerged as patterns in the interview study: 1) under-reporting at the sharp end, and 2) reports are not analysed and applied to improve the safety performance.

5.1 Under-reporting and a paradox of deviation handling versus documentation of occurrences at the sharp end

One clear pattern that emerges from the interviews is an under-reporting of occurrences at the sharp end. The under-reporting prevents the creation of organisational knowledge about unwanted occurrences, which in turn prevents improvement and prevention of accidents. Knowledge of the

unwanted occurrences has no value unless it is received, accepted and used by the individuals and the organisation that need the information. The interviews indicate that there are several causes of such under-reporting:

- The unwanted occurrence is seen as a normal occurrence and is therefore not reported
- Only serious occurrences are reported, while the less serious ones are fixed and not reported
- Completing the reporting form is felt to be a laborious task by people who do not like to write
- It is assumed that somebody else will report the unwanted occurrence
- Because of lack of feedback, workers do not report new occurrences
- Occurrences are not reported for fear of being blamed
- Reporting is regarded as 'grassing'
- Fewer RUOs is seen as an indication of better project performance
- The severity of occurrences is downgraded on account of the focus and work involved in handling serious occurrences

The above list of causes is in accordance with previous safety studies on under-reporting (e.g. Reason, 1997; Kongsvik et al., 2012; Probst & Graso, 2013; Kjellén & Albrechtsen, 2017), and also bears resemblances to the obstacles to knowledge sharing listed in Table 1 (Riege, 2005).

The list above contains one causal factor to under-reporting that is not mentioned elsewhere in the literature on under-reporting. The interview study showed that many skilled workers and team leaders are flexible and choose to correct the situation right there and then rather than to document occurrences. They consider it more important to correct the fault and continue the work than to comply with formal requirements for reporting unwanted occurrences. It is paradoxical that those at the sharp end prefer to put things right and continue the work in a safer manner, at the same time as the HSE management wants all unwanted occurrences to be documented.

The paradox reflects a conflicting objective of safety management on the one hand, and efficiency and getting the work done, on the other. In general, this paradox is reflected in several parts of the systematic safety work. Workers at the sharp end want to perform the work both safely and efficiently, which naturally is in accordance with the organisation's wishes. At the same time, some people in the organisation seek written documentation of unwanted occurrences, both to be in control of the safety work and to have the papers in order should an accident occur. We can observe the same pattern in connection with the performance of job safety analyses (JSAs), where the process of talking through the job at hand is regarded as more important than documenting the results of the JSA (Solberg & Svensli, 2016). The same pattern is also found where small companies are required by large companies to have a thorough and documented safety system in place (Flatjord Nilsen et al., 2016). Those who work on production consider that the informal safety work is more important than documentation.

Employees at the sharp end are an important barrier element for preventing and stopping hazardous situations from developing. They are able to recognise and handle a wide range of hazardous situations and conditions, and are thus part of the expertise that is essential to maintain control of sources of danger. The interviews show a pattern whereby the workers identify and correct unwanted occurrences and conditions without reporting them in order to get the job done safe and

efficient. Reason (2008) designates workers who secure smooth operation of imperfect systems as heroes. Flin et al. (2008) explains their contribution to smooth operation in terms of non-technical skills, which also explain why workers might correct deviations without reporting them. These non-technical skills are cognitive and social skills that complement the workers' technical skills. Non-technical skills include situational awareness and decision-making. Decision-making consists of assessing the situation and deciding how to respond to their perception of the situation. Flin et al. (2008) distinguishes between two methods of decision-making – rule-based and intuitive. The rule-based method is to comply with procedures (in this study, for reporting unwanted occurrences), while the intuitive (recognition) method is based on a recognition of responses to similar situations (Klein, 2015). Intuitive decision-making is characterised by providing satisfactory and functional solutions, is fitting in routine operations and involves little stress. All these factors help to explain why some workers prefer to correct faults to create a smooth working situation rather than to report unwanted occurrences.

The factors that have a bearing on the choice of decision-making method are technical competence, level of experience, whether the situation is one that can be recognised and response practice in relation to problems (Flin et al., 2008). No widespread training was provided in use of the RUO system studied in this article. This could explain why the workers do not use a rule-based decision-making method whereby unwanted occurrences are to be reported. At the same time, many skilled workers want to get on with their job in a safe manner. Hale & Borys (2013) discuss the relationship between compliance with safety rules and adaptation and breach of the rules in order to get the job done. They conclude that breaching the rules is natural and necessary in many situations, in order to get the job done. Moreover, they conclude that the reality cannot be adapted to the rules, but that it is possible to adapt a rule-based method to the reality. An example of the latter is to have clear criteria for which unwanted occurrences should be reported.

The construction industry is characterized by use of contractors as well as temporary workers. A study of contractors in the Norwegian offshore petroleum industry (Kongsvik et al., 2012) shows that reporting can give rise to challenges because measuring safety performance in terms of the number of reports influence tender evaluation. Such mechanisms may strengthen the safety paradox described above, contractors fix problems to get the job done safely and efficient as desired by the client but avoid reporting the conditions. Temporary workers have less reporting reliability and reporting willingness than full-time employees (Underhill and Quinlan, 2011; Bråten et al., 2014). The mechanism of correcting unwanted conditions in order to get work done both safe and efficient without reporting the occurrence and the counter-measures taken since the problem has been taken care of is likely to be strengthened by temporary workers that already have lower reporting willingness that full-time workers.

5.2 Obstacles in the analysis of information and dissemination to decision makers

The interviews indicate that registration and processing of handwritten reports is perceived as too complicated and time-consuming, while this is seen to run smoothly in other projects. Nonetheless, several informants state that the reporting of unwanted occurrences is seen as extra work for the projects, both when it comes to the actual completion of the reports at the sharp end, electronic

registration, processing, closing and implementation and follow-up of measures. This means that organisational learning is impeded because information about unwanted occurrences is not made explicit and available to others in the organisation. The quality of registered information declines and fewer unwanted occurrences are closed, and this reduces the organisational learning.

However, the interview study indicates that organisational learning occurs nonetheless in that unwanted occurrences are discussed by the team and at morning meetings after the event, so that tacit knowledge is shared and becomes the tacit knowledge of more people. This means that one gets a learning spiral whereby tacit knowledge is communicated and becomes accessible, but only for those working locally on the project, often limited to employees at the sharp end. The failure to use of the RUO system means that the knowledge fails to reach the whole project organisation and other projects and levels of the organisation, which prevents knowledge development in the organisation as a whole.

One possible solution to the challenges involved in registration and processing is to assist the projects by establishing a central HSE function at the regional management level, an entity that can assist several projects that find it hard to assign sufficient resources for the job. Such a function could help to register and process reported unwanted occurrences in the database in a uniform manner, and ensure quality control of the assigned category of severity and free text. A dedicated resource would make it easier to recognise any pattern that the RUOs might represent and identify frequent unwanted occurrences. The quality assurance would make it easier to select what serious and potentially serious conditions/occurrences require follow-up. The interview study indicates that the severity of occurrences is incorrectly reported, while such a resource would be able to quality-assure the reporting.

To simply place this function at central management level would entail challenges, as it would be too far removed from the context in which the occurrences take place and thus lack local knowledge of the conditions. As opposed to a position in the head office, a more ambulant regime whereby the HSE resource visits and spends time on the project, would place him/her close enough to map unwanted occurrences. There is reason to believe that, with such a function, the organisation would gain a better overview of what happens locally in the projects. At the same time, it will help to improve learning in the projects, experience transfer and the quality of learning processes within and between projects.

Better processing quality will also strengthen the basis for making decisions, and follow-up of unwanted occurrences and conditions in all projects will be more consistent and uniform regardless of whether the project has dedicated local resources. At present, it appears that very few make use of RUO data. Hale (2003) points out that effective safety work requires coordination between different levels of the project organisation: execution (skilled workers), planning (executive staff) and strategy (line management). In such a model, the role of executive staff is to coordinate, monitor and evaluate safety performance and support the line and skilled workers so that the work is carried out safely. Responsibility for safe work rests with the line organisation while the executive staff is there to provide decision-making support on the basis of information about safety performance at the sharp end. This means that safety work, including use of RUOs, must be an integral part of all organisational activity (Hale, 2003). Storgård et al. (2012) point out that in order to establish a well-

functioning reporting system, an undertaking must be prepared to engage in continuous safety work, not only in relation to the reporting system, but also as regards safety management in general.

6. Conclusion

The presented qualitative study of the use of a RUO-system in construction projects identifies several obstacles to experience feedback. The obstacles are recognized in previous studies of reporting of incidents, near-misses and unwanted conditions. However, the study adds one obstacle to the current literature about underreporting. Sharp-end operators tend to correct deviations and unwanted conditions in order to get work done both safe and efficient without reporting the occurrence and the counter-measures taken since the problem has been taken care of. In that way, the potential for organisational learning is lost.

In order to break down the obstacles, clear criteria are needed for what to report, and a balance must be found concerning the type and amount of information to be reported. This means that workers at the sharp end in construction companies must be involved in the data collection, and that they are given information about registered reports. A well-functioning RUO system will benefit from a centralized support function in the company that can support all projects with quality assurance; analysis of reports; support decisions; and improve the basis for learning locally in the projects. Data collection, dissemination of information and decisions to implement measures must be incorporated as integral parts of all the project activities.

7. References

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