

## Increasing the Learning Potential from Events: Case studies

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Learning from incidents is a subject that is important to most organizations. We see the 'learning from incidents processes' as a set of processes from reporting an incident to verifying the effectiveness of the measures taken. This study aims to identify how learning can be more successful and more efficient, by identifying conditions that influence the learning processes. To structure these conditions a framework of the learning process consisting of five phases is used and as a starting point four initial categories of conditions were extracted from the literature. After four cases studies on how organizations learn from a specific incident, these initial categories were renamed and an extra category was added, resulting in five categories representing conditions to address to use more learning potential: people, communications, information quality, organizational aspects (culture) and formal conditions or resources.

### 1. Introduction

In the concurring economy and complex society, enterprises underline a safe core business without disturbances in production. An incident could result in such disturbances, but it can also damage the health of employees or the environment. Therefore prevention of incidents has special attention of managers, safety-consultants and researchers.

An important strategy in incident prevention is to learn from previous occurrences (Kletz, 2004). Kidam et al analysed for instance accidents in the chemical process industry to determine lessons learnt (2010) and many papers are written about analyses of famous accidents, such as the paper of Hauge et al on 'Deepwater Horizon' (2012) or that of Manca et al on 'Texas City' (2011). Clearly, it is assumed that if an organisation learns from what went wrong, this enables the organization to improve and to prevent future incidents from happening. Although in this paper the term incident is used, one could learn from any type of meaningful event, irrespectively of the consequence severity. An organization could learn from near misses, dangerous situations, accidents, disasters, etc. In this paper we focus on learning from both personal safety incidents as from process safety incidents.

This study is part of a larger research project 'learning from events'. We see the 'learning from incidents processes' as a set of processes from reporting an incident to verifying the effectiveness of the measures taken. Building on theories of organisational learning, an analytical framework and a survey have been developed to analyse in which phase learning potential is lost (Drupsteen, Groeneweg et al., 2013). The framework consists of thirteen steps, divided over five phases: collecting information, investigation and analysis, planning of interventions, intervening and evaluating.

Output of one phase provides the necessary input for the following phase. Application of this framework to identify weaknesses in learning from incidents showed a suboptimal performance of the phases in practice. It also showed differences between the formal organisation of the learning processes and how the process is performed in daily practice (ibid.).

In this study, we explore organizational conditions and resources which hinder or facilitate learning from incidents. More specifically, we study the factors that should be addressed to use more learning potential throughout the learning cycle, meaning not only that the five phases are completed, but also that the quality of the output for each phase is increased. In a review of the literature on learning from incidents four categories of factors that influence learning from incidents are identified: the people involved (Choularton, 2001) -their motivation, competences and knowledge-, the incident impact or severity

(Pidgeon and O'Leary, 2000), communication and sharing throughout the process (Pidgeon and O'Leary, 2000) and the organizational values; trust and openness (Hovden, 2011). These four categories of conditions provide the theoretical framework for this study.

To learn more about learning from incidents in the process industries, this study focusses on learning from single incidents that occurred within an organization. To increase our knowledge on this subject, four case studies are performed, aimed at studying the following questions:

- How do organisations learn from an incident?
- What are conditions that hinder or facilitate the use of learning potential when learning from incidents?
- What are factors that specifically influence –positively and negatively- how the phases in the learning cycle are performed?

## 2. Methodology

The main research question for this study is “how do organizations learn from incidents?” This overall research question of the study is a “how” question. The study also has the ambition to identify possible conditions that influence how organizations learn. This calls for an explorative and qualitative approach and a case study design was chosen (Yin, 2009).

### 2.1 Selection of organizations and cases

Dutch safety professionals in our network were invited to participate in this case study by email and via a conference-meeting. After the response of ten organizations, two process organizations met the inclusion criteria. Within the two organizations four cases were selected together with the safety professionals, based on the following criteria:

- The incident should be specific, but generalizable to other teams, departments or organizations.
- It should be recognizable and its impact on the organization should be significant.
- There should be a potential to learn from this incident on a team level.
- Occurrence of the incident was between 9 months and 1 week ago.
- Preferably an incident that had aspects of recurrence, that was similar to earlier situations.
- It should not be too ‘high impact’, involving too many actors or having a disastrous consequences.

The organizations and the cases are presented anonymously, since the information about the incidents and about weaknesses in how the organizations learn is sensitive.

#### Organization A

Organization A has a production site in the Netherlands with approximately 250 employees and about 50 contractors a day. The Safety, Health, Environment and Quality manager that approached us for participation joined this organization recently and was positive about the learning intention of the organization. He noted also that some recent, smaller incidents showed similarities to older incidents and therefore wanted to improve learning in this organization. This organization reports all types of incidents in one system, including dangerous situations, near misses and accidents. Approximately 180 situations are reported each month. Two specific incident cases are selected in organization A:

##### *Case 1 (Organization A): Lye leakage*

While replacing a device on top of an empty tank, a part breaks and drops on the bottom of the tank. The operator consulted a supervisor by phone and asked what to do. The supervisor suggested to recover the part by opening the bottom of the tank. The situation of this extra job has been evaluated as having comparable risks and conditions and no additional measures were needed. However when removing the equipment from the bottom of the tank, some fluid (lye) was released and contaminated his gloved hands.

##### *Case 2 (organization A): Repair on wrong pipeline*

Organization A consists of two plants, but at the whole site of this organization pipes are entangled. Repair work had to be done at a specific pipe that was exactly located at the cross section of the two plants. The work was prepared by people from plant 1, and executed by people from plant 2. However, the work was by mistake performed on the wrong pipe. Due to the complexity of the plant this could happen easily. A solution was thought out after an earlier, similar incident but this hadn't been implemented yet.

#### Organization B

Organization B has a site in the Netherlands with about 350 employees. The health and safety manager explained that due to recent incidents, the organization realized the need to learn. There was a recurrence of incidents that could potentially have large consequences. They needed to increase their safety performance. In this organization environmental, personal, process incidents are separately registered but

the organization intends to learn from all of them. Approximately 80 incidents are registered per month, or 200 if customer complaints are included.

*Case 3 (organization B): Emission after pressure relieve*

There is a pressure relieve valve (prv) that regulates the pressure in the pipeline (to an oil tank). If the pressure is too high, the valve opens and blows off. It occurs regularly that the prv opens, but this time it didn't close again and that was not noticed. This led to emission to which two contractors were exposed; they got unwell. Some people noted that this situation occurred regularly, others had never heard about it.

*Case 4 (organization B): Malfunction pressure relieve valve (prv)*

In this case the prv did not open when needed, therefore there was high pressure in the pipeline. A contractor noticed this in time, but it could have had severe consequences.

## 2.2 Data collection and analysis

In each organization two cases on "how is learned from each of the selected incidents" were studied by performing focus groups and desk research. In the two focus groups in each organization, people were questioned about "how their organization followed up on case x and case xx and what they believed main hindrances were". So, in each of the two organizations, two focus groups are performed in which both incidents were discussed. In addition: incident reports, the incident analysis and action plans were studied.

### Desk research

A list of incidents of the past year was retrieved to gain an overview of the type and number of incidents and the amount of background information for each incident. For the incidents that were selected, the report, analysis and action plan were requested and studied to determine what method was used, whether underlying causes were identified, who were involved in the phases of the learning process and whether the proposed actions were clearly related to incident causes. These documents gave background knowledge about the incident cases and the formal learning process: the procedures and methods used.

### Focus group

In each organization two focus group sessions were held with each about 10 participants. For one session the people from operations and maintenance were invited. For the other session management levels and engineering departments were invited. The invitation was sent out by the health and safety manager.

The sessions started with a presentation on learning and by setting out rules for the session: "no blame, please be honest and open, there is no right or wrong answer, we are not in search of who did what, but we aim to improve learning." In both groups, the two incidents were discussed after each other. The incident was very briefly mentioned and followed by the first question: "Do you recognize this incident?". The questions for each case were semi-structured, with as main questions: Did the organization learn from this incident? Could a similar incident happen again? Who or what solved the situation and why? What can be improved even more? How do you think learning from incidents in this organization can be improved? A topic list was used for each question to see whether human, technical and organizational aspects were all addressed and to make sure there was not only attention for either facilitating structures, individual aspects or cultural aspects. If specific factors or conditions were mentioned it was verified whether these were related to specific phases in the learning process or not. The notes from the focus group were checked by the safety representative and then coded into categories.

### Data analysis

The results of the document study and focus groups were studied using qualitative methods. A coding scheme based on the initial framework was used to systematically structure the data. The horizontal axes represented the five stages of the learning from events cycle: reporting; analyzing; planning; intervening; evaluating and a category for factors that influence the overall process. The vertical axes presented the categories of possible influential factors that were determined based on the literature study: people, incident impact, sharing and communication, trust and openness. A category "other" was included, since the researchers expected to find factors that were not identified beforehand. After coding the notes from the focus groups and the documents, new categories were added to this framework.

## 3. Results

An overall analysis of the four cases led to 18 different 'codes'. The codes are clusters of factors that influence learning from incidents according to the participants in the focus groups. Sometimes the factors were specifically related to one phase of the process, others were mentioned as an influence on learning in general. The codes and the phases to which they are explicitly related are presented in Table 1.

Table 1: categories of conditions in relation to phases of learning

		Overall	1. Collecting information	2. investigation and analysis	3. Planning of interventions	4. intervening	5. Evaluating
People	Formal Role	x					
	Motivation to learn	x					
	Competences	x	x	x	x	x	
Communication	Actual role (ownership)	x	x	x	x		
	Formal feedback	x					
	Actual feedback	x		x			
Information	Actual communication	x		x			x
	information quality	x	x	x	x	x	x
Organizational aspects	Information quantity		x		x		
	Assumptions	x	x		x	x	
Formal conditions	Expressions	x	x	x			
	Formal procedures			x			
	Resources	x		x	x	x	
	Functioning of selection		x	x	x		
	Formal system present	x	x			x	x
	Quality of formal system	x	x		x		
	Formal criteria		x	x			

In this section, the codes are clustered into categories. The categories are similar to the original categories: 'people', 'incident impact', 'organizational values' and 'communication'. However, there are also some differences. The results illustrate for instance that further in the learning process we there is more distance from the incident itself. Through the learning from incidents process, different information is used. In each phase the information forms a key aspect, but the information itself differs from an incident, to incident causes, to a plan and to actions. Therefore the category 'incident impact' is replaced by a category 'information'. The category 'organizational values' is now labeled 'organizational aspects'. And an extra category has been added to the framework that involves the formal conditions for learning. The common demeanors that result from the analysis are described here according to these five categories.

#### Formal conditions

Some factors could not be related to any of the original four categories but formed a new category. These factors are related to the more formal aspects of the learning process. The main factor is 'resources', such as time and financial support. These are necessary to perform all the phases in the learning process. But there should also be some formal learning process, that specifies criteria, procedures and steps to facilitate learning from incidents and that is supported by a structure, for instance by IT-systems. Those formal requirements need to be present, clear, accessible and understandable. Especially for selection of incidents to study in detail or for actions to perform participants would wish to have some formal criteria.

#### People (Agents)

People are involved in any of the phases of the learning from incidents process. They are the ones that experience the incident, but also when analyzing, planning or performing actions this is strongly dependent on the people involved in that phase. It is conditional that those people are motivated to learn, and each phase also requires specific knowledge and competences. The expertise that is present should be valued and used, for instance when planning improvements and implementing them. Operators for instance often know the installations best. The importance of competence, including both experience related to the work, as well as expertise on performing the phases – such as risk estimation, incident selection and incident analysis- is mentioned for all phases, except for the evaluation phase.

In the focus group there was a clear distinction between the formal role or responsibility and the actual role, who performs it in daily practice. Both roles and the discrepancies between them lead to unclearness. It is not clear who is responsible for learning in general, but in daily practice the management is expected to take the lead for the specific phases: to make decisions what to investigate or not, which actions are selected and who should be involved. However, in reporting incidents anyone has a role.

### **Communication**

The aspects related to communication are mostly aimed at feedback. There is no structural feedback about the follow-up on reports in both of the organizations. In one case feedback was given bilateral by a supervisor, but then only the person who reported the incident knew about the follow-up, whereas others never heard from it again. Most incidents are not shared and therefore not known if it happened in another shift or other department. In one specific case this was noted: lessons were only locally used since they were not shared.

In one of the organizations it was specifically noted that all information was spread in the organization by email, whereas the operators did not all have access to a computer and neither did they have time to read the emails. In all four cases more meetings, or better use of existing meetings to share only important information and also to clarify tasks and set priorities, could improve learning.

### **Information**

Whereas communication is the process in which information is shared or transferred, this category is about the information itself: its availability and its quality. It is said in the focus group that "we keep starting all over again", implicating that overall information is not used to learn from. Learning from incidents starts with the incident as input information to learn from. The number of incidents that are reported and the quality of the reports are very important, because they form the input to learn from. The quantity of information is an aspect that was also mentioned for the planning phase. For the reports a higher number is considered a good thing, but for the third phase - planning- a selection is necessary, and the number of actions planned is considered soon too high.

The quality of information is the only condition that is mentioned for each of the phases. In the first phase, this is the quality of the reports: they are too brief, too many abbreviations are used, context is not described and, the report titles are not sufficient to determine relevance and to choose further actions. Incident investigation is not structurally done and therefore the quality of the second phase is considered too low. In the third phase-an action plan- solutions are thought out, without bearing in mind the possible consequences of changes and when actions are performed, quick fixes are chosen and "the temporary solution often turns out to be the final solution". The quality of the evaluation is also considered too low, since there is no check whether actions are performed or not, in any of the cases.

### **Organizational aspects**

The organizational aspects that were mentioned in the focus groups are hard to cluster. They are very specific and are therefore all listed in this section. Some factors are related to assumptions, such as: "incidents and lessons learned are already known", "equipment always will fail" and "an incident is just one type of many unwanted events". Other factors are better described as expressions on how things are done or the mental models used by the organization such as: "Separation of health, safety and environment and their incidents over departments", "A singular perspective (in this case engineering perspective) on how things work", "Commercial pressure is leading in choices for actions to perform", "A "We have a fix-it' culture". A final factor that was mentioned was the internal drive to learn, of both the organization and its members. This is an important condition for learning. Most of the aspects are expressions of the organizational culture. In the original category "organization" from the literature the values openness and trust were key aspects. The lists of factors in this category based on the case studies seem to be expressions of those two values.

### **Differences between the organizations**

Clearly, the organizational aspects form the most important differences between organization A and organization B. Organization B was more technical oriented, focused at the formal process and at managing this process and although there was an internal drive to learn, this organization recognized that now they were very much focused on fixing things and other short term solutions. Organization A used any type of event to learn from and was very much focused at determining underlying causes at a technical and human level. Since there was much attention to incident investigation and analysis at a management level, the assumption was made by this management that people within the organization knew about this.

## **4. Conclusion**

The main goal of this project was to identify aspects that should be addressed to increase the use of learning potential. Five categories of aspects are identified that cover technical, human and organizational aspects: the formal conditions, the people or agents that are learning, communication, the learning information itself and some aspects that characterize the organizations. The aspects in this last category seem to be expressions of the organizational safety culture although cultural aspects such as leadership style, openness and trust were not explicitly mentioned in these cases.

The identified categories are quite similar to the original framework as presented in the introduction, that consists of the four categories: 'people', 'incident impact', 'organizational values' and 'sharing and communication'. The fifth category that is added in this paper was possibly not mentioned in the literature, because it is considered more as a precondition, without which learning might not occur at all.

To improve the use of learning potential all five categories are relevant, but they are strongly intertwined. The formal conditions and resources are for instance created by the organization. If learning is very important to the organization, probably more resources are available. And if an incident has strong impact on the organization, the availability of resources will be increased, therefore facilitating learning. Communication is a category of aspects that relates to all other categories. The people in the organization are the ones to communicate and they are facilitated by the formal conditions. Information is the subject which is communicated about.

If limited use of learning potential means that not all phases are completed, a first step in improving learning would be to address some basic conditions, such as the facilitating systems and time, but also knowledge and competence. In the case studies the final phases were not well performed, and the results also show that less aspects were specifically mentioned in relation to the last phase (evaluation).

On the other hand use of learning potential can be increased by improving the quality of each phase. The information quality is the only factor that is mentioned for each of the phases. Information is the aspect that connects the phases, but it is also the crucial aspect in communication and in making sure learning is not only local, but spread. To increase the use of learning potential then means that criteria for quality need to be specified and methods should be available. To meet the criteria, knowledge and competences need to be enhanced. However the use of information is more difficult to address: what information is crucial in which step? To whom is it spread and should it be spread? And how can information best be transferred? These are questions that are to be answered.

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