

ANALYSING LESSONS FROM EXPERIENCE¹ AS PART OF A PROJECT TO PREPARE/TRAIN TEAMS TO MANAGE POTENTIALLY STRESSFUL CRISIS SITUATIONS

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ABSTRACT

Following the presentation of the methodology for making use of Operating Experience (OE) data, implemented as part of a study on preparing teams to manage potentially stressful crisis situations, this paper discusses and enhances the "Implementing a Learning Organisation (ILO) " model, the aim of which is to organise operating experience for learning purposes. By way of introduction, we first present this model, which is divided into four fields of investigation for organising an OE mechanism to support learning, to pose the question we aim to answer in this paper: how does the field relating to the use of OE in the ILO model help us to turn the experience acquired to good account? With this in mind, we then present the different stages of the methodology for making use of OE. The first stage involves defining the area under examination in line with current best practices. This definition is then used in the second stage, as a basis for developing a framework to guide the analysis of OE. Finally, the third stage of the methodology involves selecting the OE data to be analysed. The findings obtained in the chosen case are then presented and several points are discussed based on this experience. These relate to the following: the acquisition of knowledge on current working situations enabled by OE; the stored data analysis method; and the conditions facilitating the use of OE.

Key Words: Operating Experience (OE), lessons learned

1 INTRODUCTION

Our work on Operating Experience (OE) in the nuclear industry has led us to develop a model for organising OE for learning purposes. This is known as the "ILO" (Implementing a Learning Organisation) model and consists of four fields that need to be investigated to make best use of the experience acquired [1].

These fields, which are presented in the form of questions that need to be answered to organise an OE mechanism for learning purposes, relate to the following:

¹ Operating experience (OE) is a management tool used within potentially hazardous industrial sectors. Throughout this paper, the term OE also refers to stored data and to analyses performed as part of the company's organised operating experience mechanisms. Making use of OE involves analysing stored data, or examining analyses already produced, to learn pertinent lessons from the information.

- 1/ the gathering and storage of OE data. This involves examining the data storage needs and the associated storage methods: *what needs to be stored? In what forms and under which categories? In response to which needs? With which supporting information systems?*

- 2/ the use of the stored data and analyses. Here, the question relates to defining the possible types of OE data usage, over fragmented spaces and time frames: *how should the OE data be used? What should it be used for (preparing operation files, training, management, design, studies and research)? In what forms?*

- 3/ the methods feeding into the activities relating to the OE: *how should the data be gathered? How should malfunctions be individually analysed? How should overall diagnostics be developed? In which organisational frameworks should these methods be implemented?*

- 4/ the organisation of the mechanism and the associated managerial practices. This field is a fundamental link in an OE system, in that it suggests a principled dynamic, incorporating all of the activities and players concerned by the OE mechanism: *how should the OE process be organised? With what kind of managerial coordination? How does the OE fit into each person's activities and the decision-making processes?*

In this paper, we are interested in the second field in the proposed model – the use of the stored data and analyses – an area which, thus far, has not been examined in any great depth. Indeed, work on operating experience has tended more towards OE mechanisms in general and the first-level data collection and event analysis phases, given the industrial context of the last decade. As a result of this, little work has been carried out on the practices relating to the use of stored data and analyses, in second levels, across fragmented spaces and time frames. The aim of our paper is, therefore, to provide food for thought on this theme.

More specifically, **based on the presentation of the methodology for making use of OE data implemented in a particular scenario, this paper discusses and enhances the ILO model for organising OE for learning purposes.**

The scenario in question involves the analysis of operating experience within a risk-carrying industrial sector, conducted as part of a human factor study on preparing teams to manage potentially stressful crisis situations, beginning with past incident situations.

Our reflections are based on the context of studies on organisational learning [2]. This involves analysing the conditions under which an OE mechanism supports a learning dynamic, which can then feed the experience back into the action. More specifically, this paper poses the following question: **how does the field relating to the use of OE in the ILO model help us to turn the experience acquired in a particular domain to good account?**

The following section describes the methodology implemented to make use of OE with a view to acquiring knowledge on the current management of crisis situations within the company's own socio-technical system.

2 METHODOLOGY FOR MAKING USE OF OPERATING EXPERIENCE

The methodology for making use of OE implemented in the given scenario is structured around several steps, which are presented in this section.

2.1 Defining the crisis and stress situation

The first step was to provide a definition of a potentially stressful crisis situation, from an individual and/or a team point of view, based on literature. A crisis is defined by destabilisation, emergency and uncertainty [3], [4], [5].

The teams tasked with managing a crisis are faced with a potentially stressful dual contradiction:

- Being able to provide unprecedented, quick and relevant responses to a complex, dynamic and sometimes unexpected situation, when certain aspects of this situation go beyond the understanding of the players concerned;
- Being able to provide relevant responses to a crisis situation when the stress itself is likely to have a negative effect on performance.

2.2 Developing a framework for crisis management-oriented operating experience

The second step involved constructing a special crisis management-oriented framework, adapted to the company's socio-technical system. This tool then served as a guide for identifying lessons learned from the OE that would be appropriate to our study on preparing teams to manage crisis situations and handle stress factors, even though the data that we used was not initially stored specifically for the purposes of crisis management.

Figure 1 illustrates our framework and shows the interactions between the components of a crisis situation.

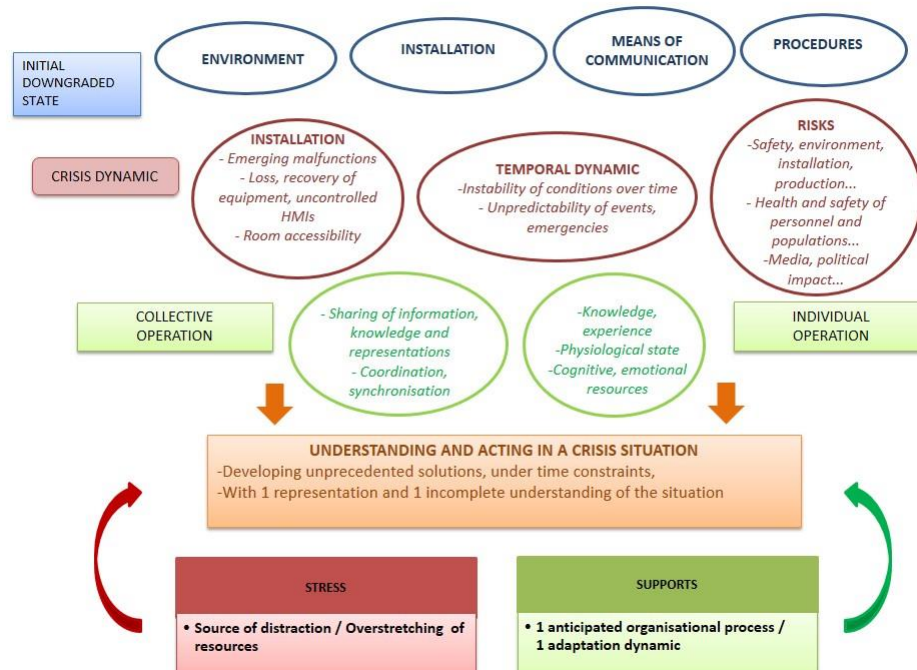


Figure 1. Representation of a crisis situation in the nuclear context

In our study, the crisis situation is understood in its entirety and consists of:

- An initial state: the state of the environment (weather conditions, etc.), the installation, the communication and the procedures;
- A dynamic in relation to i) the installation, with emerging failures, the loss and recovery of different items of equipment, etc.; ii) the time, involving emergencies and uncertainties; iii) the changing risks in terms of industrial safety, the safety of personnel and local residents, etc.
- A human context linked to the ways in which individuals and groups of people operate.

These three dimensions interact with one another and may help or hinder the teams in their understanding of the situation, depending on the numerous goals and various constraints, with fragmented information, an incomplete picture of the situation, and the varying level of technical and emotional support available from colleagues, etc. It is in this context that unprecedented solutions are developed, sometimes irreversible decisions taken, and actions prioritised.

Finally, as shown in Figure 1, crisis management benefits from the support tools that the organisation makes available (such as personal and collective resources, equipment, documents and communication channels) but, at the same time, it may also be hindered by stress, which weakens the teams' ability to understand the situation and take action.

The themes presented in this framework were used to guide our analysis of the OE by addressing the cognitive, organisational and equipment-related aspects. Furthermore, based on the analysed data, and by focusing on the roles of the players (command posts, assessment, control operators), we sought to identify events or indices relating to the management of a crisis situation with regard to:

- The actual requirements associated with the activities for performing their tasks;
- The success or support factors assisting the players, i.e. the individual, collective, organisational, equipment-related or other elements facilitating crisis management;
- The difficulties encountered, i.e. the elements appearing to be lacking and the stress factors.

In our work on the use of operating experience, we turned our focus towards the temporal dynamic of the defined situations and sought to identify key moments of difficulty or stress or, conversely, moments conducive to the implementation of tasks.

The next stage involved selecting the OE data to include in the analysis.

2.3 Selecting the operating experience data to use

The selection of the OE data was divided into several phases and was discussed with our research project controllers.

Firstly, event analyses in the form of written reports, produced as part of declarations for the competent inspection authorities, appeared to provide interesting material for us to explore. These reports specifically included time sequences of events, which could be used in conjunction with our crisis management-oriented framework.

Once this scope was defined, in the second phase we targeted events with the highest severity level² (from level 0 to level 2 on the INES Scale) from the declarations to the inspection authority, cross-referencing them with the nature of the event and only examining the situations that had taken place when the installation was in operation. These criteria led us to select events relating to (1) exceptional weather conditions affecting the socio-technical system under examination, (2) fires and (3) technical problems, all of these cases having resulted in a crisis management situation.

A total of ten cases were selected, based on the principle that their use would provide knowledge illustrating the true characteristics of crisis and stress situation management, specific to the particular tasks of the players involved in these types of situations.

To help us select the OE data to use, we also consulted two additional databases that were available to us. The first was the company senior management's OE exchange database, containing the archived event reports that had been declared to the inspection authority. The second was a database containing information relating to crisis organisation (reports on situations leading to crisis management procedures

² Corresponding to level 1 and 2 on the International Nuclear Event Scale, consisting of 8 levels (from 0 to 7), for measuring the severity of a nuclear incident or accident (<http://www-ns.iaea.org/tech-areas/emergency/ines.asp>)

or data linked to emergency drills). In the context of our study, the fact that the cases we examined had been declared to the inspection authority and had initiated a crisis organisation process, enabled us to gather additional data from each of the databases. The event reports distributed outside the company gave us a better understanding of the technical management of each event, whereas the reports accessed internally, relating to the implementation of crisis organisation processes, shed further light on the strengths and drawbacks associated with the deployment of these forms of management.

The following section outlines our findings on OE use, obtained based on the methodology presented earlier.

3 FINDINGS

Our analyses yielded three main types of findings: firstly, the identification of specific requirements according to each person's tasks; secondly, the success factors; and thirdly, the potentially stress-inducing problems.

3.1 Requirements specific to crisis management

One aspect that our analysis of OE revealed is that in a crisis situation, the teams are required to develop and implement strategies to best manage the situation based on the resources they have available. In this context, we observed deviations from the required procedures, adaptations to existing organisational methods, and controlled initiatives. The implementation of these requirements particularly concerns the Process Decision and Action Command Post operators, such as in cases where an operating procedure needs to be adapted.

3.2 Success factors and support tools assisting the players

Our use of OE also revealed that the operating procedures for the process and on-call teams, the standardisation of communication messages and technical meetings, and the crisis organisation process itself (recruiting the teams and assigning a role to each team member) all serve as support tools to aid coordination between the individuals and entities concerned and to increase the effectiveness of crisis management.

3.3 Potentially stress-inducing problems

Our analysis of OE showed that in a crisis situation, the management of equipment and logistics is likely to cause potentially stress-inducing disruptive problems. Furthermore, while taking the necessary action in situ, personnel may be surprised by the operating state of a particular piece of equipment or may have difficulty finding help on how to use it. Items of equipment are sometimes hard to locate and access to certain geographical areas may prove difficult, depending on the damage to the installation (due to the absence of lighting, obstructed access, etc.). Moreover, in terms of logistics, organising meal rations and making arrangements for personnel to take rest can lead to potentially stress-inducing problems. These situations more specifically concern the field operators and the logistics and crisis resources command post.

Finally, our analysis of OE also revealed key, potentially stress-inducing moments in terms of the temporal dynamic. One such moment is when the binding decision is taken to initiate an Internal Emergency Plan, and the period immediately after the crisis organisation process has been set up; this is when the command posts need to take over the situation, in order to make decisions and take action as quickly as possible, and to the best of their ability, given that the information they have will be fragmented and unconfirmed. Other key, potentially stress-inducing moments occur during team changeovers and when emergency response team members need to be assigned and relieved.

Additional analyses, particularly interviews, and the observation of emergency drills, enabled us to enrich these findings. It should be noted here that the knowledge acquired during our analysis of the OE (overall knowledge of characteristic company events, acquisition of a small number of technical details facilitating discussions in a world of technicians, and knowledge of event time lines) assisted our dialogue with the players interviewed. Knowledge of the current situation, acquired through the OE, thus emerged as a support tool for the interviews and a way for the human factor experts to take over the area under examination. It also helped to enhance the interview grid.

4 DISCUSSION

Operating experience only shows its true worth when it is reused, which is why we identified the area of data usage as an important field in the organisation of OE mechanisms during the initial development phase of the ILO model [1]. In particular, we highlighted the benefit of organising the field of OE data usage as a reconstruction process for stored data. Furthermore, in order to ensure that OE is used efficiently, we encouraged the organisers of OE mechanisms to be mindful of the diverse range of possible uses for stored data, across varied time frames and fragmented spaces. We also recommended considering collective work associated with the data analysis performed, according to specific, short-term goals.

Through the case presented, what lessons have we now learned about the use of operating experience, which might help us enhance the ILO model for organising OE for learning purposes?

The areas that we propose for discussion are as follows: the use of OE as a means to understand current situations; method-related components; and conditions facilitating the use of OE.

4.1 The use of operating experience as a means to understand current situations

The human factor approach requires access to knowledge of current working situations to explain the activity of individuals and teams in specific contexts. We believe that OE contributes to knowledge of current situations, by supplementing observations of real or simulated working situations and interviews with the players concerned. The case study presented in this paper confirms this point of view. The use of OE has, for example, enabled us to identify the players whose activities are a potential source of stress, even though they may not be recognised as such initially. These particularly relate to the logistics and crisis resources command post. The study has also enabled us to gather knowledge on the construction of representations, the development of innovative strategies and solutions, and the prioritisation of actions in accordance with specific contexts. Additionally, it has allowed us to consider the organisational aspects of crisis management, such as coordination and communication between individuals and between entities.

Gaining access to relevant knowledge on real situations is often achieved by conducting analyses and cross-referencing them with data from various sources. As far as OE data is concerned, we have seen how event reports distributed outside the company and reports on the implementation of crisis organisation processes have contained complementary information for one and the same situation. We have also seen how this data needs to be cross-referenced against observational and interview data.

4.2 Method-related components: reconstructing stored data to access knowledge of current situations

During the development of the ILO model, we considered [1] how making good use of operating experience involves reconstructing data according to a specific, short-term goal. The use of OE is, therefore, quite different from the use (or "consumption") of raw, standard, decontextualised information, it being an analytical task that requires skills and time. The method developed for the case study presented in this paper illustrates and enhances the proposed OE organisational model. Implementing the three stages for making use of OE – (1) defining the area under examination in line with current best practices,

(2) developing a framework for analysing the OE, and (3) selecting the data to analyse – gives meaning to OE data that was not initially stored for the purpose of addressing a particular area. As our model shows, this case study also confirms the benefit of drawing from different sources of OE to enrich our knowledge of a real situation. Indeed, consulting different databases allows us to access complementary information.

Establishing the fact that the use of OE involves giving a particular meaning to stored data, based on a specific, short-term goal, places this OE practice in a perpetual dynamic, which involves questioning past experiences based on an open learning loop.

This suggestion goes hand in hand with the definition of the "organic" model [6], which highlights the dynamic aspect of the compilation and use of OE, with the permanent option to turn past experience to good account. Throughout this continuous learning activity, the same stored OE data is available to be re-analysed as many times as necessary, based on varying goals.

4.3 Conditions facilitating the use of operating experience

4.3.1 Available data on the working contexts and the time sequence of events

In addition to the usage method, the analysis of OE is facilitated when data is available on the working contexts [7] and on the time sequence of events, placing the facts in chronological order. Having this data available enables us to understand the stored information, which is all the more important when the people using the OE have no prior knowledge of the events being analysed or the players involved. It is often the case that the people collecting the OE data and the people using it belong to different entities and are working with the information at completely different times.

The case study presented in this paper confirms the suggestion formalised in the ILO model, inviting the organisers of OE mechanisms to encourage an approach to data storage that helps people understand malfunctions after the fact, by saving contextual information and establishing a time sequence of events.

4.3.2 Organising the common coordination of operating experience

Studies carried out on operating experience in relation to organisational learning, place the manager in a central role as the player who brings the experiences of the professionals on his/her team together and links all of the available OE to organisational management. This begs the question of how we might make lessons learned from past experience sufficiently effective, so that they can not only be applied to current situations but may also be extended to future scenarios. Within this learning mechanism, the manager's role as relay and translator appears to be key to making best use of acquired experience.

The ILO model is consistent with the studies carried out in relation to organisational learning, as it places great importance on the organisation and management of the OE mechanism.

However, the scope covered by these studies favours operational team management situations, i.e. those directly affecting the production tool. In these conditions, the learning loop only concerns one entity or one department.

The case study presented in this paper is applicable to situations involving several entities (operational entities, the corporate level, the training entity, R&D, etc.). In this context, the case under examination allowed us to investigate the organisational and managerial conditions favourable to the use of OE when several entities are involved over a medium-term temporal dynamic. On the one hand, we believe that the use of data by entities other than those responsible for storing it is a complex process, requiring joined-up structures that share certain common references, starting with access to information bases. On the other hand, the case study presented helps us realise that the use of OE is a collective and common task between entities. The ability to rely on a network of players across the various entities facilitates the use of OE. On a final note, it is also beneficial to recycle the actual activities linked to OE and to ensure that the practice of learning lessons from OE is recognised within companies.

5 CONCLUSION

Following the presentation of the methodology for analysing OE data, implemented as part of a human factor study on preparing teams to manage potentially stressful crisis situations, the purpose of this paper was to discuss and enhance the "ILO" model for organising operating experience for learning purposes, supported by work on organisational learning.

To this end, we presented the methodology implemented to make use of OE with a view to acquiring knowledge on the current management of crisis situations within the company's own socio-technical system. We then outlined our findings on the use of operating experience.

From the study presented in this paper, we proposed the following areas for discussion: the use of OE as a means to understand current situations; method-related components; and conditions facilitating the use of OE.

As well as the lessons learned in relation to the ILO model, this case study provides food for thought, which might be considered in the broader perspective of implementing an OE mechanism for learning purposes relating to crisis management activities in companies.

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