

# Facilitators and hindrances to individual and organisational learning within the nuclear sector

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## Abstract

Learning for both individuals and organisations, operating within the nuclear sector, is fundamental during the current climate of change. The organisations operating within the current environment must make certain they participate in the process of learning in order to ensure safety and efficiency is maintained. The current paper will consider the facilitators and barriers to organisational learning and discuss improvement strategies for removing barriers to organisational learning. Finally, comparisons will be drawn between the UK data and the data generated from other participating European countries.

**Keywords:** Organisational learning, barriers, high reliability organisations.

**Suggested track:** G. Practice-based perspectives on knowledge and learning.

## Introduction

The nuclear industry in Europe has been faced with continuous change over the past decade; recently, these changes have accelerated within the UK. The establishment of the Nuclear Decommissioning Authority (NDA), to oversee legacy waste has created huge change for the nuclear power sector as current operators of nuclear installations will be required to tender for clean up work and will thus need to organize accordingly. All of the UK Magnox plants have now been issued with a date for closure, indicating the beginning of the decommissioning process. Plant closure has a potentially huge impact on personnel motivation and is thus an important challenge for senior management to overcome; key personnel may leave the sector and thus skills and knowledge will be lost. As a result of such challenges, learning at both an individual and organisational level is of fundamental importance to the nuclear sector (Jones and Cox, 2001).

One of the greatest challenges to an organisation operating in a changing environment is its ability to develop into a learning organisation (IAEA, 2002a). If an organisation

stops searching for improvements and new methods of working, via benchmarking and seeking out best practices, there is a danger that it will slip backwards (IAEA, 2002b). Thus, in order to maintain safety and efficiency during change, organisations and the individuals employed by such organisations, must continually diagnose and self-manage; such organisations are more likely to be resilient and successful in today's dynamic, fast moving environmental conditions. A learning organisation is able to tap into the ideas and concerns of those at all levels of the organisation. Enhancements in safety can then be sustained by ensuring that the benefits obtained from improvements are widely recognised by individuals and teams.

Learning, both individual and organisational, has thus been recognised as a key objective for safe and effective organisations (Cox and Cox, 1996). Effective learning is a fundamental characteristic of a positive safety culture (Cox and Flin, 1998). There are few contemporary treatments of safety culture that do not attach considerable importance to the goal of learning from incidents, accidents and other relevant experience (Pidgeon, 1998). Therefore, an important component in sustaining a state of intelligent and respectful wariness within high reliability organisations is a safety information system that collects, analyses and disseminates the knowledge gained from accidents and near misses (Reason, 1998). Questioning whether organisations do indeed learn the lessons of disasters, Pidgeon focuses on 'intelligence failures' (1997: p176) that typically characterise disaster incubation. For Pidgeon, barriers to organisational learning are a key issue that can sustain corporate myopia and corrupt the effective management of safety culture.

Organisational learning is also called for in situations in which there is much uncertainty (Senge, 1990). Thus there is a need for trust to enable experimentation, reflection and action (Edmondson and Moingeon, 1999). Edmondson and Moingeon believe that when significant change is announced in an organisation, the announcement creates uncertainty that can lead people to reject or block change. They suggest that in order for significant change to be implemented the degree of perceived uncertainty must be offset by an increase in trust. Furthermore, trust in a person's intentions and trust in a person's competence can have a positive impact on organisational learning and the acceptance of change (Cox et al, In Press).

Organisations operating within the nuclear sector, are required to 'manage safety as a major component of operations, and must learn from precursors and near misses rather than exclusively by trial and error' (Carroll, 1998). Carroll et al (2004) illustrate, using a four-stage model, the skills and mechanisms that enable organisations to move from a low level learning capacity to a high level learning capacity. The stage model illustrates the different ways in which organisations can learn from experience. During the first stage, the local stage, knowledge is based primarily on the experience and skill of individuals. According to Carroll et al, organisation-specific and task-specific knowledge is local, contextual, tacit and sticky or hard to transfer. The organisation is reliant on technical expertise to cope with surprises and provide flexibility or resilience (Wildavsky, 1988). Learning is decentralized in individuals and workgroups and primarily single-loop (Argyris and Schon, 1996). The second stage illustrated in the four-stage model is the control stage. During this stage the organisation institutes controls to encourage uniformity. Learning is understood as a set of routines and is directed at further control through exploitation of the known rather than exploration of the unknown. The third stage, the open stage, is characterised by a climate of psychological safety encouraging organisation members to ask questions, explore, listen and learn. However, in turbulent and unpredictable environments such organisations do not learn or change fast enough. Finally, Carroll et al identified the deep learning stage. During this stage, organisations build upon the open stage by adding more capacity for double-loop learning that promotes understanding of deep, systemic causes and creates a wider range of action possibilities to address such causes. Individuals transcend component-level understanding and additive models of performance to develop systems thinking skills and more comprehensive mental models (Carroll et al, 2004).

Weick (2001) believes that organisations in which reliability is a more pressing issue than efficiency often have unique problems in learning and understanding, which if unresolved can affect performance adversely. One such unique problem is that a major learning strategy, trial and error, is not available to them because errors cannot be contained. Due to this limitation high reliability organisations potentially know little about the very events that can be most damaging to them. As a result of the limited use of trial and error many high reliability organisations use unconventional means to achieve error free performance.

Failure within a nuclear facility could have potentially disastrous implications and must therefore be avoided. Furthermore, even minor events at nuclear reactor sites are immediately disseminated worldwide. However, Sitkin (1992) proposed that learning from our own and others failures is an essential prerequisite for effective organisational learning. The presence of failure leads to an increased resilience when employees are confronted with novel situations; furthermore, Weick (1985) suggests that people can cope with surprise better when they have repeated exposure to it. Sitkin believes that an organisation will learn more effectively from experiencing failure rather than success. Even within high reliability organisations where the specter of catastrophe makes failure difficult to routinise, it is essential that large-scale problems be reduced to more manageable levels to permit experimentation (Leary, 1988).

The importance of learning both at an organisational and individual level can not be understated (Cox et al, 2004). Understanding the facilitators and barriers to achieving organisational learning and implementing change allows organisations to participate in continuous improvements. The importance of the learning process in maintaining safety and efficiency within high reliability organisations has led to the development of the 'LearnSafe' project (<http://www.vtt.fi/virtual/learnsafe/>).

This paper will consider how the European research grant 'LearnSafe' (funded by the Nuclear Fission Safety part of the 5<sup>th</sup> Framework Programme of the European Union) has attempted to address the key issue of individual and organisational learning within the nuclear sector. Partners in the project include representatives from both academia and industry within five European countries. One of the project's main focuses was placed upon the identification of facilitators and barriers to learning within the nuclear industry during the current climate of immense change. The aims and objectives of this paper will be to present the UK findings of the LearnSafe project. The paper will identify and discuss the facilitators and barriers to organisational learning and the ways in which barriers to organisational learning can be removed. Finally, comparisons will be drawn between the UK data and the data generated from other participating European countries (Finland, Germany, Sweden and Spain).

## **Methods**

Senior and functional managers from representative UK nuclear power plants (NPP) and key stakeholders from the organisations safety management group participated in the

study. Several methods were selected to gather data in response to the research questions:

Q1: What kind of features and attributes characterise learning organisations?

Q2: What are the most common barriers to organisational learning?

Q3: How can barriers to organisational learning be removed?

Data were collected using various methods including semi-structured interviews, metaplan sessions and group discussion sessions. The methods utilised by researchers to generate data are discussed below.

### **Semi-structured group interviews**

Semi-structured group interviews were conducted with NPP managers from across the UK. During the course of the interviews participants were asked to identify and discuss the features and attributes that characterise learning organisations. The researchers transcribed the interviews. Across Europe 36 participants took part in the semi-structured group interviews from 8 nuclear power plants.

### **Metaplan sessions**

Senior and functional managers at participating NPPs were asked to participate in metaplan sessions designed to provide an opportunity to discuss the barriers to organisational learning. Metaplan sessions create an opportunity for mapping responses to the research question. Metaplan is an active data collection technique during which the researcher acts as a moderator to the process and guides the group through the discussion.

The metaplan sessions would typically begin with individuals generating barriers to organisational learning. Participants would be asked to record their answers clearly on the cards provided. The cards are then collected, read aloud and stuck to the board in random order. The group is then asked to sort each of the barriers by content, to create clusters of cards with the same or similar meaning. Participants are encouraged to interact with each other and the board. Any objections or questions are recorded on small rectangular cards and stuck next to the original contribution. Once participants had finished sorting the cards the moderator would proceed by asking participants to find a

title for each of the clusters that encompasses all contributions within the particular cluster.

During the session the researcher ensures that all participants were given the opportunity to share their opinions and notes of the discussions between the members of the group are taken. Typically, further discussions between participants, of the barriers to organisational learning, followed the metaplan session.

Metaplan sessions were conducted across Europe at 10 reactor sites; each session involved approximately 10 NPP managers. Researchers transcribed the discussions between the members of the group.

### **Group discussion sessions**

Senior and functional managers at participating NPPs were also asked to participate in group discussion sessions. Such sessions enabled participants to identify and discuss the ways in which barriers to organisational learning can be removed. The researchers transcribed the discussion sessions. Across Europe 10 group discussion sessions were held at 10 reactor site locations; approximately 10 NPP managers participated in each of the sessions.

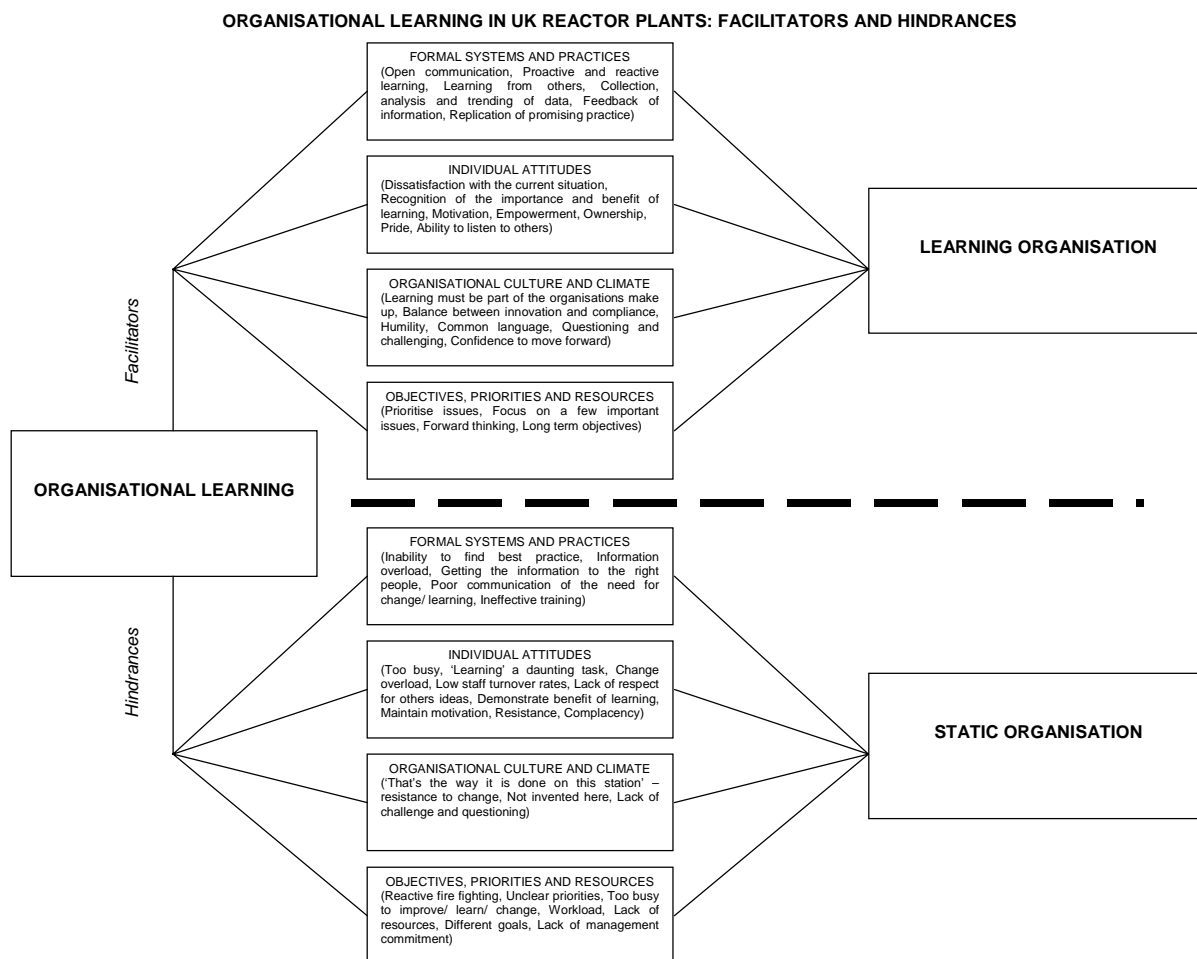
### **Data analysis**

Researchers analysed data generated via semi-structured group interviews, metaplan sessions and group discussion sessions using qualitative methods. Content analysis was selected by researchers to analyse the data. Content analysis is a process by which communication content is transformed, through the objective and systematic application of categorization rules, into data that can be summarized and compared. Using content analysis hypotheses can be tested by comparing the messages produced by 2 or more different sources. The benefit of content analysis is that it enables researchers to generate frequencies from qualitative data, whilst still maintaining the richness of the data. The method involves the generation of key words and phrases from the interview, metaplan and discussion session transcripts being listed, counted and categorized.

Researchers utilised computer assisted qualitative data analysis software to carry out the content analyses of the data. NVivo 2.0 was selected for use by the researchers as it encourages an exploratory approach to data analysis. Once the analyses were complete the coded data was retrieved and reported.

## Results

Following the qualitative analysis, data collected from the interviews, metaplan and discussion sessions were grouped into four categories: objectives, priorities and resources, formal systems and practices, individual attitudes and organisational culture and climate (see Figure 1). Figure 1 thus reflects the outcome of the content analysis. Researchers differentiated between data that denote learning facilitators and data describing key hindrances to organisational learning.



**Fig 1:** Organisational learning at UK reactor plants.

Senior managers at participating reactor sites in the UK reported that the use of formal systems, which encourage open and free flowing information to be shared among individuals, facilitated effective learning within the organisation. Participants recognised that formal systems and practices enabled organisations to learn proactively. In

particular, the use of behavioural safety (Cox et al, 2004) and operating experience feedback were recognised as important tools for supporting learning at UK reactors sites; such tools allow for the collection, analysis and trending of data as well as supporting the identification and replication of promising practices. However, one of the major hindrances recognised by individuals was the need to avoid information overload and ensure that the correct information actually filters through to the right people.

Individual attitudes were also recognised by NPP managers as being an important facilitator to successful organisational learning. Dissatisfaction with the current situation was considered to be one of the major facilitators for organisational learning. Participants recognised that people in successful organisations often become complacent and fail to search for improvements; it was reported that such organisations feel that they have nothing to learn from others. Empowerment as well as a recognition and understanding of the benefits of learning were also seen to be key facilitators in the learning process. While, maintaining employee motivation to learn, in the current UK operating climate, was seen as a major hindrance to learning.

The organisations culture was reported to have an impact on learning. In particular, managers reported that there was a need to create a balance between innovation and compliance in order to facilitate organisational learning. The development of a challenging and questioning attitude within the organisation was considered to be an important facilitator of learning at both an individual and organisational level. Furthermore, some of the organisations espoused values ('it's the way it is done on this station' and 'not invented here') were reported to negatively impact on the organisations ability to learn.

UK managers reported that objectives, priorities and resources could facilitate learning within the organisation. Manager's ability to focus on a few key issues and develop long-term objectives were felt to positively impact organisational learning. Whilst, managers recognised that one of the major barriers to learning and implementing change was the availability of resources i.e. time and money. Furthermore, lack of management commitment was also considered to be a key hindrance to effective learning.

The data generated from managers in other participating European countries uncovered similar facilitators and barriers to individual and organisational learning compared to



those identified by UK managers. Non-UK European managers reported that formal systems and practices were the most important facilitator of learning. In particular, they identified the importance of external bodies such as INPO and WANO and their involvement in the collection and dissemination of instances of best practice. Non-UK European managers also highlighted the importance of informal mechanisms to support learning, for instance, 'development days', 'co-operation groups', etc. Management objectives, priorities and the availability of resources were however, highlighted as a major barrier to learning. Thus, there were various similarities in both the facilitators and hindrances identified by managers from the UK and across other European countries. However, key differences with the UK and other European data sets were evident. In particular, employee motivation to learn was considered to be a key facilitator to learning with the UK, however, it was not reported to be an issue within other European reactor sites. This could be largely due to the imminent closure of many UK sites. Finally, the routine nature of tasks and the high turnover of employees at non-UK European plants was recognised as a key barrier to organisational learning. This was not however, reported to be a key issue within the UK.

Finally, improvement strategies were also discussed within group discussion sessions. Various methods of overcoming barriers and improving organisational learning were identified and discussed.

## **Discussion**

Cox and Cox (1996) postulated that learning was a key objective for safe and effective organisations. Organisations must learn from incidents, accidents and other relevant experience in order to maintain a state of intelligent and respectful wariness. This is achieved via a safety information system that collects, analyses and disseminates the knowledge gained from accidents and near misses (Reason, 1998). Senior managers at participating reactor sites in the UK reflected these findings, reporting that the use of formal systems, enable personal experiences to be transferred within the organisation. Such formal support systems encourage and allow open and free flowing information to be shared among individuals, as well as facilitating effective learning within the organisation. Furthermore, it was recognised that data generated using formal systems are able to monitor and provide feedback to management regarding the effectiveness of the improvements that have been implemented. Formal systems also ensure that the

organisation retains 'corporate memory' of why and how improvements have been made (IAEA, 2002b). Managers also reported that informal methods were not being utilised in the support of organisational learning at participating UK reactor sites.

Carroll et al (2004) illustrate, using a four-stage model, the skills and mechanisms that enable organisations to move from a low level learning capacity to a high level learning capacity. The four-stage model was postulated following extensive research within high reliability organisations. The model emphasizes the importance of 'deep learning' i.e. building capacity for double-loop learning that promotes understanding of deep, systemic causes and creates a wider range of action possibilities to address such causes. According to Carroll et al, organisations operating at this level would be capable not only of mutual respect across internal and external boundaries but also of skillful inquiry with the facility to gain insights and challenge assumptions. These findings were reflected in the data reported by NPP managers in the study organisation.

Individual attitudes were also perceived to impact on the ability of the organisation to learn. Dissatisfaction with the current situation was reported by NPP managers as being one of major facilitators for organisational learning. Empowerment as well as a recognition and understanding of the benefits of learning were also seen to be key facilitators in the learning process. Therefore, managers can encourage learning via open and honest communication, highlighting the benefits of participating in learning and continuous improvement. Maintaining motivation to learn was seen as a major hindrance to learning as many people felt that 'it was too late to change' thus people took the view 'what difference will it make'. When comparisons were drawn between the UK operating environment to that in which the Finnish plants are operating there are considerable differences. While the UK plants are reaching the end of their life cycles and moving forth with their closure programs; the Finnish operators are in the process of commissioning a new plant.

Organisational culture and climate was reported to have an impact on learning. UK managers reported that there was a need to create a balance between innovation and compliance in order to facilitate organisational learning. This was considered to be particularly problematic due to the very nature of the compliance-driven environment in which nuclear power plants operate. The development of a challenging and questioning attitude within the organisation was considered to be an important facilitator of learning

at both an individual and organisational level. UK managers also highlighted a number of culturally driven hindrances to organisational learning. In particular, two espoused values ('it's the way it is done on this station' and 'not invented here') of the organisations culture were seen to have a negative impact on the organisations ability to learn. Both of these underlying values held by employees were believed to hinder learning and lead to a resistance to change.

Finally, both UK and non-UK European managers reported that objectives, priorities and resources could facilitate learning within the organisation. Management ability to focus on a few key issues and develop long-term objectives were felt to positively impact on organisational learning. By adopting a long-term focus and strategic outlook managers can plan and prioritise tasks according to their importance. This approach also ensures that employees know what is expected of them and thus mitigate against potential resistance resulting from managers constantly 'changing the goal posts'. Frequent changes in strategic direction often lead employees to believe that there is a lack of management commitment. Lack of management commitment was reported by participants as being a key hindrance to effective learning. Edmondson and Moingeon (1999) reported that when significant change is announced in an organisation, uncertainty must be offset by an increase in trust. These findings were reflected in the data gathered from UK managers. Thus, employees must trust that managers are fully committed to learning and the adoption of subsequent changes. One of the ways in which senior managers can show their commitment to learning and change is to provide adequate resources with which to participate in learning and implement change. During the UK metaplan sessions senior and functional managers reported that the availability of resources, in particular time and money was an important barrier to learning within the study organisation.

Participants of the group discussion sessions identified and discussed a number of possible improvement strategies to overcome the barriers to organisational learning. Managers reported that organisational learning could be improved if change was easier to initiate. In particular, participants felt that learning could be improved upon if change was 'faster and more efficient'. Managers also believed that change should not be attempted if there is a chance that it could not 'be seen through successfully'. Furthermore, it was reported that the organisation would benefit if examples of successful change were communicated to individuals. Managers also believed that

organisational learning could be better facilitated if learning was integrated into all existing processes rather than it being a 'bolt on' to existing practices. More specifically, participants suggested the development of 'quality time' allocated to learning (and supported by management) i.e. 'invest for return'. Also important for the improvement of both individual and organisational learning was the need for managers to 'sell' the benefits of learning via continued communication; were possible ownership of the potential change should be secured prior to implementation. Managers also reported that there was a need to move away from 'change for change sake', thus changes must be perceived to be relevant and beneficial. Finally, managers also reported that there was a need to reinforce the message that 'to do nothing is unacceptable' in order for complacency to be avoided and a culture of focused of continuous improvement to be adopted.

### **Conclusion**

Formal systems to support learning were recognised as key facilitators to organisational learning. Whilst the largest hindrance to learning, as reported by UK managers, were individual attitudes i.e. 'I'm too busy to learn'. The data collected within the UK has been compared to the data generated from other participating European countries. Key differences in the data sets have been identified and discussed.

The 'LearnSafe' project has recently been completed and findings have been presented to the European Commission. The authors are continuing to support individual reactor sites in overcoming barriers to organisational learning and to enhance facilitative approaches to learning.

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