STRENGTHENING LEARNING FROM EMERGENCY RESPONSES

Borell, Jonas[1,3] & Eriksson, Kerstin[2,3]

Lund University, Lund, Sweden

Keywords: emergency response, transfer, learning, emergency management

Abstract

During the last years a couple of emergencies have affected the Swedish municipality Ljungby and its inhabitants and forced the municipality to initiate emergency responses. Some examples are a flooding that happened during the summer of 2004, the storm Gudrun that occurred in January 2005 and the storm Per that occurred in January 2007. These emergencies, as well as other incidents, are situations with a great potential for learning. Constructive use of principles or rules gained during one experience (in this case an emergency response) in another situation is sometimes referred to as 'positive transfer'. There are several methods available for evaluating responses to incidents and emergencies. However, such methods do not always use the full potential for drawing lessons (i.e. positive transfer) from the occurred emergency situations. For example, when trying to learn from experiences organisations often tend to "prepare to fight the last war" instead of planning for the future. The problem is that history is not known to repeat itself in perfect detail. The objective of this paper is to propose an approach to improving learning from evaluations of specific response experiences. This is done through adopting suitable theories from the field of learning. In the literature one prominent principle to facilitate the transfer process is to design the learning process so that the dimensions of variation become visible to the learners. Successful transfer for strengthening future capability demands that critical dimensions of possible variation specific for the domain of interest are considered. To demonstrate the proposed approach to improving learning from experience we apply it on the municipality of Ljungby's responses to the consequences of the storm Gudrun and their managing of the flooding in 2004.

Introduction

During recent years there has been an increased demand from the public that society should prevent emergencies to occur or at least minimize their negative outcomes. The demand for a more and more robust society also enhances the need for the society to learn from past experience. Experience and evaluations of instances of emergency response are two of many possible inputs to an emergency management planning process. Other important inputs are risk analyses, exercises as well as experience from everyday work. Ideally the result from an evaluation improves the organisations ability to handle future incidents. In addition, experience of a real emergency situation commonly creates awareness and willingness to

[1]Department of Design Sciences, Division of Ergonomics and Aerosol Technology, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden, jonas.borell@design.lth.se
[2] Department of Fire Safety Engineering and Systems Safety, Lund University, P.O. Box 118, SE-221 00 Lund, Sweden, kerstin.eriksson@brand.lth.se
[3] LUCRAM (Lund University Centre for Risk Analysis and Management), http://www.lucram.lu.se

prepare for future emergencies (Tierney et al., 2001; Boin et al., 2005). The question is if the full potential of an evaluation of an emergency is used. Sometimes there is a tendency to plan for the current situation. For example Lagadec (2006, p. 489) mention that it is essential to "…not prepare to fight the last war" but for future emergencies. In addition, other barriers against learning from experience are described in the literature by e.g. Smith and Elliott (2007).

During the last four years three larger emergencies have affected the municipality of Ljungby. In 2004 parts of the municipality was flooded, in 2005 Ljungby was hit by the major storm Gudrun and in 2007 the municipality was hit by yet a storm, this time called Per. Especially the storms, with wind gusts of hurricane strength, left great damages. These emergency situations have helped to develop the municipality's emergency response capability. Still, as the future is not equal to the past, it is unclear how much of this knowledge Ljungby can use in future situations. Put more general, the question is how an organisation can be trained to face future unknown incidents based on known cases.

The objective of this paper is to propose an approach to strengthening emergency response capability through improving learning from the evaluation of specific response experiences. A hypothetical approach based on learning theories has been tested on a study of Ljungby's emergency response work during and after the storm Gudrun and the flooding of 2004. The preliminary findings indicate that the developed approach can improve experience-based learning in organisations.

Method

From pedagogic theories of learning a first hypothetical approach of how to improve learning from evaluations of emergency responses was created. To further examine and refine this approach it was tested in a study of Ljungby's emergency response to the storm Gudrun in 2005 and the flooding of 2004. The study is based on an analysis of interviews as well as collected documents. The interviews were carried out with mainly municipal actors involved during the incident. In total 8 interviews were made. The documents analysed were e.g. notes and minutes from managerial meetings during the events and written preparedness plans. This study can be seen as a first test of the approach, and resulted in an enhanced approach for improved learning from evolutions of emergency situations.

Theory

Organisational learning

For maintaining a response capability in an organisation over time there is a need that not only separate individuals but the entire organisation has the necessary knowledge. According to Senge (2006, p. 129) "…Organizations learn only through individuals who learn. Individual learning does not guarantee organizational learning. But without it no organizational learning occurs". Also Argyris and Schön (1996) point out that organisational learning is when the individual members learn for the organisation. Argyris and Schön (1996) also discuss two types of organisational learning: single-loop learning and double-loop learning. Single-loop learning occurs when an organisation modifies its performance due to a difference between expected and obtained outcome, without questioning and changing the underlying program (e.g. changes in values, norms and objectives). If the underlying program that led to the behaviour in the first place is questioned and the organisation modifies it, double-loop learning has taken place.

Transfer

Constructive use of principles or rules that a person gained during one experience (in this case an emergency response operation) in another situation is sometimes referred to as 'positive transfer' (Reber, 1995). Transfer may be quite specific when two situations are similar (positive or negative transfer), but also more general, e.g. 'learning how to learn'. The

concept of transfer is also discussed within organisational theory. At an organisational level the concept transfer involves transfer at an individual level but also transfer between different individuals or organisations. Transfer at an organisational level can be defined as "…the process through which one unit (e.g., group, department, or division) is affected by experience of another" (Argote and Ingram, 2000, p. 151).

Scenario

A specific emergency situation can be described as a scenario, here seen as a description of a series of occurred or future events arranged along a timeline. Scenarios describing past emergencies "…answers the question: 'What happened?'" (Alexander, 2000, pp. 89-90). An emergency scenario can further be seen as consisting of various parameters. The concept parameter is here defined in very broad terms and every aspect with a potential for variation in a scenario is seen as a parameter. For example duration of a scenario or the quantity of recourses that is needed can be viewed as parameters. Alexander (2000, p. 90) further mentions that when imagining the future the question to ask is "What if…?".

Variation

One essential principle for facilitating the transfer process, established in the literature on learning, is to design the learning process so that the dimensions of possible variation become visible to the learners (Pang, 2003). Successful transfer for strengthening future capability demands that critical dimensions of possible variation specific for the domain of interest are considered (Runesson, 2006).

When studying an emergency scenario two different kinds of variation are possible; variation of the parameter values and variation of the set of parameters that build up the scenario. The first kind of variation is thus the variation of the values of the specific parameters that build up the scenario. In practice, it is not possible to vary all possible parameter values. A central challenge is how to know which parameters are critical in the particular scenario and thus worth closer examination by simulated variation of their values. The variation of parameter values can be compared to the concept of single-loop learning (Argyris and Schön, 1996). When the value of a given parameter in a scenario is altered, that is analogous to when a difference between expected and obtained outcome is detected and a change of behaviour is made. The second kind of variation is the variation of the set of parameters. This kind of variation may be discerned through e.g. discussing similarities as well as dissimilarities of parameter sets between different scenarios. The variation of the set of parameters can be compared to the concept of double-loop learning (Argyris and Schön, 1996), wherein the system itself is altered due to an observed difference between expected and obtained outcome. A central question is what the possible sets of parameters in future emergency scenarios are.

The proposed approach

The main goal of this paper is to propose an approach to strengthening emergency response capability through improving learning from the evaluation of specific response experiences.

Description of the emergency scenario

The first step in the proposed approach is to construct a description of the emergency scenario, i.e. create and document a description of the occurred emergency situation. The description of the occurred scenario is needed for further discussions on the organisation's ability to handle future emergencies. By describing the series of events that build up the scenario the most relevant parameters can be identified. From this description it is then possible to answer the question "what if …? " by varying the possible parameters as well as the set of parameters that build up the scenario.

Variation of the values of the parameters

The second step is to vary the value of the parameters that build up the scenario. This may be carried out through imagining variation of the included parameters (that are seen as relevant) within the scenario description.

Variation of parameter values makes the parameters themselves as well as the possible variation of their values visible. This can function as a foundation for positive transfer to future emergency situations with similar sets of relevant parameters, which in turn may strengthen the capability to handle future emergencies of the same kind as the one evaluated, but with for example greater impact.

Variation of the set of parameters

The third step is the variation of the set of parameters. By comparing the current case with other cases both occurred (e.g. earlier emergencies) and imagined (e.g. results of risk and vulnerability analyses) different sets of parameters can be discussed. Both similarities and differences are interesting.

Obviously it is not possible to decide the ultimate set of parameters to prepare for with general validity. There is always a need for adaption to the situation. Yet it is often possible for an organisation to observe patterns of similarities in the parameters after a couple of evaluations. Even if two emergency scenarios differ when it comes to the physical characteristics there are often similarities in the managing of the scenarios.

One kind of parameters suitable for imagined variation that is discussed in the literature is the different needs or problems that arise during an emergency situation. Dynes (1994) discusses two different types of needs or problems that requires to be responded to during an emergency. One of those types of needs is quite general and often occurs during an emergency. These are the response generated needs that result from the particular organisational response to the emergency, e.g. communication and coordination. The other type of need is the agent generated needs (Dynes et al., 1981), which are the needs and problems that the emergency in itself creates, for example search, rescue, care of injured and dead as well as protection against continuing threats. These needs tend to differ more between emergencies than the response generated needs do.

Greater experience means more opportunities for positive transfer. Furthermore, with increasing experience of thinking in terms of varying the set of parameters and their values, it is probable that the organisation and its employees also develop the ability to more general transfer, through the abstract ability to think of variation of parameters.

Transferring information and knowledge

A step that is often given inadequate attention is the transferring of information and knowledge obtained during the managing and the evaluation of an emergency to the entire organisation. Thus there is a need for creating organisational learning. This task is not an easy one, and requires serious resources. Therefore it is essential for organisations to create a planned structure or process for this task. In the end it is essential that the findings are carried by the individuals as well as codified in suitable artefacts of the organisation.

In addition, to create a better transfer and organisational learning it is throughout all steps of the approach recommendable to work in groups. One reason for this is that more people can be potential messengers to the rest of the organisation.

Testing of the approach

The main goal of this paper is to propose an approach to strengthening emergency response capability through improving learning from the evaluation of specific response experiences. From theories of learning a hypothetical approach has been constructed. The constructed

approach will below be tested on the municipality of Ljungby's managing of the storm Gudrun and the flooding of 2004. In addition, some comparisons are made with risk and vulnerability analyses that had been made before the emergencies.

Description of the emergency scenario

The test of the approach started from a construction of the emergency scenario of the storm Gudrun. During that step critical parameters for the response to the storm Gudrun were observed.

Variation of the values of the parameters

The study of the storm Gudrun resulted in a discussion of several critical parameters. One major consequence of the storm was a difficulty to physically reach as well as getting in contact with the affected people, who were trapped at home due to fallen trees. The storm resulted in a breakdown of several infrastructures in the municipality such as roads and telephones. The loss of communication utilities also made it difficult for the inhabitants to reach the fire brigade, the medical service or the police in case of emergency. One obviously interesting parameter to choose for imaginary variation is the level of infrastructure disruptions due to fallen trees. A critical question to ask is "If the situation had been worse, how would the affected persons have managed?".

The loss of infrastructures also made the municipality's efforts to support the inhabitants more difficult. For example, the municipal employees had to drive around by car to get in contact with each other and coordinate their response activities. A critical question to ask is: If the situation would have been even worse, would the response organisation have been able to coordinate its actions?

Through a discussion of these and other critical aspects or parameters, by asking 'what if-questions' and thus varying the parameter values, an organisation and its employees may get an improved capability to manage future emergencies. When analysing the variation of the values of the parameters of the managing of the storm Gudrun several problems became visible. These insights will probably be useful when preparing for the future.

Comparing the storm Gudrun with a risk and vulnerability analysis that had been done before the event gives interesting results. After the storm households were out of electricity for several weeks. In their risk and vulnerability analysis the municipality had identified the possibility of blackout, but just with the duration of a few days. This shows a discrepancy concerning the level of a highly critical parameter (duration of blackout) between what had been imagined and what actually happened.

Variation of the set of parameters

The second step is to vary the set of parameters by for example comparing the emergency scenario to other scenarios. In the interviews many of the informants compared the managing of the storm Gudrun with the managing of the flood six months earlier. In hindsight several actually regarded the flood as a "training camp".

The response generated needs were very similar between the two events. For example, during both situations the municipality used more or less the same organisation to coordinate the municipal response. Furthermore, both situations required transfer of information within and outside the municipal organisation. At the same time the situations varied much regarding disaster agents. Before the flooding the municipality was forewarned, and knew that the water was coming. The response was focused on managing the relatively slow changes of the water level so that the water would not destroy sensitive buildings and critical infrastructures. This was done with different forms of barriers. Also before the storm the municipality was forewarned, but officials did not correctly understand the level of threat. The storm was a situation with a rapid trajectory, and the response was focused on cleaning up the mess that the storm created.

The emergencies affecting the municipality of Ljungby have all been quite similar and thus the organisation has been able to work in similar ways. The really interesting question is what will happen in the future. What if a very different situation will occur? What if Ljungby will be hit by a terrorist attack? How would that influence the city? Who will need help? Will there be any need for social support or just a need for technical help? Will people die or get hurt? Obviously, this is a never ending discussion. The main idea is not to find all possible future scenarios but to create a capability for this way of thinking. There is a need to always expect the unexpected.

Transferring information and knowledge

Ljungby seems to have learned a lot between the flooding and the storm Gudrun. In interviews several informants attributed success in managing Gudrun to lessons learned from the earlier flooding. During the storm they also used an analysis group that discussed what to do if things got worse. The thinking in that group resembled the way of thinking about variation proposed here.

Discussion

This paper has focused on the construction of an approach to strengthening emergency response capability through improving learning from the evaluation of specific response experiences. As demonstrated by the application on the Ljungby cases, the new way of thinking may result in more effective identifications of critical aspects of emergency scenarios and emergency responses. Furthermore, it can contribute to both positive and general transfer.

We suggest that scenarios are seen as sets of parameters. We have described how imaginary variation of sets of parameters and parameter values can be used in evaluation processes around such scenarios. Similar views are discussed in the literature. For example Weick and Sutcliffe (2001) discuss how to manage the unexpected. They describe certain attitudes within an organisation, e.g. that the organisation is preoccupied with failures and reluctant to simplify interpretations, that help the organisation to create mindfulness. A mindful organisation continues to question and reconsider conceptualisations and models and thus increases the reliability of their operations.

As shown by the duration of blackout example, it is highly recommendable to try to imagine extreme values of critical parameters. The advantage of imagining ‘worst cases’ is also discussed by Clarke (2005): “*It is sometimes said that playing with hypothetical scenarios and concentrating on consequences is unproductive. But if we can do those things in a reasonably disciplined way, we can be smarter and more imaginative*” (Clarke, 2005, p. 84).

There is still a need to further study how an organisation knows which the critical dimensions are. It is also needed to further evaluate and refine the approach in other organisations and on other forms of emergencies.

References

Alexander, D. (2000). Scenario methodology for teaching principles of emergency management. *Disaster Prevention and Management: An International Journal*, Vol. 9, No. 2, pp. 89-97. Emerald, United Kingdom.

Argote, L. and Ingram, P. (2000). Knowledge Transfer: A Basis for Competitive Advantage in Firms. *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp. 150-169. Academic Press, United States

Argyris, C. and Schön, D. A. (1996). *Organizational Learning II: Theory, Method, and Practice*. Addison-Wesley Publishing Company, Reading, Massachusetts.

Boin, A., 't Hart, P., Stern, E., et al. (2005). *The Politics of Crisis Management: Public Leadership Under Pressure*. Cambridge University Press, Cambridge.

Clarke, L. (2005). *Worst cases: terror and catastrophe in the popular imagination*. University of Chicago Press, Chicago.

Dynes, R. R. (1994). Community Emergency Planning: False Assumptions and Inappropriate Analogies. *International Journal of Mass Emergencies and Disasters*, Vol. 12, No. 2, pp. 141-158. International Research Committee on Disasters, United States

Dynes, R. R., Quarantelli, E. L. and Kreps, G. A. (1981). A perspective on disaster planning, 3rd edition. Delaware, University of Delaware, Disaster Research Center

Lagadec, P. (2006). Crisis Management in the Twenty-First Century: "Unthinkable" Events in "Inconceivable" Contexts. In H. Rodriguez, E. L. Quarantelli and R. Dynes (Eds.). *Handbook of Disaster Research*. pp. 489-507, Springer, New York.

Pang, M. F. (2003). Two Faces of Variation: on continuity in the phenomenographic movement. *Scandinavian Journal of Educational Research*, Vol. 47, No. 2, pp. 145-156. Routledge, United Kingdom

Reber, A. S. (1995). *The Penguin dictionary of psychology*. Penguin Books, London.

Runesson, U. (2006). What is it Possible to Learn? On Variation as a Necessary Condition for Learning. *Scandinavian Journal of Educational Research*, Vol. 50, No. 4, pp. 397-410. Routledge, United Kingdom

Senge, P. M. (2006). *The Fifth Discipline: The Art and Practice of the Learning Organization*. Random House Business, London.

Smith, D. and Elliott, D. (2007). Exploring the Barriers to Learning from Crisis: Organizational Learning and Crisis. *Management Learning*, Vol. 38, No. 5, pp. 519-538. Sage Publications Ltd.,United Kingdom.

Tierney, K. J., Lindell, M. K. and Perry, R. W. (2001). *Facing the unexpected: Disaster preparedness and response in the United States*. Joseph Henry Press, Washington, D.C.

Weick, K. E. and Sutcliffe, K. M. (2001). Managing the Unexpected: Assuring High Performance in an Age of Complexity. Jossey-Bass, San Francisco.

Author Biographies

Jonas Borell is a PhD student at the Department of Design Sciences at Lund University. Jonas has a MSc in Psychology. Main research area is proactive safety management. Jonas participates in FRIVA, a framework research program funded by the Swedish Emergency Management Agency.

Kerstin Eriksson is a PhD student at the Department of Fire Safety Engineering and Systems Safety at Lund University. Kerstin has a MSc in Risk Management and Safety Engineering. Main research area is risk and vulnerability analysis and crisis management. Kerstin participates in FRIVA, a framework research program funded by the Swedish Emergency Management Agency.