Emergency Management: Identifying Problem Domains in Communication

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ABSTRACT

In emergency management, the identification of hazards, analysis of risks, development of mitigation and response plans, maintaining of situational awareness and support of response and recovery are all complex responsibilities. A major accident brings together individuals belonging to many different organizations, having backgrounds in different fields of operation, and representing different organizational cultures. They have to absorb a large amount of information about the accident over a short period of time. In order to take effective action, actors are expected to work smoothly together, thus the flow of information from and to the actors involved is crucial. Nevertheless, there are certain problem domains in the different phases of emergency management, which may weaken the flow of information. In this paper we present the findings of the first round of a Delphi study in which we identified problem domains in communication both in long-term and short-term planning for major accidents.

Keywords

Emergency management, communication, long-term planning and short-term planning, Delphi method.

INTRODUCTION

An emergency situation can be caused either by natural forces or by human activities. We have to be prepared for possible emergencies at different levels of society, however they are caused. Usually a major accident will bring together individuals belonging to many different organizations and representing different organization cultures that may also differ in their use of language. Trying to draw conclusions from a large amount and variety of information is a demanding task, but very typical in crisis management (Ley et al. 2012). In order to improve emergency management it is essential to anticipate and be ready for cross-sectoral collaboration between different organizations and different fields of operation.

For various reasons, different authorities or companies specialized in their own fields use different concepts and terms for the same issue, although the object domain is the same. Some of these differences may be explained by cultural differences or differences in organization cultures (e.g. Lewis 2006; Carver and Turoff 2007; Hofstede, Hofstede, and Minkov 2010). Communication problems are a common occurrence, even more so in collaborative software, where actors communicate across organizational boundaries. One reason for these problems is that different actors have a different idea of the same 'symbol' (Reuter et al. 2012). In general, heterogeneity is ubiquitous in emergency management informatics. We have heterogeneous names for entities, process rules, sensor platforms, information systems platforms, data and communication formats, organizations, and even languages. The fact is that such heterogeneity can hinder effective emergency response (Galton and Worboys 2011). Furthermore, there are different challenges in the long-term planning and short-term planning phases of emergency management (Alexander 2002).

In order to take effective action in an emergency situation involving different actors who are expected to work smoothly together, more attention should be focused on the situations where their communication takes place. The objective of our research is to produce new knowledge of emergency management for both authorities and the business sector. The aim is to study emergency management using the Delphi method and to identify circumstances where actors have recognized potential problems or risk situations related to the flow of information and communication. In this paper, the research setting and findings of the first round of our Delphi study are presented.

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DELPHI STUDY

Delphi is a survey or interview method in which experts' knowledge and presumptions on the issue or development process under study are collected in an interactive process. Delphi is especially useful when the phenomenon under study is complex or when the topic is somehow delicate – difficult to define, awkward to talk about, politically sensitive, etc. (e.g. Linstone and Turoff 1975; Gordon 2011). Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone and Turoff 1975).

The successful realization of Delphi requires the design of a panel structure that incorporates many knowledgeable individuals from different disciplines or specialties, with different working backgrounds and experience, who can contribute information or judgments on the problem area which is much broader in scope than the knowledge that any single individual can possess. (Linstone and Turoff 1975; Kuusi 1999; Gordon 2011; Laakso, Rubin, and Linturi 2012.) Diversity among panelists generates a variety of opinions, at least in the first Delphi round, which can then be taken into account by all of the experts in the panel (Hussler, Muller, and Rondé 2011). Besides allowing a variety of opinions, there are other advantages to the Delphi method in finding solutions for communication problems: for instance, its ability to take into account the tacit knowledge and experience of the panelists (e.g. Linstone and Turoff 1975; Lilja, Laakso, and Palomäki 2011).

The objective of our research is to produce new knowledge of preparedness planning and emergency management for both authorities and the business sector. The aims of our study were to:

1. Identify situations where there have been problems in the flow of information and communication in or between different organizations related to major accidents.
2. Identify problem domains in different phases, i.e. what are the challenges in long-term planning, and, conversely, what are the challenges in short-term planning?

Thirty-five Finnish organizations were invited to join our Delphi study (Laakso 2012). They comprised 16 different authorities, 16 medium-sized or large companies, and three other organizations, e.g. volunteer fire brigades. The invited organizations nominated a total of 48 experts for our Delphi panel. All the experts have several years of experience in emergency management with backgrounds in different lines of business. The first round of the Delphi study was carried out by means of personal interviews, which were recorded and then transcribed. The material was transcribed and, as a result, a total of 683 issues mentioned in the interviews were identified in relation to problems in the flow of information and communication in emergency management.

Problem Domains in Long-Term Planning

One part of our Delphi study dealt with long-term planning related to major accidents. As a result of the analysis of the transcribed material, a total of 351 issues mentioned in the interviews were identified in relation to problems in the flow of information and communication in long-term planning. These 351 issues were grouped into 16 domains, all of which included issues mentioned five or more times, as follows:

- Issues related to operations of authorities (72 mentions)
- Issues related to companies' preparedness planning (37 mentions)
- Issues related to training (32 mentions)
- Attitude to preparedness (28 mentions)
- Co-operation between companies and authorities (18 mentions)
- Co-operation between companies involved (17 mentions)
- Issues related to communication systems (15 mentions)
- Difficulties in applying regulations (15 mentions)
- Necessity to improve regulations (15 mentions)
- Lack of resources (14 mentions)
- Prioritizing of preparedness resources (14 mentions)
- Issues related to emergency supplies (11 mentions)
- Strict group policies of international companies (11 mentions)
- Issues related to insurance companies (10 mentions)
- Safety management (9 mentions)
- Issues related to outsourcing (5 mentions)
- Others (28 mentions)

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As an example, next we give a brief presentation of the most frequent domains mentioned with regard to long-term planning. The most frequent domain was *issues related to operations of authorities,* mentioned 72 times. Experts in the panel highlighted the lack of cooperation between the authorities and the need for better coordination between different authorities.

The experts believe that collaboration between the authorities could be developed by planning operations better, so that operations of other authorities are taken into account. For instance, in preparedness planning, the viewpoints of emergency services and supervisory authorities could be more compatible. It was considered that the current situation is such that many authorities have overlapping functions, which may cause issues in the flow of information. This could be avoided through better planning.

At present, safety documents issued by the authorities and those supplied to them by companies are fragmented and saved in such a way that they cannot be utilized properly. In the view of the experts, there are plenty of these documents in existence, also in electronic form. One major challenge was seen to be firstly the fact that data is collected in a disjointed fashion, secondly that the authorities do not have sufficient knowhow to utilize the documents, and thirdly that the management of data access rights prevents the smooth search and utilization of this data. One proposed option was to establish a common data bank.

Another point that was highlighted was that the authorities are not good at disseminating their safety knowhow to companies, although they possess a lot of knowledge of good practices. The hope was clearly expressed that authorities would act in more of an advisory or briefing role in relation to preparedness than they do at present.

The second most frequent domain was *companies' preparedness planning* with 37 mentions. For example, different backup systems, contingency planning itself, as well as the development of operations for a variety of unexpected situations were at the top of the list, and also the fact that regulations and group policies are sometimes contradictory.

More and more operations are dependent on the functioning of electricity and IT networks. It was the view of the experts that companies in general and electricity and IT network companies in particular should develop or add back-up systems, in order to minimize potential outages. In planning for longer disruptions, companies should also pay more attention to the availability of other critical resources.

Nowadays, many companies operate in cooperation with other companies in networks or via long chains of subcontractors. It was felt that corporate preparedness planning should take into consideration more not only their own operations but also the ability of the whole network to operate during disruptions. This should also be taken into account in companies' internal emergency plans and the authorities' emergency plans.

According to the experts, corporate quality and management systems as such are on average at a satisfactory level in normal operating processes. As far as quality and management systems are concerned, there is room for improvement in the fact that they have not sufficiently taken into account major abnormal situations. Instructions in the event of major damage may be deficient or, in the worst case, non-existent.

The third most frequent domain with 32 mentions was *issues related to training and education*. The experts highlighted the need for instance for increasing safety training extensively throughout company personnel.

In the experts' opinion, both companies and authorities should train their personnel more. For example, increasing know-how regarding chemicals was mentioned in this regard. It was particularly felt that the emergency services that come to the plant area should improve their know-how of chemicals. As for companies, it was considered important that the entire network of subcontractors should also be trained. In particular, concern was expressed about companies that do not deal with chemicals on a daily basis, but only in relation to repairs, extension work, or annual maintenance, when the quality or quantity of substances to be handled deviates from normal.

Another significant issue related to improving training was leadership development. Especially in major accidents where there are several actors, the view was that leadership know-how should be improved, on the part of both companies and authorities. One reason for this is the fact that, since major accidents are rare, there is not sufficient practical experience of leadership situations involving many actors.

Problem Domains in Short-Term Planning

The other part of our study was to address short-term planning related to major accidents. As a result of the analysis of the transcribed material, we identified a total of 332 issues mentioned in the interviews related to problems in communication in short-term planning. The issues were then grouped into 15 domains, all of which included issues mentioned five or more times, as follows:

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- Situation awareness (72 mentions)
- Issues related to joint company-authorities rescue drills (47 mentions)
- Communication at the time of impact and immediately after (34 mentions)
- Communication at the accident site including the media (31 mentions)
- Co-operation between organizations at the site (22 mentions)
- Issues related to communication systems (21 mentions)
- Analysis of accidents (18 mentions)
- Usage of secured communications network (12 mentions)
- Usage of live cameras (9 mentions)
- Managerial skills (8 mentions)
- Functionality of command center (7 mentions)
- Issues related to company fire brigade (7 mentions)
- Skills of authorities (6 mentions)
- Issues related to knowledge of accident area (6 mentions)
- Language skills (5 mentions)
- Others (27 mentions)

As an example, the most frequent domains in short-term planning are presented below. *Situation awareness* was the most common domain, with 72 mentions. The experts on our Delphi panel had often experienced problems with special vocabulary and terminology as well as jargon. Additionally, the lack of a proper system for collecting and sharing situation-related information was very often mentioned in this domain. According to the experts, there is plenty of potential for improvement in the information systems required to obtain the right kind of situation awareness. One of the most significant single factors that arose was the lack of interoperability between the data systems used by the authorities. This causes problems, particularly in the management of major accidents where units from various authorities perform rescue operations simultaneously.

The second most frequent domain was *joint company-authorities rescue drills,* with 47 mentions. The experts on the panel were quite dissatisfied with the *rescue drills* they had attended and above all with the execution of the development ideas arising from the drills. They also argued that the planning of rescue drills is very often poor and also that the commitment of attendees could have been better. According to the experts, even though drills were organized, they tended to concentrate on only the most typical or small-scale accidents. It was considered that there was a lack of drills concerning major disasters and serious cases in particular. This results in the fact that insufficient attention is paid in drills to situations where, for example, there would be several units from different authorities carrying out emergency operations at the same time.

Communication at the time of the accident and immediately after was the third most common domain, with 34 domains. The poor level of information, improper or inadequate information given to the authorities (e.g. fire service) at the site was one of the most frequently mentioned issues. The lack of sufficient instructions and to-do lists for company personnel was also often mentioned. One deficiency was felt to be the fact that the rescue services did not have sufficient prior knowledge available of the risk elements in their area. One factor that could improve the situation would be company drawings, process flow sheets (including the properties, quantities and locations of toxic and explosive materials), and fire extinguishing system diagrams, which should be made available to the emergency services in electronic form. At the very least, firms should have up-to-date drawings, process flow sheets, and fire extinguishing system diagrams printed on paper to give to the emergency services arriving on site.

CONCLUSION AND DISCUSSION

Globalization, the network economy, and technological development have changed our outlook and modes of operation. This new awareness of emergency situations requires better integration of public and private sectors. The common goals of the authorities and companies are to guarantee the security of personnel and the general public and in addition to prevent or minimize material damage and to help recover the functioning of society. Emergency management organizations, both public and private, are responsible for preparedness and reducing vulnerabilities, and also for establishing an effective response. In coping with these responsibilities, it is crucial to have a common understanding among the parties involved.

The main concern in this paper was the importance of communication between the actors involved in emergency management and potential problem domains in the flow of information and communication. The results of the

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first round interviews of a Delphi study, including the opinions of 48 experts representing different lines of business, indicated clearly that it is possible to find the crucial problem domains connected with the flow of information between actors in emergency management. In long-term planning, 16 problem domains were found, whereas in short-term planning there were 15 problem domains, all of which were identified by the Delphi panel as possible reasons for weak communication and a poor level of the flow of information in emergency management.

Such domains as "issues related to operations of authorities," "companies' preparedness planning," and "issues related to training " were mentioned most frequently in long-term disaster planning. In short-term planning, "situation awareness", "joint company-authorities rescue drills," and "communication at the time of accident and immediately after" were the domains most frequently mentioned. A detailed report of the findings has been delivered to the experts before the second Delphi round. In our future research and following Delphi rounds, the intention is to explore these critical problem domains using the expertise of the same Delphi panel.

There are many benefits of using Delphi to solve challenges in the communication process between the actors in major accidents. In particular, Delphi is a proven research method for exploring the underlying assumptions or information that leads to different judgments; allowing the exchange of tacit knowledge among professionals; seeking out information which may generate a consensus on the part of the respondent group; correlating informed judgments on a topic spanning a wide range of disciplines; and educating the respondent group on diverse and interrelated aspects of the topic (Linstone and Turoff 1975; Walle van de and Turoff 2008).

REFERENCES:

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1. Alexander, D. (2002) Principles of emergency planning and management, Terra Publishing, Harpender.

2. Carver, L. and Turoff, M. (2007) Human-computer interaction: The human and computer as a team in emergency management information systems. Communications of the ACM 50, 3, 33-38.

3. Galton, A. and Worboys, M (2011) An ontology of information for emergency management, Paper presented at the International Conference on Information Systems for Crisis Management and Response (ISCRAM), Lisbon, Portugal.

4. Gordon, T. J. (2011) The Delphi method in futures research methodology-V3.0. In The Millennium Project. Available from http://www.millennium-project.org/millennium/FRM-V3.html. [cited 10/26/2012].

5. Hofstede, G., Hofstede, G.J. and Minkov, M. (2010) Cultures and organizations: Software of the mind - intercultural cooperation and its importance for survival, McGraw-Hill, New York.

6. Hussler, C., Muller, P. and Rondé, P. (2011) Is diversity in Delphi panelist groups useful? Evidence from a French forecasting exercise on the future of nuclear energy, Technological Forecasting and Social Change 78, 9, 1642-1653.

7. Kuusi, O. (1999) Expertise in the future use of generic technologies, Epistemic and methodological considerations concerning Delphi studies, HeSe Print, Helsinki.

8. Laakso, K. (2012) Selection of panelists for a Delphi survey on emergency preparedness and management, Paper presented at Portland International Conference of Management of Engineering and Technology (PICMET), Vancouver, Canada.

9. Laakso, K., Rubin, A. and Linturi, H. (2012) The role of regulation in the mobile operator business in Finland, Foresight: The Journal of Future Studies, Strategic Thinking and Policy, 14, 2, 157-164.

10. Lewis, R.D. (2006) When cultures collide: Leading across cultures, Nicholas Brealey, Boston (MA).

11. Ley, B., Pipek, V., Reuter, C. and Wiedenhoefer, T. (2012) Supporting inter-organizational situation assessment in crisis management, Paper presented at the International Conference on Information Systems for Crisis Management and Response (ISCRAM), Vancouver, Canada.

12. Lilja, K.K., Laakso, K. and Palomäki, J. (2011) Using the Delphi method, Paper presented at Portland International Conference on Management of Engineering and Technology (PICMET), Portland, USA.

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T. Comes, F. Fiedrich, S. Fortier, J. Geldermann and T.Müller, eds.

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13. Linstone, H.A. and Turoff, M. (1975) The Delphi method: Techniques and applications, Addison-Wesley, London.

14. Reuter, C., Pipek, V., Wiedenhoefer, T. and Ley, B. (2012) Dealing with terminologies in collaborative systems for crisis management, Paper presented at the International Conference on Information Systems for Crisis Management and Response (ISCRAM), Vancouver, Canada.

15. Walle van de, B. and Turoff, M. (2008) Decision support system for emergency situations, In Handbooks on decision support systems 2, Eds. Burstein, F. and Holsapple C.W., 39-63, Springer, Berlin.

Proceedings of the 10th International ISCRAM Conference – Baden-Baden, Germany, May 2013
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