Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2009 Proceedings | Americas Conference on Information Systems (AMCIS)

2009

Group Support Systems for Knowledge Acquisition in Humanitarian Disaster Response Teams: Embedded Research in the Belgian First Aid and Support Team

Wilem J. Muhren
University of Tilburg, w.j.muhren@uvt.nl

Sven Hakkenbroek
University of Tilburg, s.hakkenbroek@uvt.nl

Bartel Van de Walle
University of Tilburg, bartel@uvt.nl

Group Support Systems for Knowledge Acquisition in Humanitarian Disaster Response Teams: Embedded Research in the Belgian First Aid and Support Team

Willem J. Muhren
Tilburg University
w.j.muhren@uvt.nl

Sven Hakkenbroek
Tilburg University
s.hakkenbroek@uvt.nl

Bartel Van de Walle
Tilburg University
bartel@uvt.nl

ABSTRACT

Knowledge management systems (KMS) are designed to support and enhance the process of creating, storing, retrieving and transferring knowledge. In this contribution we investigate the use of such systems for the acquisition of knowledge in humanitarian disaster response teams. First, we present a framework describing how KMS should enhance group process gains and alleviate group process losses, and create an effective learning environment for successfully supporting the acquisition of knowledge. Second, we describe ongoing research on the acquisition of knowledge in the Belgian humanitarian response team (B-FAST, for Belgian First Aid and Support Team) that uses Microsoft Groove as knowledge management system before, during and after their missions. Initial findings are presented based on participant observation and interviews of the B-FAST team during a large humanitarian exercise, along with plans for future research.

Keywords

Group support systems, knowledge acquisition, knowledge management systems, humanitarian assistance, disaster response.

INTRODUCTION

Humanitarian response to natural hazards or conflicts takes place in dynamic, rapidly changing and turbulent environments, in which actors face several information processing problems (Bui and Sankaran, 2001; Muhren, Van Den Eede and Van de Walle, 2008b), leading to challenges in decision making (Van de Walle and Turoff, 2008) and making sense of the information and the situation at hand (Muhren, Van Den Eede and Van de Walle, 2008a). Information systems are needed that provide timely access to comprehensive, relevant, and reliable information (Van de Walle and Turoff, 2007; Van de Walle, Van Den Eede and Muhren, 2009). Not everything that humanitarian aid organizations need to know, however, can be found in databases, documents and visual products. There is also tacit knowledge that is usually not documented, but derived from expertise, collaboration and field experience (King, 2005).

The humanitarian aid sector is characterized by high staff turnover. Moreover, the composition of people in teams that are sent out by their humanitarian organization changes for each mission. It is therefore a great challenge for organizations to create an environment in which their members can effectively acquire the knowledge they need. This contribution describes an ongoing research project that focuses on the role of information systems in the acquisition of knowledge within humanitarian disaster response teams. We have conducted a case study on the use of a particular information system, Microsoft Groove, for knowledge acquisition in the Belgian First Aid and Support Team (B-FAST). Groove provides the team the possibility to share knowledge during and across their missions. In this contribution we report on our research model and initial findings, obtained from participatory observation and interviews during the humanitarian TRIPLEX exercise, on how the members of B-FAST experience Groove in their acquisition of knowledge.

The paper is structured as follows. First we discuss knowledge management systems (KMS) and give examples of previous applications of KMS in humanitarian assistance. We then present the characteristics of knowledge acquisition, indicate how knowledge acquisition can be stimulated in teams by creating an effective learning environment and by enhancing group process gains and alleviating group process losses, and present our research model. We then describe our research setting: B-FAST, the KMS they use (Microsoft Groove), and the case study we conducted including the methodology we used. Finally, we present the initial findings of our research, followed-up by our plans for future research.

KNOWLEDGE MANAGEMENT SYSTEMS

Knowledge is "an evolving mix of framed experiences, values, contextual information and expert in sight, which provides a framework for evaluating and incorporating new experiences and information" (Murphy and Jennex, 2006). Knowledge management is based on the identification and classification of collective knowledge (Alavi and Leidner, 2001). A KMS is designed to support and enhance the process of creating, storing, retrieving and transferring knowledge (Lin and Huang, 2008; Murphy and Jennex, 2006). KMS can take the form of knowledge repositories (e.g. providing documents and information databases, search engines, and intelligent agents), expert directories (such as yellow pages and knowledge maps), and/or collaborative tools (such as groupware, email, listserv, newsgroup, chat and conferencing) (Bernard, 2006). In practice, there are three common applications of KMS: KMS are used for the coding and sharing of best practices, the creation of corporate knowledge directories through the mapping of internal expertise, and.the creation of knowledge networks (Alavi and Leidner, 2001).

Knowledge Management Systems in Humanitarian Assistance

There are several examples of systems reported to be used in humanitarian disaster response for knowledge management, in order to create, store, and retrieve knowledge.

One recent initiative to specifically target knowledge management in humanitarian disaster response was taken during hurricane Kathrina when KMS were developed and implemented (Jennex, 2007a; Murphy and Jennex, 2006). These systems however were only used during hurricane Kathrina and were not being used to share knowledge for a longer period of time.

The Information Management System for Hurricane Disasters (IMASH) aims at providing knowledge on the response to hurricanes (Jennex, 2007a). Users are able to retrieve knowledge about hurricanes on the portal, where both textual and graphical information is presented.

Digital Typhoon is designed "to provide a hub of information on the Internet during a typhoon disaster. Digital Typhoon provides access to information from official sources (news, satellite imagery) as well as a forum for individuals to provide information (local, personal)" (Jennex, 2007a).

Virtual OSOCC (On Site Operations Coordination Center) is a portal of the United Nations to facilitate decision making through real-time information exchange by all actors of the international humanitarian disaster response community. Virtual OSOCC provides its users with a discussion forum for any area of interest, including both visual (photos) and textual information exchange on best practice and lessons learned after humanitarian disaster response operations.

KNOWLEDGE ACQUISITION IN TEAMS

In this contribution we focus on KMS that support the acquisition and sharing of knowledge. Holsapple and Joshi (2002) define knowledge acquisition as "the activity of identifying knowledge in the environment and transforming it into a representation that can be internalized, and/or used". They make a distinction between four sub activities of knowledge acquisition: *identifying* appropriate knowledge from external sources, such as locating, accessing, valuing, or filtering knowledge from outside sources; *capturing* identified knowledge from outside, such as extracting, collecting, or gathering knowledge that appears to be sufficiently valid and useful; *organizing* captured knowledge, such as distilling, refining, orienting, interpreting, packaging, assembling or transforming captured knowledge into representations that can be understood and processed by another knowledge manipulation activity; and *transferring* organized knowledge, such as identifying, selecting, scheduling, and sending knowledge through a communication channel (Holsapple and Joshi, 2002).

We will now describe how the acquisition of knowledge in teams can be enhanced. First, we will highlight the need for the creation of an effective learning environment. Second, we will discuss several aspects of group processes, and they should be supported by information systems.

Creating an Effective Learning Environment

Organizations typically strive to become learning organizations (Van Den Eede, Muhren and Van de Walle, 2009), "organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (Senge, 1990). By creating such an effective learning environment, the acquisition of knowledge can be enhanced (Kwok and Khalifa, 1998). Alavi (1994) reveals three important attributes of effective learning processes. First, "active learning and construction of knowledge" stresses that the learning process is characterized by active engagement in the construction of knowledge (Alavi, 1994). Second, "cooperation and teamwork in learning" highlights the social aspects of the learning process, as learning is "a social process that occurs more effectively through interpersonal interactions in a cooperative context" (Alavi, 1994). Third, the attribute "learning via problem solving" – learning by doing – argues that learning is "expedited in challenging problem-solving situations in which mental models are tested, extended, and refined until they are effective and reliable in solving that problem" (Alavi, 1994). In the remainder of the paper we refer to these attributes as "active engagement", "cooperation", and "problem based learning" respectively (Kwok and Khalifa, 1998).

Group Processes and Group Support Systems for Effective Learning

Group Support Systems (GSS) provide communications, a group memory, tools and structures to coordinate group processes (Turoff, Hiltz, Bahgat and Rana, 1993). GSS can enable a collaborative learning environment that facilitates the acquisition of knowledge (Kwok and Khalifa, 1998). Nunamaker, Dennis, Valacich, Vogel and George (1991)'s distinction between process gains and process losses of group work makes it possible to discuss how GSS can optimally support groups. Kwok and Khalifa (1998) performed a study on the effect of GSS on group process gains and group process losses in order to create an effective learning environment. The process gains they have found to have an effect on an effective learning environment are shown in Table 1, together with the attributes of an effective learning environment they influence.

Process gain	**Description of gain**	**Influenced attribute of effective learning environment**
More information	A group as a whole has more information than any one member.	Cooperation, Problem-based learning
More objective evaluation	Groups are better at catching errors than are the individuals who proposed ideas.	Cooperation, Problem-based learning
Stimulation	Working as part of a group may stimulate and encourage individuals to perform better.	Active engagement
Learning	Members may learn from and imitate more skilled members to improve performance.	Cooperation

Table 1. Process Gains of Group Work (Nunamaker et al., 1991) and their Influence on an Effective Learning Environment (Kwok and Khalifa, 1998)

Similarly, Table 2 shows the process losses found by Kwok and Khalifa (1998) to have an effect on an effective learning environment, together with the attributes of an effective learning environment they influence.

Process loss	**Description of loss**	**Influenced attribute of effective learning environment**
Air time fragmentation	The group must partition available speaking time among members.	Cooperation
Evaluation apprehension	Fear of negative evaluation causes members to withhold ideas and comments.	Active engagement, Cooperation
Free riding	Members rely on others to accomplish goals, due to cognitive loafing, the need to compete for air time, or because they perceive their input to be unneeded.	Active engagement
Domination	Some group member(s) exercise undue influence or monopolize the group's time in an unproductive manner.	Active engagement, Cooperation
Incomplete use of information	Incomplete access to and use of information necessary for successful task completion.	Problem-based learning
Incomplete task analysis	Incomplete analysis and understanding of task resulting in superficial discussions.	Problem-based learning

Table 2. Process Losses of Group Work (Nunamaker et al., 1991) and their Influence on an Effective Learning Environment (Kwok and Khalifa, 1998)

Research Model

We have adapted the model by Kwok and Khalifa (1998) to study how a GSS facilitates the acquisition of knowledge in a humanitarian disaster response team by enhancing group process gains and reducing group process losses. Our conceptual model is shown in Figure 1.

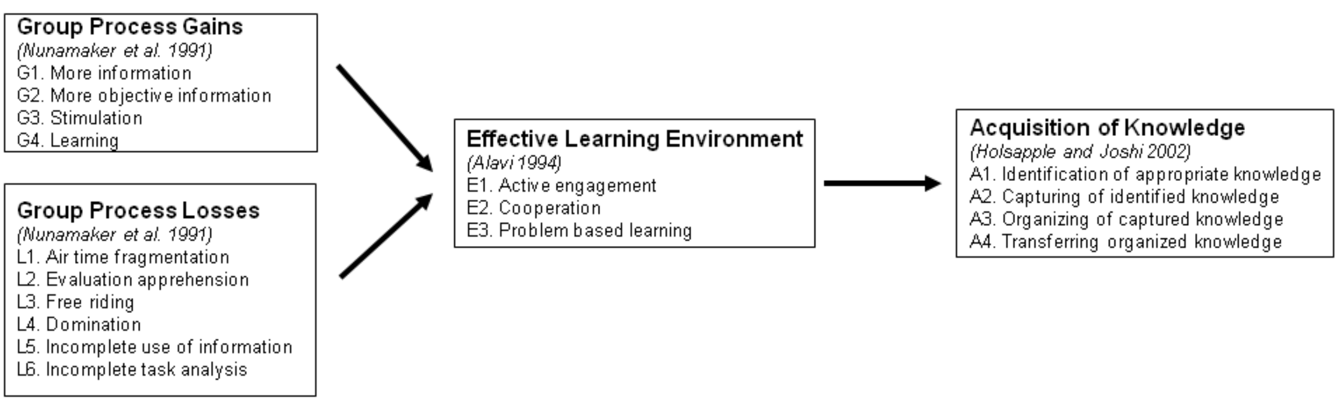

Figure 1. Conceptual Model

RESEARCH DESIGN

The goal of our research reported here is to investigate how members of the B-FAST team experience the use of Groove for the acquisition of knowledge.

Belgian First Aid and Support Team

The Belgian government created B-FAST to have a quick responding intervention structure for emergency response to countries affected by a natural or man-made disaster. After a disaster B-FAST can send humanitarian goods as well as experts to assist the local population. Other examples of assistance that has been provided are the installation of water purification plants and the setting up of field hospitals. Since 2001, over 35 missions have been conducted. Once a disaster strikes, the Coordination Council of B-FAST, presided by the Minister of Foreign Affairs, decides on the kind of assistance that will be offered.

B-FAST only starts a mission if there are no armed conflicts in the disaster area, the size of a disaster is such that affected countries are not able to cope with the situation themselves, or the government of an affected country requests Belgium or the international community for assistance. As the response should be undertaken swiftly, the B-FAST members should be available to leave for a mission within 12 hours. Their mission will usually not last longer than 10 days.

Microsoft Groove

In the beginning of 2008 B-FAST started with an initiative for information systems support of their missions. This initiative resulted in the implementation of Groove in the first quarter of 2008, with a first time usage during the hurricane in Burma in May 2008.

Microsoft Groove ("Groove") is a peer to peer software system in a decentralized structure, in which users have the possibility to collaborate in virtual rooms (workspaces) irrespective of whether a user is online or not. A workspace contains all kinds of facilities, such as document sharing, calendar functionality, whiteboard functionality, adaptable forms, instant messaging, project management tool, and user log. Only workspace members can view and change documents in the workspace, and all members can constantly see what has been changed by whom. Data that is used within a workspace is located on a user's computer. Documents can be added or changed offline, and will be updated in the workspace when users connect to the internet.

Nowadays Groove is used frequently in humanitarian disaster response. Groove was tested on a large scale in the 2006 Strong Angel III humanitarian disaster response exercise (Jennex, 2007b), and has been adopted by many humanitarian organizations, such as CARE, Infoshare and B-FAST. The United Nations have used Groove the last few years in their disaster assessment and coordination teams (Muhren and Van de Walle, 2009).

TRIPLEX Exercise

TRIPLEX is a biennial humanitarian exercise organized by the International Humanitarian Partnership (IHP), a voluntary international cooperation which provides support for international humanitarian operations. In September 2008 the TRIPLEX exercise took place during three days on the border of Norway and Sweden, the countries that for exercise purposes were known as "Westlandia" and "Eastlandia" respectively. The exercise was based on a floods scenario, which affected the two countries. TRIPLEX was organized as realistic as possible, with participants staying in an actual base camp and using vehicles and communication equipment as in an actual field operation. Moreover, Norwegian and Swedish municipalities were actively participating in the exercise by playing their role as local authorities and affected population.

Not all aspects of B-FAST's normal procedures, such as first aid activities, were performed in the TRIPLEX exercise. B-FAST also did not use Groove much during TRIPLEX. However, similar to a real mission, B-FAST conducted assessments. The assessments focused on the real needs of the local people and their environment, shortly after the disaster hit.

Research Methodology

All three authors were embedded in the B-FAST team during the TRIPLEX exercise. As such, we could engage in participant observation. The purpose of participant observation is to gain a close and intimate familiarity with a given group of individuals and their practices through an intensive involvement with people in their natural environment (Jorgensen, 1989). We participated in all activities of B-FAST during TRIPLEX, including the conduct of assessments.

Participant observation gave us the possibility of observing the group processes within the team. We focused on different aspects of group work: how the team members worked together, how they coordinated their work, how they conducted assessments, and how they managed knowledge in the team.

In order to obtain deeper insights into knowledge acquisition and its support by information systems (Groove) in B-FAST missions, we conducted interviews which were structured according to the research model from Figure 1. These interviews were conducted with six out of the nine 'real' B-FAST members who participated in the TRIPLEX exercise. For confidentiality purposes we will only reveal some background information on the interviewees in Table 3.

	Type of role within B-FAST	**Number of years operating in B-FAST**	**Level of experience with use of Groove during missions**
Person 1	Operational	7	inexperienced
Person 2	Operational	5	experienced
Person 3	Operational	1	experienced
Person 4	Operational	5	experienced
Person 5	Operational	5	experienced
Person 6	Managerial	5	inexperienced

Table 3. Information on the B-FAST Interviewees

The interviews lasted on average between 30 and 45 minutes, in which questions were asked from a questionnaire based on the research model. Some of the interviews were conducted during TRIPLEX, others shortly after TRIPLEX. During TRIPLEX most interviews were conducted in the evening after the assessments of the day. The interviews after TRIPLEX were conducted through Skype. All interviews were tape recorded with permission of the interviewees, and fully transcribed.

FINDINGS AND ANALYSIS

Participant Observation

In TRIPLEX the B-FAST team members conducted assessments of the disaster situation and the humanitarian assistance that was required. Relevant knowledge for this was for example knowledge on how to conduct assessments, how to find out what is needed, the characteristics of specific types of disasters and its effect, the general needs after a disaster, how to provide assistance, what type of assistance to provide in different situations, and what cues to focus on in the environment.

For most of the B-FAST team members TRIPLEX was the first venue to work together. During the course of the mission however it was notable that all team members were growing towards one another as they were getting to know each other better, and were taking a lot of effort to adapt themselves to the other team members' behaviors and preferences. This was for example notable in the two different official Belgian languages that were spoken, as people were making an effort to switch to other people's language if it was not understood properly. All team members were actively contributing to the team's mission and objectives, and everybody's contributions and expertise were appreciated and integrated. For example, the team members got to know each other's expertise, and would then consult and share it.

However, many activities performed by the team were ad-hoc based, as there was no formal learning process in place to make us of previous experiences of the organization. Although B-FAST had implemented Groove already in their 'real' missions, it was not much used in the exercise. Groove could play a role to fill this gap, as routine operations can be structured in standard workspaces, and lessons learned from previous missions can be easily documented and subsequently accessed in future missions.

Structured Interviews

Structured interviews were conducted to investigate the role of Groove in the acquisition of knowledge within B-FAST. The results of our questionnaire related to our research model are presented in Table 4.

	G1	G2	G3	G4	L1	L2	L3	L4	L5	L6	E1	E2	E3	A1	A2	A3	A4
Person 1	1	1	1	1	1	0	0	0	1	1	1	0	1	0	1	1	1
Person 2	1	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0
Person 3	1	1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1
Person 4	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1
Person 5	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1
Person 6	1	1	0	0	0	1	0	0	1	0	0	1	1	0	1	1	0

Table 4. Questionnaire Results

The results in Table 4 are presented in dichotomous form, indicating whether there is or there is not a perceived influence of a specific variable. The columns represent the questions related to the different variables discussed previously and shown in Figure 1, while each row represents the answers given by one person. A score of 1 implies a positive perceived effect of Groove (enhancement of process gain, alleviation of process loss, contribution to effective learning environment attribute, contribution to acquisition of knowledge characteristic), while a score of 0 implies a negative perceived effect of Groove (no enhancement of process gain, no alleviation of process loss, no contribution to effective learning environment attribute, no contribution to acquisition of knowledge characteristic). In the following section we go into further detail on these results.

Process Gains

More information (G1): Groove enables team members to get more information from other team members than without the system. Groove facilitates the sharing of information. For example, when B-FAST team members are on a mission, they can get important information through Groove from their headquarters situated hundreds of kilometers from their own position.

More Objective Evaluation (G2): Most interviewees agreed that Groove enables them to better catch errors in the assessment than without the system, as more people can check the same information in the system. One interviewee believed that people will make mistakes anyway, whether they use Groove or not, and therefore did not think Groove would lead to more objective evaluation.

Stimulation (G3): Half of the interviewees thought that the use of Groove works stimulating, and encourages team members to perform better in the team, while the other half of the interviewees disagreed. On a mission, once Groove is set up, almost everyone is motivated to consult Groove from time to time to check whether there are any changes in the workspace. According to other people, Groove could have a negative effect, since people will not be inclined to use it, or people will focus too much on what is happening in Groove and loose attention for the actual work that they need to do in the mission.

Learning (G4): Not all interviewees saw the positive effect of Groove on learning from more skilled or experienced team members. Most B-FAST team members agreed that Groove is useful for looking up information when they need to know something, since more experienced team members can upload their knowledge and information for everyone to consult. However, other people thought that Groove can be quite chaotic in its structure of information and it is difficult to find what you need, while the sharing of experiences is much more effective face-to-face.

Process Losses

Air Time Fragmentation (L1): Although team members can communicate in parallel to each other with Groove, there are restrictions such as the amount of computers that are available (not all team members have their own computer), and the chaos when everybody communicates at the same time.

Evaluation Apprehension (L2): Four team members agreed that Groove does not alleviate the group process loss of the fear of negative evaluation, causing team members to withhold ideas and comments. They have experienced that some information or comments will not be posted, as in Groove it is indicated who posted the information and when they posted it.

Free Riding (L3): Although one person thinks that Groove alleviates free riding as it is possible to see who changed something in the system, the other people think that Groove does not really make a difference for team members to rely on others for completing a task.

Domination (L4): Domination is not always seen to be something bad for B-FAST, as the team leader should be responsible and should control the work that is being done. But Groove is not perceived to alleviate the fact that some team members can dominate the team's task when using Groove, or monopolize the group's time in an unproductive manner.

Incomplete use of information (L5): All interviewees agree that Groove gives team members complete access to and use of information necessary for successful task completion.

Incomplete Task Analysis (L6): All interviewees except one perceive Groove to enable team members to analyze and understand the problem sufficiently, and therefore prevent superficial discussions, as Groove facilitates a better dialogue.

Attributes of an Effective Learning Environment

Active engagement (E1): Five out of six interviewees consider Groove to stimulate team members to become active, autonomous, and confident in knowledge construction; the sixth person disagreed with this statement.

Cooperation (E2): The first interviewee believes that cooperation without the system will be better than when using Groove, all other interviewees consider Groove to encourage team members to support each other for generating and reinforcing understanding.

Problem-based learning (E3): Most B-FAST team members think that Groove contributes to problem-based learning, as it enables team members to perform a deeper analysis resulting in a better understanding of the problem. In Groove information is stored in one place, and it is possible to check in hindsight where things changed or happened.

Characteristics of Acquisition of Knowledge

Identification of appropriate knowledge (A1): Four interviewees agreed that Groove sufficiently contributes to the identification, from external sources, of knowledge in the team. Two others did not consider this to be true, as mostly other means are used for this.

Capturing of identified knowledge (A2): The interviewees were unanimous in their opinion that Groove sufficiently contributes to the capturing of knowledge in the team, as all team member's experiences and knowledge can be stored in the workspace. Interviewee number four had some concerns that this could be improved in Groove, as people now mostly just store anything without thinking too much before uploading it to the workspace. This person also believed that the indication of the different versions of the documents can be improved in Groove.

Organizing of captured knowledge (A3): Once more the interviewees unanimously agreed, now for Groove's contribution to the organization of knowledge in the team. Groove provides the facilities for team members to structure the information, such as through creating and managing the folders in the workspace.

Transferring organized knowledge (A4): Although two thirds of the interviewees considered Groove to sufficiently contribute to the transferring of knowledge in the team, two people did not agree to this, and person two even believed this to be the main drawback of Groove as there is one person in charge of managing the workspace in Groove, and he/she is then responsible for the knowledge transfer in the team.

CONCLUSION

Participatory observation in the TRIPLEX exercise revealed that B-FAST team members were successfully overcoming and exploiting differences in expertise, skills, and language. However, there is room for improvement in the learning process within and across missions. Subsequently, interviews were conducted to investigate how Groove facilitates the acquisition of knowledge within B-FAST. The findings indicate that Groove is generally experienced as enhancing group process gains, but not always considered to alleviate group process losses, such as "free riding" and "domination". Groove is mostly perceived as a good system to create an effective learning environment, and in general contributes to the acquisition of knowledge.

As the findings are based on interviews with only six people, we clearly cannot generalize our findings at this point. However, these results are the starting point for continued research on the use of Groove as a KMS within B-FAST. We will further investigate the influences of the different variables, and study implications on how Groove should be adapted and/or used to make it a successful system in B-FAST for the acquisition of knowledge.

ACKNOWLEDGMENTS

The authors are grateful to the Belgian First Aid and Support Team (B-FAST) – in particular Geert Gijs and Ronald Ackermans – for their support of our research by giving us field training and including us in their exercise mission. The first and third authors are funded in part by the Interactive Collaborative Information Systems (ICIS) project (http://www.icis.decis.nl/), supported by the Dutch Ministry of Economic Affairs, grant nr: BSIK03024.

REFERENCES

1. Alavi, M. (1994) Computer-Mediated Collaborative Learning: An Empirical Evaluation, *MIS Quarterly*, 18, 2, 159-174.
2. Alavi, M. and Leidner, D.E. (2001) Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues, *MIS Quarterly*, 25, 1, 107-136.
3. Bernard, J.-G. (2006) A Typology of Knowledge Management System Use by Teams, in *Proceedings of the 39th Hawaii International Conference on System Sciences (HICSS)*, Kauai, HI, 155a.
4. Bui, T.X. and Sankaran, S.R. (2001) Design considerations for a virtual information center for humanitarian assistance/disaster relief using workflow modeling, *Decision Support Systems*, 31, 2, 165–179.
5. Holsapple, C.W. and Joshi, K.D. (2002) Knowledge manipulation activities: results of a Delphi study, *Information & Management*, 39, 6, 477–490.
6. Jennex, M.E. (2007a) Modeling Emergency Response Systems, in *Proceedings of the 40th Hawaii International Conference on System Sciences (HICSS)*, 1-8.
7. Jennex, M.E. (2007b) Reflections on Strong Angel III: Some Lessons Learned, in B. Van de Walle, P. Burghardt and C. Nieuwenhuis (Eds.) *Proceedings of the 4th International ISCRAM Conference*, Delft, 537-544.
8. Jorgensen, D.L. (1989) Participant Observation: A Methodology for Human Studies, Sage Publications, Newbury Park.
9. King, D. (2005) Humanitarian Knowledge Management, in B. Van de Walle and B. Carlé (Eds.) *Proceedings of the 2nd International ISCRAM Conference*, Brussels, 291-295.
10. Kwok, R.C.-W. and Khalifa, M. (1998) Effect of GSS on Knowledge Acquisition, *Information & Management*, 34, 6, 307-315.
11. Lin, T.-C. and Huang, C.-C. (2008) Understanding Knowledge Management System Usage Antecedents: An Integration of Social Cognitive Theory and Task Technology Fit, *Information & Management*, 45, 6, 410-417.
12. Muhren, W.J. and Van de Walle, B. (2009) Sensemaking and Information Management in Humanitarian Disaster Response: Observations from the TRIPLEX Exercise, in J. Landgren, U. Nulden and B. Van de Walle (Eds.) *Proceedings of the 6th International ISCRAM Conference*, Gothenburg.
13. Muhren, W.J., Van Den Eede, G. and Van de Walle, B. (2008a) Sensemaking and Implications for Information Systems Design: Findings from the Democratic Republic of Congo's Ongoing Crisis, *Information Technology for Development*, 14, 3, 197-212.
14. Muhren, W.J., Van Den Eede, G. and Van de Walle, B. (2008b) Sensemaking as a Methodology for ISCRAM Research: Information Processing in an Ongoing Crisis, in F. Fiedrich and B. Van de Walle (Eds.) *Proceedings of the 5th International ISCRAM Conference*, Washington DC, 315-323.
15. Murphy, T. and Jennex, M.E. (2006) Knowledge Management and Hurricane Katrina Response, *International Journal of Knowledge Management*, 2, 4, 52-66.
16. Nunamaker, J.F., Dennis, A.R., Valacich, J.S., Vogel, D.R. and George, J.F. (1991) Electronic Meeting Systems to Support Group Work, *Communications of the ACM*, 34, 7, 40-61.
17. Senge, P.M. (1990) The Fifth Discipline: The Art and Science of the Learning Organization, Doubleday, New York.
18. Turoff, M., Hiltz, S.R., Bahgat, A.N.F. and Rana, A.R. (1993) Distributed group support systems, *MIS Quarterly*, 17, 4, 399-417.
19. Van Den Eede, G., Muhren, W.J. and Van de Walle, B. (2009) Organizational Learning for the Incident Management Process: Lessons from High Reliability Organizations, *Journal of Information System Security (JISSec)*, 4, 3, 3-23.
20. Van de Walle, B. and Turoff, M. (2007) Emergency Response Information Systems: Emerging Trends and Technologies, *Communications of the ACM*, 50, 3, 29-31.
21. Van de Walle, B. and Turoff, M. (2008) Decision Support for Emergency Situations, in F. Burstein and C. Holsapple (Eds.) *Handbook on Decision Support Systems*, Springer-Verlag, Berlin Heidelberg, 39–64.
22. Van de Walle, B., Van Den Eede, G. and Muhren, W.J. (2009) Humanitarian Information Management and Systems, in J. Löffler and M. Klann (Eds.) *Mobile Response*, LNCS volume 5424, Springer-Verlag, Berlin Heidelberg, 12-21.