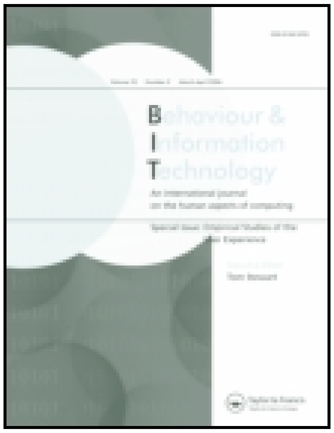

Behaviour & Information Technology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tbit20

# Assessing roles of people, technology and structure in emergency management systems: a public sector perspective

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Published online: 18 Feb 2011.

*Behaviour & Information Technology*
Vol. 31, No. 12, December 2012, 1147–1160



# Assessing roles of people, technology and structure in emergency management systems: a public sector perspective

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*(Received 8 February 2010; final version received 14 July 2010)*

Emergency management systems are a critical factor in successful mitigation of natural and man-made disasters, facilitating responder decision making in complex situations. Based on socio-technical systems, have which four components (people, technology, structure and task), this study develops a research framework of factors affecting effective emergency management. People factors include psychological factors such as responders' self-efficacy, support from family, peers and community, and training. Technology factors are task technology and information sharing. The structure factors are leadership, labour and logistics. Finally, the task factor refers to effective emergency management. This study empirically tests this framework by collecting surveys from emergency responders who participated in the 2006 Buffalo October Storm. The research results demonstrate that training and support positively affect emergency management self-efficacy which, in turn, has a positive significant relationship with effective emergency management. Task technology and information sharing also have a positive impact on effective emergency management. However, findings suggest that the structure factors do not show a significant relationship with effective emergency management. This research presents that human factors in emergency management are essential to conduct effective operations. More importantly, investing in technology to assist responders in performing their jobs during the emergency is crucial during the emergency operations.

**Keywords:** socio-technical systems; responders; emergency management systems; self-efficacy; support; training; task technology; information sharing; leadership; labour; logistics



## 1. Introduction

Disasters such as the 9/11 attacks and Hurricane Katrina raised the profile of emergency management systems since these disasters were very unpredictable and created enormous damage to society. For example, Hurricane Katrina caused an estimated 1570 deaths and an estimated damage of 40 billion dollars. (http://www.usatoday.com/weather/graphics/hurricane/hurricane2005/flash.htm?strmName=Katrina&strmNum=strm12&tabName=a). As risk from natural disasters as well as terrorist attacks has been increasing, emergency management systems emerged as crucial role players in responding to acute situations. Utilising an emergency management system, first responders, members of emergency organisations and agencies who are prime evaluators during the incident, are responsible for making key and immediate decisions in order to reduce damage from the incidents (Sawyer *et al*. 2004). First responders and second responders, who provide the technical support aftermath (Berg 2004) as part of the emergency system, play an important role in managing the emergency effectively.

In October 2006, the worst October storm in Buffalo's history devastated Buffalo areas and did serious damage such as downed trees, lost power, several inches of snow and flooding. Although the Western New York area was well-prepared and well-equipped to deal with typical snowstorms, this severe storm led to resultant chain reactions. Because 2 feet of extremely heavy snow in 2 days fell on thousands of trees, 396,000 residents lost electric power and suffered flooding due to melting snow (New York State Department of Public Service 2007). In addition, the residents had to be prevented from using tap water because of the failure of the water pumping stations in some areas. Even though this area was prepared for natural disasters, this area was exposed and vulnerable,

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ISSN 0144-929X print/ISSN 1362-3001 online

http://dx.doi.org/10.1080/0144929X.2010.510209
http://www.tandfonline.com

which raised the importance of effective emergency management.

Any emergency management system totally depends on the collaboration of human and technological resources. People need to make decisions on complex systems while coordinating all personnel and resources in response to the emergency (Mendonca *et al*. 2007). Technology plays a vital role in efficiently expending human capabilities as a part of the system (Carver and Turoff 2007). In addition to people and technology, the infrastructure was also identified as an essential component of the emergency management system (Kim *et al*. 2005). To develop preparedness, to respond quickly to the disasters, to perform effective mitigation and execute the recovery, all three factors, people, technology and structure, should interact with each other to perform effective emergency management. Because interactions among people, technology and structure factors generate synergy effect of performing effective emergency management, which is considered as a task, this study is based on socio-technical systems (STSs) as a theoretical background to find factors on effective emergency management

The main objective of this research is to develop a framework of factors (people, technology and structure) affecting effective emergency management task and provide useful insights into the critical factors that affect successful emergency management based on STSs. Regarding the human factor, this research looks more specifically into psychological perspectives and experiences of first responders during emergency management. When addressing the technology factors, it examines the role of technology as well as information sharing. Labour and logistic structure is observed as structural factors.

The contributions of this article are twofold. First, this study develops a framework based on STSs theory. Adopting STSs in the context of emergency management, this framework emphasises that the combination of all three factors are antecedents for effective emergency management. Second, this article presents insights, specific to first responders, for disaster planning, execution and mitigation, as well as recovery. This article is organised in seven sections as follows. Second section reviews the background and introduces various emergency management systems. Third section explains the theoretical background of a research framework. Fourth section establishes a research framework with hypothesis. Fifth section describes the methodology. Next section shows the research results. Finally, the last section presents discussion and conclusion.

## 2. Background

Various emergency management systems exist in practice, which share the same objectives but have different characteristics. In 1971, the emergency management information system for the wage price freeze was established to deal with the transportation and coal strikes and severe natural disasters while the system was objected to assist in distributing the proper personnel to coordinate their activities where they were needed (Turoff 2002). E-team (www.eteam.com) provides emergency management solutions which help organisations to collaborate and make a plan for emergency. This system is easy to implement and use and emphasises the importance of having all key players involved in the response to protect lives and properties. The Center for Research on Unexpected Events is a federal agency focused on improving the capability to respond to unexpected events like natural disasters (Arens and Rosenbloom 2003). The most prominent emergency management system is called the National Incident Management System (i.e. NIMS) developed by the Department of Homeland Security. This system is designed to provide comprehensive guidelines of incident management procedures to federal, state and local governments as well as other profit and non-profit organisations in order to work effectively together for prepare plan, response, mitigation and recover in the incidents (FEMA 2004).

DisasterLan (http://www.buffalocomputergraphics.com/content/pages/dlan-crisis-info-mgmt-system) is a flexible system of managing all aspects of the emergency operation centre. As the situation changes, DisaterLan system can be changed to fit a dynamic emergency situation. Additionally, members of an emergency management team can access the system to participate in crisis management activities from outside of the emergency operation centre. Emergency response management information systems also emphasise an auditing requirement since it integrates an emergency response process with decision process (Turoff *et al*. 2004). The emergency medical system enhances the performance of call, response, patching and treatment in critical situation (Horan *et al*. 2005). Finally, a critical incident management system, called emergency management system, deals with natural disasters as well as man-made incidents. This system focuses on utilising people, process and technologies for managing critical incidents such as natural disasters and terrorist attacks (Kim *et al*. 2007).

## 3. Theoretical background

Because of the lack of a theoretical background on the emergency management system, this research applies Socio-Technical Theory (STT), alternatively called STS in this research. STS was introduced as a quest for organisation system to satisfy members and effective tasks (Horan *et al*. 2005). In this approach, a functioning system works interactively as technical system is concerned with process and technology and social system is concerned with the people and structure (Horan *et al.* 2005). This design needs to be applied to the Management Information System area (Bostrom and Heinen 1977). Leaviit classified a diamond shape of components of the organisation which had people, technology, structure and task interacting and adjusting in the complex nature of social systems (Leavitt 1965). The main point of this theory represents that two systems, technical and socio system, need to work together to produce optimised outputs, which makes this approach generate the optimisation of the entire system (Bostrom and Heinen 1977). Aligned components of STSs which maintain stable relationships are capable of conducting the task effectively (Lyytinen and Newman 2008). This research views STT as the whole social perspective and two sub socio and technical systems as organisational perspective.

Social system includes people, knowledge, skills, attitudes in the working environment and relationships and technical system is composed of the devices, techniques and tools to perform the task (Pasmore *et al.* 1982). This research has human factors such as self-efficacy, support and training and structural factors such as leadership, labour and logistics in social system based on STT. It includes technological factors such as task technology and information sharing and tasks as an effective emergency management in technological system. According to socio-technical system, technical systems provide technical functions as well as interactions between technological functions (Moor and Aakhus 2006). In this study, the task is effective emergency management. This framework is proposed to find out how these factors affect effective emergency management. Thus, the final task for people, technology and structure is to achieve the effective emergency management.

Because STT focuses on two systems working together to produce optimised benefits, superior benefits can be generated due to harmonious interaction between the two systems. However, due to the interdependence of the two systems, a small problem can create larger impacts on the systems (DeGreene 1973, Pasmore *et al.* 1982). Another aspect of STT meets the demands of the external environment (Liu *et al.* 2006). Because emergency management has to deal with dynamic environment, the STS is applied to assist responders when making critical decisions during the emergency. STT is based on the view of incorporating two systems: social and technological systems. However, it is assumed that social and technological systems must interact with each other and it does not consider unexpected behavioural problems from human factors. Therefore, in order to eliminate these problems, STT should be applied in various contexts. In addition, people factors should be carefully focused in order to be complementary to STT.

Emergency management deals with a lot of economic loss as well as loss of lives. If all systems work together, benefits will be created such as minimising the economic damage and preventing loss of lives. All members of socio-technical systems including human and technology have one goal of achieving effective emergency management by interacting with each other (Lee and Pritchett 2008). However, if some problems occurred, tremendous negative impacts would be created such as in the example of Hurricane Katrina.

Therefore, this study applies STSs in the context of the emergency management system which has components of people, technology, structure and tasks. In order to perform effective emergency management, social and technical systems need to be interacted actively. Figure 1 illustrates STT.

Prior studies applied the STS approach to various domains in the information systems area. The study of Grover *et al.* (1995) applied STS approach in implementing business process engineering. The research of Lyytinen *et al.* (1998) used STS approach in risk management of software. STS approach was integrated in designing the knowledge system (Lu and Cai 2000). It is also applied for the quality assessment of information systems (Palvia *et al.* 2001). The STS approach was used to make a decision in information technology investment (Ryan and Harrison 2000, Ryan *et al.* 2002). It was also applied in communication and learning in an electronic forum (Kling and Courtright 2003, Kling *et al.* 2003). This

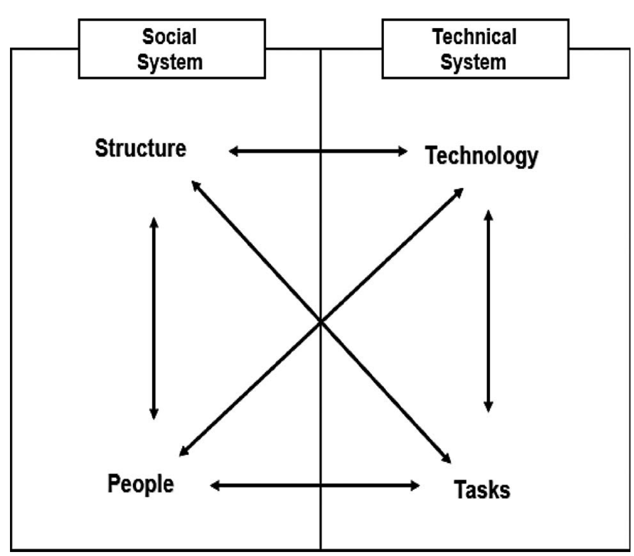


Figure 1. STT adapted from Bostrom and Heinen (1977).

research applies the STS approach in the context of emergency management since two subsystems need to work together in order to perform effective emergency management.

## 4. Research framework with hypothesis

Based on the STSs, we propose a research framework of effective emergency management. Prior literature indicates that people who need to make a crucial decision in a complex environment utilise the technology in order to perform effective emergency management with the support of structure (Carver and Turoff 2007, Mendonca *et al.* 2007). Four components are introduced as main factors in STSs. First, there are people who are supposed to make a decision in complex emergency situation. People who command and control the process in the emergency have to deal with a lot of information as well as extensive work hours (Carver and Turoff 2007). People called first responders also face stress affecting their job performance (Paton and Flin 1999).

In the people factor, this research investigates emergency management self-efficacy. Self-efficacy is tied closely to confidence in one's ability to make effective life-death decision in an emergency (Carver and Turoff 2007). As self-efficacy is widely applied in the Information Systems literature, it is defined as people's judgements of their capabilities to execute and organise actions which are required to achieve performances not with the skills that they possess but with judgements of what they can do with whatever skills they possess (Bandura 1986). Adopting a definition of self-efficacy in the context of emergency management, this study defines emergency management self-efficacy as the responders' confidence in their capability to execute and organise actions in achieving effective emergency management with skills that they possess. It is important to note that the positive relationship between self-efficacy and outcome expectations is supported in the IS literature as well as psychology literature. The higher an individual's computer self-efficacy, the higher his/her outcome expectations and higher computer use (Compeau and Higgins 1995). Adding to these findings, the higher the individual's computer self-efficacy, the higher his/her performance-related outcome expectations (Compeau *et al.* 1999). Self-efficacy was applied in Internet usage. Internet self-efficacy and web-specific self-efficacy turned out to be important factors in improving e-service usage (Hsu and Chiu 2004). The research of Lam and Lee (2006) also found that Internet self-efficacy positively affects personal and performance outcome expectations as well as perceived use competence for older Internet users (Lam and Lee 2006). The research result of Yi and Davis (2003) supported that software self-efficacy positively affected both immediate and delayed task performance in software (Yi and Davis 2003). The study of Moores and Chang empirically proved that self-efficacy positively influences the performance of information systems analysis and design (Moores and Chang 2009). Based on the above discussions, this study proposes the first hypothesis:

> **H1:** Emergency management self-efficacy positively affects effective emergency management.

Training in emergency management receives a lot of attention and is considered as one of the highest priorities. It is directly related to the quality of response and recovery efforts done by emergency staff (Schaafastal *et al.* 2001). Training also enhances responders' understanding in the emergency management system (Perry 2004). Since training is considered a critical factor in emergency management, the positive impact of training on self-efficacy has been discussed in previous literature. Training improved both workers' general self-efficacy and work-specific self-efficacy of their job performance (Schwoerer *et al.* 2005). Martocchio empirically proved that training heightened computer self-efficacy (Martocchio 1994). The research result of Yi and Davis (2003) also provided support that training in using software made a positive impact on software self-efficacy. Consistent with previous literature, training positively influenced computer and Internet self-efficacy (Torkzadeh *et al.* 2006). After training, the research result showed a significant positive difference between pre training self-efficacy and after training self-efficacy in all 17 items of Internet self-efficacy (Torkzadeh and Van Dyke 2002). This research establishes a hypothesis based on above discussions.

> **H2:** Training in emergency management makes a positive impact on emergency management self-efficacy.

It is very important for responders to be supported by their families since they would be stressed by emergency situation. Interaction and support from family and community can serve to modify the stress (Cook-Cottone 2006). Peer support in the organisation also improves their job performance (Randall *et al.* 1999). This study defines support as emotional and psychological support from family, peers and community that responders received in the emergency situation. Since responders need support while conducting their jobs in the emergency, support is regarded as one of the antecedents for self-efficacy. The study of

Compeau and Higgins developed the hypothesis that encouragement by others in an organisation and the support of the organisation itself with the availability of assistance within the organisation increases self-efficacy depending on social cognitive theory. However, their interesting study result showed that encouragement by others and support has a negative relationship with computer self-efficacy (Compeau and Higgins 1995). Unlike their empirical result, previous literature shows positive relationships between support and self-efficacy. According to the study of Vekiri and Chronaki, parental and peer support have a positive relationship with students' computer self-efficacy outside of their school (Vekiri and Chronaki 2008). Encouragement by others has a positive significant relationship with Internet self-efficacy although support, and available assistance did not have a significant relationship with Internet self-efficacy (Lam and Lee 2006). Based on above discussions, this study presents the following hypothesis:

**H3:** Support from family, peers and community that responders received in the emergency positively influences emergency management self-efficacy.

Second, technology plays a very important role in emergency management system. To contribute to the success of the emergency response operations, information and communication technologies support the personnel and enhance improvisation and creativity (Mendonca *et al.* 2007). Carver and Turoff also emphasise the importance of technology which can play a vital role in coping with natural and man-made disasters (Carver and Turoff 2007).

Within the technology factors, information sharing is considered a key factor in the technology because technology helps responders and agencies to share critical information during the emergency. In the critical incident management system, information sharing is one of the factors in the technology affecting efficient decision making in critical incident management system framework (Kim *et al.* 2006). Information sharing is a critical success factor in emergency response systems (Goughnour and Durbin 2008). 9/11 and Hurricane Katrina emphasised the need for information sharing which promotes collaboration and response coordination among government agencies during the emergency (Nabil *et al.* 2008). Information sharing has an effect on executing the response as well as preparing the plan. Information sharing enhances available information for agencies and responders leading to effective planning (Perry and Lindell 2003b). Information sharing facilitated the responders' role and performance because it provided information for effective decision making (Paton and Jackson 2002). Information sharing offers benefits for all agencies regarding their performance in emergency situation. Based on above discussions, this study proposes that:

**H4:** Information sharing has a positive relationship with effective emergency management.

Another factor in technology is task technology which investigates how responders use the technology to perform their tasks applying task technology fit (Goodhue 1995). In task technology, technology is viewed as tools used by persons in conducting their tasks which are actions performed by individuals turning inputs into outputs (Goodhue 1995). This study defines task technology in emergency management as technological tools used by responders in achieving effective emergency management. The study of Goodhue and Thompson proposed that task technology predicted performance impact (Goodhue and Thomson 1995). The research result of Goodhue *et al.* also supported that task technology affected performance (Goodhue *et al.* 2000). Task technology usage in mobile business leads to efficiency of performance in e-procurement (Gebauer and Shaw 2004). Therefore, this study proposes:

**H5:** Task technology in emergency management positively affects effective emergency management

Technology enables responders and government to share their information during the emergency. Collaborative electronic media is positively associated with information sharing (Jarvenpaa and Staples 2000). Information technology enables organisations to share information for cooperation as well as coordination among organisations (Sahin and Robinson 2002). The research of Shen and Shaw developed a conceptual model of information sharing and task technology in emergency response. First, they proposed that information technology capabilities such as communication support and information processing promote information sharing and flow. Second, they proposed that a coordination mechanism such as process and structure also influences information sharing and flow. Thus, this study hypothesises:

**H6:** Task technology in emergency management makes a positive impact on information sharing.

Third, structure is considered as one of critical factors affecting the risk issue of emergency management system (Kim *et al.* 2005). One factor is logistics. Logistics is defined as a structural support for delivering and tracking allocated resources to the affected area. The lack of logistics and logistics staff caused a shortage of resources as well as barriers in on-time delivery in the response to the Tsunami (De Silva *et al.* 2005). Logistics in emergency response has several characteristics: location, transportation, delivery strategy and objectives (Desrochers *et al.* 1990). Emergency logistics planning aims at being optimised to dispatch commodities to distribution centres in the affected area for relief operations in order to minimise the damages (Ozdamar *et al.* 2004). Quick response and urgent relief after natural disasters through efficient emergency logistics distribution is vital to minimise the impact and conduct effective emergency management (Sheu 2007). Based on the above discussions, we hypothesise:

**H7:** Emergency logistics have a positive relationship with effective emergency management.

The other factor is labour. Physical and psychological states affect the emergency managers' decision making and judgement (Paton and Flin 1999). Labour is defined as a structural support for responders to have good physical and psychological conditions to perform their jobs. In the emergency situation, responders have to deal with fatigue in its physical aspects and stress in its psychological context. Labour structure would help them to take enough rest to make a correct decision in the emergency. According to the interview with first responders, they recalled that they could not go home during 2006 Buffalo October Storm, which generated psychological and physical stress. Emergency preparedness plans pointed out that ensuring enough personnel in emergency management is crucial to respond quickly for natural disasters (Perry and Lindell 2003a). Thus, this study proposed:

**H8:** Labour in emergency management has a positive relationship with effective emergency management.

The final structural factor is leadership. In a medical emergency, victims are more fortunate if a strong leader operates a group (Firestone and Lichtman 1975). In fire services, leadership influences positively on fire fighters' performance (Pillai and Williams 2004). Leadership for emergency managers produces positive benefits for emergency management. First of all, supervisors with leadership skills gain control easily in an emergency operation. Second, it promotes team work and coordination among responders. Finally, it reduces stress in decision making (Paton and Flin 1999). One of the reasons for failure in responding to Hurricane Katrina was the lack of leadership in the operation. Leadership plays an important role in establishing collaborative networks among government agencies during the disaster to achieve effective emergency management (Waugh and Streib 2006). Based on above discussions, this study proposes:

**H9:** Leadership in emergency management makes a positive relationship with effective emergency management.

Figure 2 describes a research framework.

## 5. Method

In order to test a proposed research framework of effective emergency management, a structured survey was developed. The survey instruments are adapted from previous literature in the context of emergency management. When new instruments are needed, they were created using extant theories and past research. All items were assessed using a 5-point Likert scale.

Emergency management self-efficacy measured the responders' self-confidence in the emergency situation and adapted from Bandura (1977, 1982, 1986). This study measured support as emotional support that responders received from their family, peers and community during the emergency, which was adapted from Sarason *et al.* (1983), Goldstein and Rockart (1984), Adams *et al.* (1996) and Cook-Cottone (2006). Emergency management training was measured by the effectiveness of responders' training in the emergency (Qureshi *et al.* 2002, 2004). Information sharing measured the information sharing among responders as well as agencies during the emergency, which was adapted from Gosain *et al.* (2004–2005) and Shen and Shaw (2004). This study applied task technology in emergency management which measured the role of technology during the emergency (Goodhue and Thomson 1995, Goodhue 1995, 1998). Emergency leadership measured the existence of leadership in the emergency and the measurement (Conger and Kanungo 1994, Podsakoff *et al.* 1996, Pillai and Williams 2004, Waugh and Streib 2006). As one of structural factors, emergency management logistics investigated the role of transportation in the emergency (Lai *et al.* 2002, 2004). Emergency management labour was measured by labour force flexibility to reduce responders' fatigue (Upton 1994, Zhang *et al.* 2003). Finally, as a dependent variable, effective emergency management measured effectiveness of emergency management perceived by responders (Miller and Doyle 1987, Saunders and Jones 1992, Pitt *et al.* 1995, Yuthas and Young 1998, Chang and King 2005).

For establishing content validity, the survey was first tested through interviews with first responders in

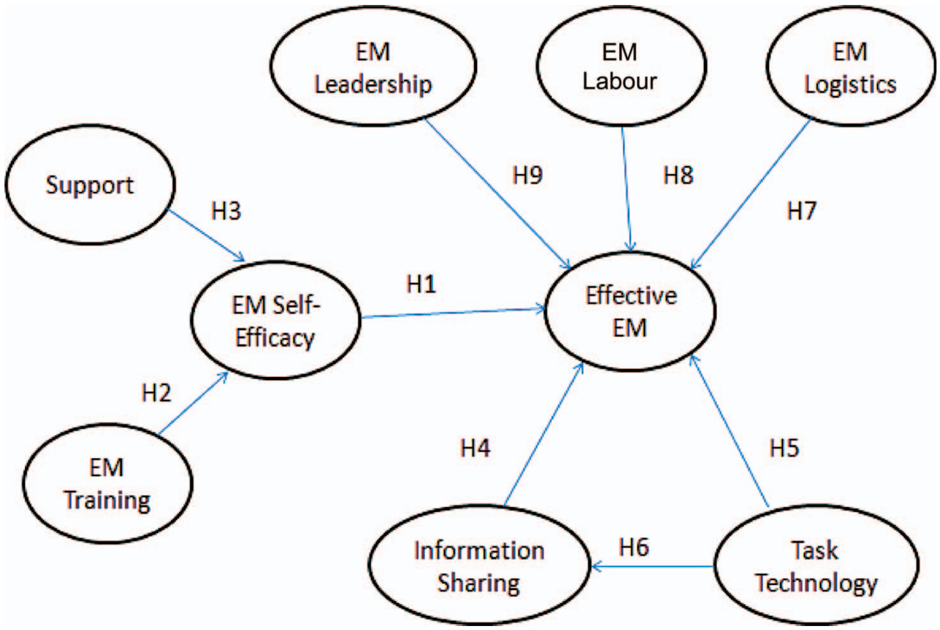


Figure 2. A research framework.

Buffalo areas. Because this research investigated 2006 Buffalo October Storm, interviews and survey contents focused on that incident. The interviewees were asked for suggestions to improve the clarity and contents of the survey. Feedback was also obtained about the format and the time required for completing the questionnaire. Responders were very familiar with contents as well as constructs in the survey. The survey was then refined based on the suggestions received. The survey instruments are described in the Appendix.

Next, the new version was sent to a small group of first responders in the Buffalo area for the pilot study. Eight surveys were returned for the pilot study. The sample size was not large enough to allow for rigorous statistical testing, yet the responses were reviewed to detect further potential problems with the questionnaire. The respondents for the final survey were first responders in Buffalo area and second responders who participated in 2006 Buffalo October Storm emergency operations. In total, 300 surveys were distributed and 190 usable responses were collected from first and second responders, which made 63.33% response rate. Table 1 describes their demographics.

Table 1. Demographics of responders.

| | | | | |
|---|---|---|---|---|
| First responders | | | 134 | |
| | Police | | 40 | |
| | Fire | | 62 | |
| | Medicine | | 24 | |
| | Emergency managers | | 8 | |
| Second responders | | | 56 | |
| Gender | Male: 167 | | Female: 23 | |
| Age | 20s: 48 | 30s: 48 | 40s: 59 | 50s: 35 |

## 6. Results

This study applied the partial least squares (PLS) technique of structural equation modelling (SEM) to investigate the structural model. There are two main reasons for using PLS. PLS, a variance-based approach to SEM, can be used to specify both the relationships among constructs as well as a measurement of constructs (Wold 1989). Compared to LISREL or AMOS, PLS has an advantage of not making any assumptions about population or scale measurement and working with no distributional assumption (Haenlein and Kaplan 2004). The other advantage of PLS is that it is less restrictive with regard to sample size with unbiased estimates (Falk and Miller 1992).

### 6.1. *Measurement model*

Measurement model of constructs in this research is examined with reliability and validity tests. For assessing reliability, factor loadings of indicators on latent constructs are necessary to be greater than 0.7 in order to establish strong reliability (Fornell and Larker 1981). Cronbach's $\alpha$ was also used to assess reliability. The acceptable score for Cronbach's $\alpha$ is 0.7 for existing constructs. Based on these criteria, all indicators of the measurement model shown in Table 2 are seen to be of acceptable reliability.

Composite reliability (CR) and average variance extracted (AVE) were used in this study to assess convergent validity. Values above the threshold value of 0.7 for CR suggest good internal consistency (Hulland 1999). Additionally, AVE, representing proportion of average variance between constructs and indicator variables, needs to be greater than 0.5 to suggest good convergent validity (Chin 1998). All measures of CR and AVE in Table 2 are seen to indicate good convergent validity.

For evaluating discriminant validity, this study followed the suggestion of Fornell and Larker: the square root of AVE should be greater than correlations of variables to prove discriminant validity. Accordingly, the value of diagonal elements should be greater than those of off-diagonal elements (Fornell and Larker 1981, Hulland 1999). Thus the values shown in Table 3 indicate good discriminant validity. Reliability and validity tests for measurement models present an evidence for acceptable measurement quality for constructs in this research.

Table 2. Measurement model.

| Indicator | Factor loading | Cronbach's α | Composite reliability | Average variance extracted |
|---|---|---|---|---|
| Emergency management self-efficacy (EMSE) | | 0.8565 | 0.8902 | 0.5754 |
| EMSE1 | 0.7051 | | | |
| EMSE2 | 0.7059 | | | |
| EMSE3 | 0.8009 | | | |
| EMSE4 | 0.8105 | | | |
| EMSE5 | 0.7769 | | | |
| EMSE6 | 0.7449 | | | |
| Support (SUP) | | 0.7987 | 0.8847 | 0.7211 |
| SUP1 | 0.7160 | | | |
| SUP2 | 0.9150 | | | |
| SUP3 | 0.9019 | | | |
| Training (TRA) | | 0.8784 | 0.9118 | 0.6747 |
| TRA1 | 0.8112 | | | |
| TRA2 | 0.8644 | | | |
| TRA3 | 0.8175 | | | |
| TRA4 | 0.8666 | | | |
| TRA5 | 0.7409 | | | |
| Information sharing (IS) | | 0.9381 | 0.9558 | 0.8440 |
| IS1 | 0.9278 | | | |
| IS2 | 0.9268 | | | |
| IS3 | 0.9401 | | | |
| IS4 | 0.8787 | | | |
| Task technology (TT) | | 0.9395 | 0.9482 | 0.6479 |
| TT1 | 0.8077 | | | |
| TT2 | 0.8608 | | | |
| TT3 | 0.8113 | | | |
| TT4 | 0.8077 | | | |
| TT5 | 0.8522 | | | |
| TT6 | 0.9005 | | | |
| TT7 | 0.7385 | | | |
| TT8 | 0.7752 | | | |
| TT9 | 0.7503 | | | |
| Leadership (LED) | | 0.9445 | 0.9561 | 0.7844 |
| LED1 | 0.8909 | | | |
| LED2 | 0.9200 | | | |
| LED3 | 0.8832 | | | |
| LED4 | 0.9338 | | | |
| LED5 | 0.7920 | | | |
| LED6 | 0.8873 | | | |
| Labour (LAB) | | 0.7127 | 0.8351 | 0.6290 |
| LAB1 | 0.8683 | | | |
| LAB2 | 0.7402 | | | |
| LAB3 | 0.7650 | | | |
| Logistics (LOG) | | 0.8181 | 0.8801 | 0.6481 |
| LOG1 | 0.8208 | | | |
| LOG2 | 0.8424 | | | |
| LOG3 | 0.8230 | | | |
| LOG4 | 0.7290 | | | |

### 6.2. Structural model

The validity of proposed structural model is examined by structural paths and $R^2$. Statistical significance was accessed by bootstrapping. Hypothesis 1 that emergency management self-efficacy positively affects effective emergency management was supported by research results. The research result supported Hypothesis 2 that training in emergency management makes a positive impact on emergency management self-efficacy. Hypothesis 3 that support from family, peers and community that responders received in the emergency positively influences emergency management self-efficacy was confirmed by the research result.

Hypothesis 4 that information sharing has a positive relationship with effective emergency management was also supported by research data. This research result supports Hypothesis 5 that task technology in emergency management positively affects effective emergency management. Hypothesis 6 that task technology makes a positive impact on information sharing was also supported by the research result.

Unlike personal and technological factors, structural factors did not have statistically significant relationship with effective emergency management except for emergency management logistics. Interestingly, Hypothesis 7 was supported by this research result. Since the natural disaster causes delays in logistics, managing logistics during the emergency plays a critical role in performing effective emergency management. Hypotheses 8 and 9 that labour and

Table 3. Correlation between latent variables and square root of AVE.

| | EMSE | SUP | TRA | IS | TT | LED | LAB | LOG |
|---|---|---|---|---|---|---|---|---|
| EMSE | *0.7586* | | | | | | | |
| SUP | 0.4592 | *0.8492* | | | | | | |
| TRA | 0.6833 | 0.3546 | *0.8214* | | | | | |
| IS | 0.2407 | 0.3278 | 0.3866 | *0.9187* | | | | |
| TT | 0.3410 | 0.2435 | 0.5446 | 0.7132 | *0.8049* | | | |
| LED | 0.3194 | 0.2796 | 0.4418 | 0.5548 | 0.5925 | *0.8857* | | |
| LAB | 0.2611 | 0.4211 | 0.4130 | 0.4869 | 0.5480 | 0.5456 | *0.7931* | |
| LOG | 0.4166 | 0.3344 | 0.6316 | 0.6691 | 0.7488 | 0.5768 | 0.5251 | *0.8050* |

Note: [a]Diagonal numbers are the square root of AVE for each construct and off-diagonal numbers are the correlations between constructs.

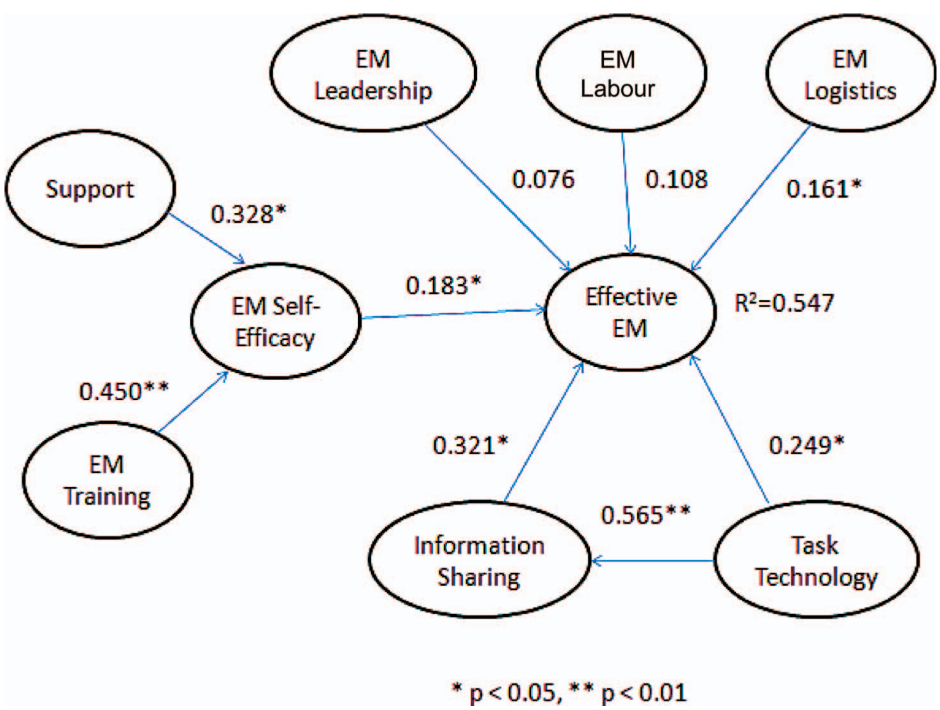


Figure 3. Research result.

leadership have a positive relationship with effective emergency management are not supported by the research result. Comparing to influence of personal and technological factors towards effective emergency management, effect of structural factors such as leadership for supervisors and labour were not large enough to be statistically significant. Figure 3 shows this research result by PLS analysis.

## 7. Discussion and conclusion

This research found that effective emergency management can be achieved by responders' high emergency self-efficacy improving by training and support and technological factors such as task technology and information sharing but not by structural factors such as supervisor's leadership, labour and logistics. Findings of this research contribute to academic and practical world.

This research has several research implications. This study applied STT in the context of emergency management. Since emergency management requires outputs from social and technological systems, this study provides empirical evidence of the applicability of STT in the context of emergency management. This work promotes optimised benefits of collaboration between social and technological systems to achieve effective emergency management. This study establishes a research framework incorporating people, technology and structure factors in the emergency management. All three aspects are considered very heavily in emergency management because lack of one factor can cause a lot of damage in the emergency. It contributes better understanding in the emergency management as it has different perspectives to approach to the emergency management. Previous literature in emergency management focuses too much on technological factors, not on people and structure factors.

This research presents several practical implications. The findings of this research raise the importance of technology in emergency management and support investment on technology in the emergency management. Our empirical research result supports that technology plays a crucial role in achieving effective emergency management. Task technology helps responders to perform their job effectively and encourages responders and government agencies to share critical information to respond quickly to the disaster and develop prepared plan.

This research's findings also pointed out how responders' psychology needs to be taken care of in the emergency situation. Responders received a lot of stress as they had to deal with extreme situation. Emotional support from their loved ones could be very helpful to solve conflict between their work and family during the emergency. In addition, training leads them to be well prepared in making a good decision. These two factors are significant antecedents of increasing self-efficacy emergency management. Finally, this research provides insights for responders to find their weakness where they should spend more effort in the emergency management.

Although this research result supports one hypothesis regarding structure factors, it raises interesting issues, especially on the significance of logistics. Due to the characteristics of the natural disaster, managing logistics is very crucial to transport resources including responders and supporting materials to emergency area. If logistics is delayed, it would generate massive damages to the disaster area. Therefore, this study emphasises establishing the effective logistics plan for the emergency management to reduce the damage.

Like other studies, this research has several limitations. First, this study investigated the 2006 October Buffalo Storm so that the research subjects are first responders in Buffalo area and second responders in US Eastern area. Future research can expand to other areas with different natural disasters. Second, since it applied the survey method, the answers are subjective as this research could not deliver objective measure of effective emergency management. Future study can develop objective measurements of effectiveness of emergency management. Finally, this study could not find out the distinction between the first and second responders due to sample size. Future study can compare the first and second responders to find distinctions.

Prevention is the best strategy for disaster. We empirically examined the people, technology and structure factors affecting effective emergency management. The research framework and empirical findings give out implications which help first responders in practical world and researchers in academic world in the emergency management area. This may provide useful insights for policy makers to develop effective emergency plans. More importantly, this research emphasises the importance of emergency management in society.

### Acknowledgements

This research is supported by NSF Grant SGER 0705292.

### References

Adam, N.R., *et al.*, 2008. Secure information sharing and analysis for effective emergency management. *Proceedings of the 2008 international conference on Digital government research*, Montreal, Canada: Digital Government Society of North America.

Adams, G., King, L., and King, D., 1996. Relationships of job and family involvement, family social support, and work-family conflict with job and life satisfaction. *Journal of Applied Psychology*, 81 (4), 411–420.

Arens, Y. and Rosenbloom, P.S., 2003. Responding to the Unexpected. *Communications of the ACM*, 46 (9), 33–35.

Bandura, A., 1977. Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, 84 (2), 191–215.

Bandura, A., 1982. Self-efficacy mechanism in human agency. *American Psychologist*, 37 (2), 122–147.

Bandura, A., 1986. *Social foundations of thought and action*. New Jersey: Prentice Hall.

Berg, R., 2004. Terrorism response and the environmental health role: the million-dollar (and some) question. *Journal of Environmental Health*, 67 (2), 29–39.

Bostrom, R. and Heinen, J.S., 1977. MIS problems and failures: a soci-technical perspective. Part I: the causes. *MIS Quarterly*, 1 (3), 17–32.

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.

Chang, J. and King, W., 2005. Measuring the performance of information systems: a functional scorecard. *Journal of Management Information Systems*, 22 (1), 85–115.

Chin, W.W., 1998. *The PLS approach to structural equation modeling*. Mahwah, NJ: Erlbaum.

Compeau, D. and Higgins, C., 1995. Computer self-efficacy: development of a measure and initial test. *MIS Quarterly*, 19 (2), 189–211.

Compeau, D., Higgins, C., and Huff, S., 1999. Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly*, 23 (2), 145–158.

Conger, J. and Kanungo, R., 1994. Charismatic leadership in organizations: perceived behavioral attributes and their measurement. *Journal of Organizational Behavior*, 15 (5), 439–452.

Cook-Cottone, C., 2006. The attuned representation model for the primary prevention of eating disorders: an overview for school psychologists. *Psychology in the Schools*, 43 (2), 223–230.

DeGreene, K.B., 1973. *Sociotechnical systems: factors in analysis, design, and management*. Englewood Cliffs, NJ: Prentice Hall.

De Silva, T., *et al*., 2005. Logistics, information technology and telecommunications in crisis management. *Prehospital and Disaster Medicine*, 20 (6), 464–467.

Desrochers, M., Lenstra, J.K., and Savelsbergh, M.W.P., 1990. A classification scheme for vehicle routing and scheduling problems. *European Journal of Operational Research*, 46 (3), 322–332.

Falk, R.F. and Miller, N.B., 1992. *A primer for soft modeling*. Akron, OH: University of Akron Press.

FEMA, 2004. *National incident management system*. USA: US Department of Homeland Security.

Firestone, I.J. and Lichtman, C.M., 1975. Leader effectivenss and leadership conferral as determinants of helping in a medical emergency. *Journal of Personality and Social Psychology*, 31 (2), 343–348.

Fornell, C. and Larker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18 (1), 39–50.

Gebauer, J. and Shaw, M.J., 2004. Success factors and impacts of mobile business applications: results from a mobile e-procurement study. *International Journal of Electronic Commerce*, 8 (3), 19–41.

Goldstein, D. and Rockart, J., 1984. An examination of work-related correlates of job satisfaction in programmer/analysts. *MIS Quarterly*, 8 (2), 103–115.

Goodhue, D., 1995. Understanding user evaluations of information systems. *Management Science*, 41 (12), 1827–1844.

Goodhue, D., 1998. Development and measurement validity of a task-technology fit instrument for user evaluations of information system. *Decision Sciences*, 29 (1), 105–138.

Goodhue, D. and Thomson, R., 1995. Find more like thistask-technology fit and individual performance. *MIS Quarterly*, 19 (2), 213–236.

Goodhue, D.L., Klein, B.D., and March, S.T., 2000. User evaluations of IS as surrogates for objective performance. *Information and Management*, 38 (2), 87–101.

Gosain, S., Malhotra, A., and El Saway, O., 2004–2005. Coordinating for flexibility in e-business supply chains. *Journal of Management Information Systems*, 21 (3), 7–45.

Goughnour, D.A. and Durbin, R.T., 2008. Device independent information sharing during incident response. *2008 IEEE Conference on Technologies for Homeland Security*, Waltham, MA.

Grover, V., *et al*., 1995. The implementation of business process reengineering. *Journal of Management Information Systems*, 12 (1), 109–144.

Haenlein, M. and Kaplan, A.M., 2004. A beginner's guide to partial least squares analysis. *Understanding Statistics*, 3 (4), 283–297.

Horan, T.A., *et al*., 2005. Performance information systems for emergency response: field examniation and simulation of end-toend rural response systems. *Journal of Homeland Security and Emergency Management*, 2 (1), Article 4. Available at http://www.bepress.com/jhsem/vol2/iss1/4.

Hsu, M.H. and Chiu, C.M., 2004. Internet self-efficacy and electronic service acceptance. *Decision Support Systems*, 38 (3), 369–381.

Hulland, J., 1999. Use of partial least squares (PLS) in strategic management research: a review of four recent studies. *Strategic Management Journal*, 20 (2), 195–204.

Jarvenpaa, S.L. and Staples, D.S., 2000. The use of collaborative electronic media for information sharing: an exploratory study of determinants. *The Journal of Strategic Information Systems*, 9 (2–3), 129–154.

Kim, J., *et al*., 2005. An investigation of risk management issues in the context of emergency response systems. *The Eleventh Americas Conference on Information Systems*, Omaha, NE, USA.

Kim, J., *et al*., 2006. Framework for analyzing critical incident management systems. *The 39th Hawaii International Conference on System Sciences*. Hawaii, USA: IEEE.

Kim, J., *et al*., 2007. Efficiency of critical incident management systems: instrument development and validation. *Decision Support Systems*, 44 (1), 235–250.

Kling, R. and Courtright, C., 2003. Group behavior and learning in electronic forums: a sociotechnical approach. *Information Society*, 19 (3), 221–235.

Kling, R., Mckim, G., and King, A., 2003. A bit more to it: scholarly communication forums as socio-technical interaction networks. *Journal of the Amercian Scoiety for Information Science and Technology*, 54 (1), 47–67.

Lai, K., Ngai, E., and Cheng, T., 2002. Measures for evaluating supply chain performance in transport logistics. *Transportation Research Part E: Logiticis and Transportation Review*, 38 (6), 439–456.

Lai, K., Ngai, E., and Cheng, T., 2004. An empirical study of supply chain performance in transport logistics. *International Journal of Production Economics*, 87 (3), 321–331.

Lam, J.C.Y. and Lee, M.K.O., 2006. Digital inclusiveness – longitudinal study of Internet adoption by older adults. *Journal of Managment Information Systems*, 22 (4), 177–206.

Leavitt, H.J., 1965. *Applying organizational change in industry: structural, technological, and humanistic approaches*. Chicago, IL, Rand McNally.

Lee, S.M. and Pritchett, A.R., 2008. Predicting interactions between agents in agent-based modeling and simulation of sociotechnical systems. *IEEE Transactions on Systems, Man and Cybernetics, Part A*, 38 (6), 1210–1220.

Liu, G., Shah, R., and Schroeder, R.G., 2006. Linking work design to mass customization: a sociotechnical systems perspective. *Decision Sciences*, 37 (4), 519–545.

Lu, S.C.Y. and Cai, J., 2000. STARS: a socio-technical framework for integrating design knowledge over the Internet. *Internet Computing, IEEE*, 4 (5), 54–62.

Lyytinen, K., Mathiassen, L., and Ropponen, J., 1998. Attention shaping and software risk – a categorical analysis of four classical risk management approaches. *Information Systems Research*, 9 (3), 233–255.

Lyytinen, K. and Newman, M., 2008. Explaining information systems change: a punctuated socio-technical change model. *European Journal of Information Systems*, 17, 589–613.

Martocchio, J.J., 1994. Effects of conceptions of ability on anxiety, self-efficacy, and learning in training. *Journal of Applied Psychology*, 79 (6), 819–825.

Mendonca, D., Jefferson, T., and Harrald, J., 2007. Collaborative adhocracies and mix-and-match technologies in emergency management. *Communications of the ACM*, 50 (3), 45–49.

Miller, J. and Doyle, B.A., 1987. Measuring the effectiveness of computer-based information systems in the financial services sector. *MIS Quarterly*, 11 (1), 107–124.

Moor, A.E. and Aakhus, M., 2006. Argumentation support: from technologies to tools. *Communications of the ACM*, 49 (3), 93–98.

Moores, T.T. and Chang, J.C.J., 2009. Self-efficacy, overconfidence, and the negative effect on subsequent performance: a field study. *Information and Management*, 46 (2), 69–76.

New York State Department of Public Service, 2007. October 2006 Western New York major snowstorm: a report on utility performance.

Ozdamar, L., Ekinci, E., and Kucukyazici, B., 2004. Emergency logistics planning in natural disasters. *Annals of Operations Research*, 129 (1–4), 217–245.

Palvia, S.C., Sharma, R.S., and Conrath, D.W., 2001. A socio-technical framework for quality assessment of computer information systems. *Industrial Management & Data Systems*, 101 (5), 237–251.

Pasmore, W., Francis, C., and Haldeman, A., 1982. Sociotechnical systems: a North American reflection on empirical studies of the seventies. *Human Relations*, 35 (12), 1179–1204.

Paton, D. and Flin, R., 1999. Disater stress: an emergency management perspective. *Disaster Prevention and Management*, 8 (4), 261–267.

Paton, D. and Jackson, D., 2002. Developing disaster management capability: an assessment centre approach. *Disaster Prevention and Management*, 11 (2), 115–122.

Perry, R., 2004. Diaster exercise outcomes for professional emergency personnel and citizen volunteers. *Journal of Contingencies and Crisis Management*, 12 (2), 64–75.

Perry, R.W. and Lindell, M.K., 2003a. Preparedness for emergency response: guidelines for the emergency planning process. *Disasters*, 27 (4), 336–350.

Perry, R.W. and Lindell, M.K., 2003b. Understanding citizen response to disasters with implications for terrorism. *Journal of Contingencies and Crisis Management*, 11 (2), 49–60.

Pillai, R. and Williams, E., 2004. Transformational leadership, self-efficacy, group cohesiveness, commitment, and performance. *Jouranl of Oranizational Change Management*, 17 (2), 144–159.

Pitt, L., Watson, R., and Kavan, B., 1995. Service quality: a measure of information systems effectiveness. *MIS Quarterly*, 19 (2), 173–187.

Podsakoff, P., Mackenzie, S., and Bommer, W., 1996. Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citizenship behaviors. *Journal of Management*, 22 (2), 259–298.

Qureshi, K., *et al.*, 2004. Effectiveness of an emergency preparedness training program for public health nurses in New York City. *Family & Community Health*, 27 (3), 242–249.

Qureshi, K., *et al.*, 2002. Emergency preparedness training for public health nurses: a pilot study. *Journal of Urban Health*, 79 (3), 413–416.

Randall, M., *et al.*, 1999. Organizational politics and organizational support as predictors of work attitudes, job performance, and organizational citizenship behavior. *Jouranal of Organizational Behavior*, 20 (2), 159–174.

Ryan, S.D. and Harrison, D.A., 2000. Considering social subsystem costs and benefits in information technology investment decisions: a view from the field on anticipated payoffs. *Journal of Management Information Systems*, 16 (4), 11–40.

Ryan, S.D., Harrison, D.A., and Schkade, L.L., 2002. Information-technology investment decisions: when do costs and benefits in the social subsystem matter? *Journal of Management Information Systems*, 19 (2), 85–127.

Sahin, F. and Robinson, E.P., 2002. Flow coordination and information sharing in supply chains: review, implications, and directions for future research. *Decision Sciences*, 33 (4), 505–536.

Sarason, I., *et al.*, 1983. Assessing social support: the social support questionnaire. *Journal of Personality and Social Psychology*, 44 (1), 127–139.

Saunders, C. and Jones, J., 1992. Measuring performance of the information systems function. *Journal of Managment Information Systems*, 8 (4), 63–82.

Sawyer, S., *et al.*, 2004. Mobility and the first responder. *Communications of the ACM*, 47 (3), 62–65.

Schaafastal, A., Johnston, J., and Oser, R., 2001. Training teams for emergency management. *Computers in Human Behavior*, 17 (5–6), 615–626.

Schwoerer, C.E., *et al.*, 2005. General and specific self-efficacy in the context of a training intervention to enhance performance expectancy. *Human Resource Development Quarterly*, 16 (1), 111–129.

Shen, S.Y. and Shaw, M., 2004. Managing coordination in emergency response systems with information technologies. *The Tenth Americas Conference on Information Systems*, New York, NY.

Sheu, J.-B., 2007. An emergency logistics distribution approach for quick response to urgent relief demand in disasters. *Transportation Research Part E: Logistics and Transportation Review*, 43 (6), 687–709.

Torkzadeh, G., Chang, J.C.J., and Demirhan, D., 2006. A contingency model of computer and Internet self-efficacy. *Information & Management*, 43 (4), 541–550.

Torkzadeh, G. and Van Dyke, T.P., 2002. Effects of training on Internet self-efficacy and computer user attitudes. *Computers in Human Behavior*, 18 (5), 479–494.

Turoff, M., 2002. Past and future emergency response information systems. *Communications of the ACM*, 45 (4), 29–32.

Turoff, M., *et al.*, 2004. Assuring homeland security: Continuos monitoring, control & assurance of emergency preparedness. *Journal of Information Technology Theory and Application*, 6 (3), 1–24.

Upton, D., 1994. The management of manufacturing flexibility. *California Management Review*, 36 (2), 72–89.

Vekiri, I. and Chronaki, A., 2008. Gender issues in technology use: perceived social support, computer self-efficacy and value beliefs, and computer use beyond school. *Computers & Education*, 51 (3), 1392–1404.

Waugh, W. and Streib, G., 2006. Collaboration and leadership for effective emergency management. *Public Administration Review*, 66 (1), 131–140.

Wold, H., 1989. *Introduction to the second generation of multivariate analysis*. New York, NY: Paragon House.

Yi, M.Y. and Davis, F.D., 2003. Developing and validating an observational learning model of computer software training and skill acquisition. *Information Systems Research*, 14 (2), 146–169.

Yuthas, K. and Young, S., 1998. Material matters: assessing the effectiveness of materials management IS. *Information & Management*, 33 (3), 115–124.

Zhang, Q., Vonderembse, M., and Lim, J., 2003. Manufacturing flexibility: defining and analyzing relationships among competence, capability, and customer satisfaction. *Journal of Operations Management*, 21 (2), 173–191.

**Appendix**

| Measurement items | Description |
|---|---|
| Emergency management self-efficacy | I was confident about what I had to do during the October Storm.<br>I was confident in my ability to make effective decisions in the emergency.<br>I was confident about my knowledge of the emergency response plan.<br>I was confident in my ability to identify the necessary resources during the emergency using the available systems.<br>I was confident in my ability to provide the immediate support to the emergency area.<br>I was confident in my ability to help the people until the recovery was finished. |
| Support | My family showed me strong support regarding my job.<br>My co-workers were supportive during the emergency.<br>I was satisfied with community support during the emergency. |
| Training | My role as laid out in the emergency plan was clear to me.<br>I knew the emergency preparedness plan well.<br>I knew the command structure that was set up to deal with the emergency.<br>I had the training I needed to make good decisions during the emergency.<br>I was able to respond to the emergency quickly. |
| Information sharing | Information sharing with other agencies was timely.<br>Information sharing among responders was timely.<br>Information sharing enabled better allocation of the resources.<br>Information sharing helped federal, state and local agencies to work cooperatively. |
| Task technology | The information was up to date for my purposes.<br>It was easy to find out what information we maintained.<br>Getting authorisation to access information for my job was easy.<br>I could find equivalent information from different sources.<br>The information system functioned properly during the storm.<br>The information system was accessible during the storm.<br>It was easy to use the computer systems to perform my tasks during the storm.<br>We had the computer support during the Storm.<br>Information technology improved my performance as compared to previous emergency during the Storm. |
| Leadership | When the October Storm was declared an emergency, our supervisor had a clear understanding of what we were supposed to do.<br>The supervisor was able to provide good leadership even when the problems presented by the storm got bigger than a typical local response.<br>When our response to the storm required additional (reserve) personnel, our supervisor was able to integrate new responders so that we were all working together in response plan.<br>Our supervisor provided a good model to follow and led by example.<br>Our supervisor respected my personal feelings.<br>Our supervisor fostered collaboration among workgroups during The storm. |
| Labour | Job rotation worked well.<br>I was working excessively long shifts during the emergency.<br>I had enough personnel support during the emergency. |
| Logistics | Public works arrived at the emergency area on time.<br>Medical support arrived at the emergency area on time.<br>I received the resources that I requested.<br>I could track the resources that I needed using the information system. |
| Effective emergency management | I was satisfied with the preparedness plan.<br>I was satisfied with the response action.<br>I was satisfied with the recovery process.<br>The emergency management system enabled quick decision making.<br>The emergency management system provided communication in a timely manner.<br>The emergency management system helped me to identify problems and errors.<br>The emergency management system improved the quality of my performance.<br>The emergency management system plan helped to streamline the work process. |