Activities in Emergency Management: Evidence from Case Study

Ashir Ahmed
Monash University, Australia
Ashir.Ahmed@buseco.monash.edu.au

Lyfie Sugianto
Monash University, Australia
Lyfie.Sugianto@buseco.monash.edu.au

Abstract - This paper presents an activity based model for the adoption of technology in emergency management. Furthermore, multiple case study has been employed as a research method to validate the proposed conceptual model. The empirical findings from multiple case studies are also reported in this paper. It is hoped that our research findings will better inform researchers in the field and facilitate organizations in adopting technology for emergency management.

Keywords - Emergency management; task-technology fit; case study

I. INTRODUCTION

Emergency or disaster is a term used to describe a situation which has serious threats to human life and property [1] whereas, emergency management is a set of procedures and strategies which are used to manage and control emergency situation. It covers all aspects of emergency situations including risks, consequences, as well as pre and post emergency activities, such as prevention, mitigation, preparedness, response, recovery and rehabilitation [2]. Research in emergency management includes the adoption of technologies and utilization of computerized systems for sensor, communication, simulation, forecast and information management[3-5]. Moreover, the literature relevant to emergency management discipline reported various models to conceptualize types of emergency management phases. A commonly used model consists of four phases of emergency management life cycle including mitigation, preparedness, response and recovery whereas the other popular emergency management models include three-phased model [3], four-phased model [4, 6, 7], six-phased model [6], seven-phased model [7] and eight-phased model [4]. Nevertheless, majority of researchers agreed on the four main phases (stages) of emergency management life cycle such as mitigation, preparedness, response and recovery. Following is a brief description of these four phases of emergency management life cycle.

Mitigation is defined as a process of planning and taking long term risk-reduction measures to eliminate hazards before the occurrence of emergency [8]. As described by Perry [9], preparedness is “a collection of actions taken in order to reduce the vicious consequences of events where there is insufficient human control to institute mitigation measure”. McEntire [10] defined response as “actions taken in anticipation of, during, and immediately after a disaster to ensure that the effects are minimized and immediate attention is provided to victims”. The actions taken following the emergency phase are often defined as recovery phase. This phase includes both rehabilitation and reconstruction and this phase targeted to make the system normal, or near normal.

The organization of the paper is as follows: The following section discusses the research gap and objectives of the research. Next, the classification of emergency management activities is described. The conceptual model is then presented, followed by the research method, data analysis and results. The paper concludes with the conclusion on the empirical findings of multiple case studies.

II. RESEARCH GAP

Literature relevant to emergency management reports several models of emergency management life cycle. Furthermore, one of these models is used as a reference model when the use of a technology is proposed. Due to the lack of standardization among the existing models, the use of technology is generally proposed on the basis of one particular model and may not satisfy the requirements (phases) of other models. Insignificant academic support is available in the relevant literature which standardizes the emergency management models based on the commonalities involved in them. Thus, there is a need of academic research which combines the existing emergency management models and provides a standardize way to adopt a technology in emergency management regardless to any specific model.

III. OBJECTIVES OF THE RESEARCH

This research aims to minimize the complexity involved in the existing emergency management models by classifying the common activities involved in the existing models. This research also addresses the following research question: Which activities are involved in emergency management life cycle? Furthermore, the common activities identified by this research are used along with the task-technology fit model to propose a conceptual model which deals and guides the way by which a technology can be adopted in emergency management.

IV. CLASSIFICATION OF EMERGENCY MANAGEMENT ACTIVITIES

Our study attempts to consolidate the existing emergency management models by classifying the common activities among the existing emergency management models. These
activities are classified after careful consideration of existing models and also based on the general observations of tasks/subtasks involved in overall emergency management life cycle. These activities are categorized into four main types such as authentication, automation, tagging/tracking and information management and are collectively known as AATI (Authentication, Automation, tagging/tracking and information management). The concept of classifying these common activities is shown in figure 1.

Following is a brief description of these activities:

A. Authentication

Authentication is a process by which a system verifies the identity of a user who wishes to access it. Rigorous and flawless authentication system is highly desired in emergency management. Strong authentication assures that only valid users can interact with the system which will eventually minimizes the risks of various manmade disasters such as technological disasters and terrorist attacks. In the context of emergency management, authentication covers the following sub-activities: (i) define policies to implement authentication protocols, (ii) assigning privileges to access the system, (iii) verify all access requests and (iv) block unauthorized access/use of system.

B. Automation

It is a process of using control system such as computers to control machinery and processes, replacing human operators. Reduction in labor cost, working in harsh climatic conditions, and consistent working hours are few advantages of automation. Emergency related experiences suggest that in most emergency cases, the real barriers are not lack of data or insufficient technological capabilities. The real bottleneck is the automatically handling of information. Consistency and efficiency in information processing is highly required in an emergency situation, and it can be achieved by automating the most critical information processing tasks [11]. This activity includes several underlying tasks: (i) identification of tasks which can be done by control systems; replacing humans, (ii) automatic detecting of inputs using sensors, (iii) automatic decision making based on the received data; using artificial intelligence and (iv) using technology to assist in human decision making process.

C. Tagging/Tracking

Tracking is a process of capturing and maintaining the information of any stationary or moving object. During an emergency situation, one of the most important and urgent problems at the emergency scene is the overwhelming number of patients that must be monitored, tracked and managed by responders. The ability to automate these tasks could greatly relieve the workload for each responder, increase the quality of patient care and more efficiently track the patient location and deliver them to the hospital [12]. Tagging/tracking can be further decomposed into following sub activities: (i) marking or tagging of humans and objects, (ii) use these tags to track humans and other objects, (iii) use these tags for human/object management before, during and after emergencies

D. Information Management

Information management is the collection and management of information from one or more sources and distribution to one or more audiences who have a stake in that information or a right to that information. Lack of inadequate and incomplete information is considered to be the main operational problem during emergency management [13]. Any system proposed for the management of emergencies in future should ensure information flows freely and the decision makers act on such information without fail [14]. Information management in emergency management is a collection of several other activities which comes under the umbrella of information management. These sub-activities include: (i) training/drills/exercises, (ii) collect information from various resources, (iii) broadcast warnings/alerts, (iv) building and maintaining information pools and (v) communication with other emergency management organizations

The above mentioned activities and the basic concept of task-technology fit model are used for the development of conceptual model which minimizes the complexity of existing emergency management models and offers a standardize way to adopt a technology in emergency management. Following is the description of conceptual model.

V. CONCEPTUAL MODEL

I. Zigurs, et al. [15] proposed TTF (task technology fit) model which describes the fit between group tasks and the characteristics of technology such as GSS (group support system). The authors further argued that task and technology characteristics should fit in such a way as to enhance group performance. The work by I. Zigurs, et al. [15] in their
TTF model has been used as the basis for developing the conceptual model. By synthesizing TTF and AATI, we propose a conceptual model for adopting a technology in emergency management and it is shown in figure 3.

Figure 3: Conceptual Model for the Use of Technology in Emergency Management.

As shown in figure 3, emergency management activities have been classified into AATI and within each activity, the core capability of the supporting technology is explored. The conceptual model presented in figure 3 also provides criteria to evaluate the feasibility for proposing a technology in emergency management. It defines the scope of emergency management to encompass four types of activities. Subsequently, if a technology is suitable for all these four activities, it is probably suitable for emergency management. Such derivation exhibits the basic concept of task-technology fit model.

VI. RESEARCH METHOD

Considering the fact that case study is an ideal research method when little is known[16, 17], it is used to empirically validate the conceptual model proposed in this study. The selection of case study method for this research is also supported by the following reasons: (i) the aim of this study is to empirically validate the framework of technological adoption in emergency management in real life settings, (ii) case study helps in capturing the experience of relevant people and the context of their actions to better understand the adoption process [18] and (iii) case study is able to take the reader to the sites and information which may not normally be accessible.

Furthermore, we have chosen to employ, multiple cases in this research because they: (i) are required to empirically validate the activities of emergency management life cycle, (ii) provide better support to theoretical replication, (iii) maximize the ability to produce analytically generic results which are highly desirable in this study, (iv) can better explain the behavior of emergency management organizations with regards to the technological adoptions.

A. Strategy For Data Collection

This research aims to provide the generalized results to emergency management organizations. The criteria to select the participating organizations are that they should be involved in the complete emergency management life cycle and they should have used (or willing to use) an appropriate technology in part of or complete emergency management life cycle. Five organizations were used as the case study. Such number of organizations was targeted to cover all the variations in the adoption process within the context of technological adoption in emergency management.

The selection of key informants within those organizations was also crucial. This study aims to record the responses from emergency management organizations in milieu of activities of emergency management. Therefore, in-depth interviews were sought from following three types of informants (i) emergency managers (ii) senior executives and (iii) emergency coordinators.

The interviews were conducted over a 6 month period from mid November 2007 to late May 2008. The case study conducted in this research mainly relies on formal in-depth interviews with key informants, whereas sources other than formal interviews (such as organizational websites, telephonic conversation and other relevant documents) are primarily used to assist in understanding and explaining the interviews material and results. This helps in exploring the contextual richness of the collected data. To record maximum and most relevant data, an interview protocol was also developed.

B. Strategy For Data Analysis

According to Yin [16] data analysis consists of examining, categorizing, tabulating or otherwise recombining the evidence in order to address the initial research question or proposition of study. Furthermore, Yin [16] suggests four dominant analytical models for data analysis: pattern matching, explanation building, time series analysis and problem logic model. Intuitively, pattern matching is the most suitable data analysis mode in our study.

VII. SUMMARY OF RESULTS

In this study, we have employed multiple case studies to validate that emergency management activities include authentication, automation, tagging/tracking and information management. All (five) cases (organizations) highly support authentication, tagging/tracking and information management as key activities in emergency management. Only one organization (case B) out of five showed some concerns on the significance of automation. Similarly, to cover the unplanned results, only one organization (case C) suggested another activity such as “training” in emergency management life cycle. Case “C” suggested that “training” could be a part of emergency management.

This research has already incorporated this activity under “information management/communication”, considering the fact that during the training process, information is actually passed from one person (source) to
other persons (destination). Table 1 lists the importance of AATI in emergency management as informed by the participating organizations.

VIII. CONCLUSION

This paper has introduced an activity-based approach for technology adoption. A proposed conceptual model outlined in this paper includes three major aspects of technological adoption in emergency management, namely identification of task characteristics (AATI) of emergency management, identification of characteristics of a technology to be use in emergency management and synthesizing the task and technology characteristics by using TTF model.

Based on in-depth interviews with key informants, the roles and importance of authentication, automation, tagging/tracking and information management within emergency management have been verified. Based on TTF, we have derived criteria to evaluate the suitability (fitness) of adopting technology for emergency management: by identifying the task characteristics and examine the appropriateness of the technology.

Table 1: EMPIRICAL FINDINGS OF AATI IN EMERGENCY MANAGEMENT

<table>
<thead>
<tr>
<th>CASE SITE</th>
<th>Authentication</th>
<th>Automation</th>
<th>Tagging / Tracking</th>
<th>Information Management</th>
<th>(AATI) AS CORE ACTIVITIES IN EMERGENCY MANAGEMENT</th>
<th>OTHER ACTIVITIES IN EMERGENCY MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>B</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Training</td>
<td>n/a</td>
</tr>
<tr>
<td>C</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>D</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>E</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Legend: (HS = highly supported, N = neutral, NS = not supported, n/a = not answered)

References: