Emergency Management: Technological Innovations Standing at the Vanguard

Jessica L. Buck, Ph.D.
Jackson State University
jessica.l.buck@jsums.edu

Jacqueline Humphrey
Jackson State University
jacqueline.l.humphrey@jsums.edu

Abstract

Due to growing threats of terrorism and ongoing natural disasters, emergency management is at the vanguard of societal concern. With such concern, it is essential that disasters or incidents (planned or unplanned) be managed in a way to cause less harm to people and the overall environment. Emergency and disaster concerns impact federal, state, and local government entities; public and private sector organizations; the general public; and the academic community. However, technological innovations may be incorporated to improve the effectiveness and efficiency in which potential emergency events can be minimized or completely alleviated. Technological systems, such as human-computer interaction, can make emergency response easier, and allow entities to adopt a user-centered systemic approach so that anyone can use the system. Nevertheless, technological integration with emergency and crisis preparedness and management helps to reduce the uneasiness, possible loss, and costs associated with natural and man-made disasters.

This paper examines the types of emergency, crisis, or incidents that have impacted the international and national general public and college communities. This paper also describes some of the technologies that help to reduce or alleviate potential hazards. The potential hazards or disasters are identified as man-made or natural.

Keywords: disaster, emergency management, hazard, incident, technology

Introduction

In lieu of earthquakes, hurricanes, tornados, terrorism, and other natural and man-made disasters, Emergency Management is a pertinent issue that is at the forefront of societal concern. The International Association of Emergency Managers defined Emergency Management as an agenda where communities decrease danger and handle catastrophe [5]. Emergency Management also emphasizes how risks should be avoided. In 2007, the Federal Emergency Management Agency provided the definition of Emergency Management as, "*the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters*" [4]. Such disasters may include natural (i.e. hurricanes, tornadoes, typhoons, tsunamis, earthquakes, and etc.), and man-made (i.e.

terrorism, bio-terrorism, pandemics, school violence, and etc.). Regardless of natural or man-made emergency events, there is a dire need for earlier detection and warning to minimize or prohibit the affects of disasters.

With such considerations, promising inclinations and technologies in emergency response systems are essential for the continuous safety efforts for both the general public and the academic community. Carver & Turoff contended that emergency response systems and processes must be improved with effective and efficient technologies. For example, emergency response information systems and governments should make human-computer interaction easier and adopt a user-centered systemic approach so that anyone can use the system. With this being a demand, there is a demand for more highly skilled people to operate and manage the complex systems [2].

People with such skill sets in the emergency management information systems must be able to absorb information quickly and discern relevance and reliability to determine proper course of action for an emergency incident. In respect of an emergency incident, the computer interface should enhance an emergency responder's capability to plan, train, respond, and evaluate emergencies. The human and computer interaction's aim is to provide an avenue to predict possible emergency events, secure accurate and timely information, dissemination information, and make continuous improvement in emergency management systems. Human and computer interaction is a needed integration, and other technologies serve as an integral facet in the on-going evolution of emergency management [2].

> **Comment [E1]:** May need to rephase

Need for technology incorporation with Emergency Management

Because of public anxieties due to associated loss and cost when disasters manifest, four (4) segments in Emergency Management (e.g. mitigation, preparedness, response, and recovery) must be in place [4]. According to FEMA, mitigation is the attempt to prevent hazarding from developing into disasters. Mitigation aims to reduce effects of disasters once they happen, and it emphasizes long-term measures to reduce or eliminate long-term threat. Preparedness entails an unremitting cycle of planning, organizing, training, equipping, exercising, evaluation, and improvement activities to ensure successful synchronization. Response refers to the mobilization of the necessary emergency services and first responders in the disaster area. Recovery involves the restoration of impacted areas to its previous state. Recovery focuses on rebuilding destroyed property, re-employment, and the repair of other pertinent infrastructure. In additional, recovery may involve mental and emotional restoration where people regain an emotional soundness in wake of a disaster. In adhering to these segments, technology serves as an asset during times of anguish. Useful technologies assist to:

- identify points where emergency management is required;
- identify new technological applications to enhance emergency management systems;
- evaluate technology's effectiveness in time reduction in an emergency;
- provide enhancements for community and campus emergency response systems; and

1

- provide information on strategies to further enhance technology's integration with emergency management.

Although technologies have greatly enhanced within the past decades, emergency management continues to render improvement. According to Mendonca, Jefferson, and Harrald, inventiveness and the development of impromptu organizations can often nullify the benefits of new technology. To ensure that emergency management information systems are able to reach their full potential, they must be designed to allow flexibility in their use; thus, leaving room for inventiveness. Mendonca, Jefferson, and Harrald further indicated that a communication and information technology may be classified according to the combination of process structuring, communication, and information processing support it best provides and the emergency response system is required [1,8].

Where Emergency Management is required

Emergencies are unexpected, and most are presented without fair warning. It is the responsibility of the highest levels of government to the average citizen to secure individual, community, national and international safety. Such responsibilities may fall in the realm of storing non perishable food items, water, and batteries in lieu of a forecasted storm to having emergency respondents and incident commanders posted with plans of actions before and during a sudden incident. Effective emergency management depends on methodical integration of emergency schemes at all levels of government and non-government involvement [3,4]. Activities at each level (individual, group, community) impact the other levels. Frequently, the responsibility may be place on governmental emergency management with the institutions for civil defense or within the conventional structure of the emergency services. In the private sector, emergency management is occasionally referred to as business permanence planning. This is the development and justification of a practiced logistical plan for how a group or institute will reestablish itself, either partially or completely, within a prearranged time after a disaster or extended disruption. Nevertheless, adequate use of innovated technologies positively impact efficiencies when considering time reduction the plan before and after a disaster.

New technologies and time reduction

One integral technology in planning and time reduction is the use of internet. The internet performs numerous capabilities that are vital in Emergency Management. According to Ozceylan and Coskun, internet utilization aids in heightening awareness through web pages that inform citizens. Internet utilization allows opportunity for community discussion groups, making disaster plans available online, providing educational disaster management material to schools, libraries, other community related places, and providing support for training or drills can be used to support cultural factors. Ozceylan and Coskun further insisted that the development of a specific type of information system which will better socio-economic factors; however, they may not be improved within a short time. However, various technology and information system utilization will increase country's progress level, and it will promote more favorable socio-economic situation for disaster management for future implementations. Nevertheless, governments and administrators of local jurisdictions

must support technology in every area. Databases, which provide all kinds of Emergency Management related data to policy makers; a department to follow new developments in disaster management area, a network with other countries' Emergency Management organizations, creating citizen groups to check political decisions might be considered for political factors [11].

In addition, Ozceylan and Coskun affirmed that databases, decision support systems, knowledge-based systems, GIS, Web-based databases, satellite systems, digital libraries, satellite communications, remote sensing, source data automation systems, data collection systems, simulations, intelligent systems, archived data for past disasters, transaction processing systems, simulations, communication systems and software, management information systems, intranet, data mining, data warehouses, resource management and planning systems are some examples of information system and technologies which can be used to support Emergency Management process. These all may be used collaboratively in enhancing emergency response efforts. Another technology approach that may be used in Emergency Management initiatives to reduce disaster risk and to increase response quality is Embedded Intelligent Real-Time Systems (EIRTS) [11].

Additional Technology Application

Main purpose of IS/IT utilization is information sharing among different entities, organizations, and people; resource (equipment, man power, money) planning and management; decision support for upper level administrators or managers; forecasting; effective and fast communication; administration and coordination of organizations and other related agencies; public education (internet); response team training; simulations of different disaster scenarios; damage assessment; and notification and informing public during and after disaster occurrence.

Better hardware, software, and telecommunication backbone, better networks for disaster management, better connection among different agencies and offices, internet based systems, backup systems can be used to support technological factors. The existing literature maintains that IT such as computer networks, virtual reality, remote sensing, GIS, and decision support systems are enhancing disaster communications. Internet/intranets and spatial analysis systems during the mitigation and preparation phases, satellite communications were mainly used during the emergency phase, remote sensing, cellular and radio communications [7]. With the latest technologies rapidly growing in implementation, there is still innovative thought on how college campuses may further benefit.

Technology on college campuses in emergency events

In light of the Virginia Tech massacre in 2007, Johnson and Keen indicated that the university's law enforcement re-evaluated security plans in lieu of the aftermath. Such utmost concerns rapidly moved to campuses in Delaware and North Carolina in which campus patrols increased to calm faculty and students, and to ensure that the act was not repeated on campuses. Soon, college campuses throughout the U. S. began to make efforts to permanently improve emergency plans. College and law officials assessed campus security

programs, which caused review from the Columbine High School shooting massacre and the University of Iowa shooting incident with occurred 16 years prior to the 2007 Virginia Tech shooting. To aid in early warning and possible prevention, technology may be an integral facet to promote progressive efforts [6].

In 2007, Swartz and Hopkins expounded on advanced technology serving as emergency warning devices. The authors reflected on the Virginia Tech shooting where there were 33 deaths. In identifying that there were four email alerts, it was suggested that text messaging may have been the best method of warning students. In 2007, at least 35 universities and colleges had an emergency system which alerted students of planned or unplanned incidences. In addition to e-mail and cell phone communications, social networking is used to announce emergency events. Today, all campuses have this and other sophisticated technologies to aid in students, faculty, and staff safety [11].

Summary

Emergency systems must be improved with effective and efficient technologies in order to meet such societal concerns. Systems such as human-computer interaction can make emergency response easier, and allow entities to adopt a user-centered systemic approach so that anyone can use the system. Nevertheless, technological integration with emergency preparedness will add to reduce the uneasiness, possible loss, and costs associated with natural and man inflicted disasters.

This paper evaluated the integration of technology and activities with recent concerning emergency management. With such events generated by natural or man-made disasters, valuable approaches must be enforced to reflect the current age of technology. Such innovations will assist in developing a deeper admiration which reflects personal emergency consideration—producing exclusive and constant awareness.

Reference

[1]   Coleman, K. (2005). Technology supporting emergency response. *Directions Magazine.*

[2]   Carver, L. & Turoff, M (2007). Human-computer interaction: the human and computers as a team in emergency management information systems. *Communications of the ACM,* 50(3), 33-38. Retrieved from http://delivery.acm.org/10.1145/1230000/1226761/p33-carver.pdf?key1=1226761&key2=5516391031&coll=DL&dl=ACM&ip=143.132.98.99&CFID=16488361&CFTOKEN=27091391 on April 04, 2011

[3]   *Emergency Management* (n. d.). Retrieved from http://www.wikipedia.com/ on September 01, 2010.

[4]   Federal Emergency Management Agency (FEMA) (n. d.). Retrieved from
        http://www.training.fema.gov/ on September 01, 2010.

[5]   International Association of Emergency Managers (2007). *Principle of emergency
        management supplement.* Retrieved from
        http://www.iaem.com/publications/documents/PrinciplesofEmergencyManagement.p
        dfon April 04, 2011.

[6]   Johnson K. & Keen, J (2007). *Universities will reconsider security plans: within
        hours, authorities bolster patrols on campuses*. USA Today. Retrieved from
        http://www.usatoday.com/education/college/arts/articles/200740415.htm/on
        November 29, 2010.

[7]   Marincioni, F. 2007. Information technologies and the sharing of disaster knowledge:
        the critical role of professional culture. *Disasters*, 31(4).

[8]   Mendonca, D., Harrald, J. & Jefferson, T. (2007). Emergent interoperability:
        collaborative adhocracies and mix and match technologies in emergency
        management. *Communications of the ACM*, 50(3) 45–49.

[9]   Mendonca, D. (2007). Decision support for improvisation in response to extreme
        events. *Decision Support Systems* 43(3) 952–967.

[10]   Pine, J. C. (2007). *Technology in emergency management.* Hoboken, NJ: John Wiley
        & Sons.

[11]   Ozceylan, D. & Coskun, E. (2008). Defining critical success factors for national
        emergency management model and supporting the model information systems. 5th
        International ISCRAM Conference – Washington, DC, USA.

[12]   Swart J. & Hopkins, J (2007). *Could cell text alert have helped in VA?: 35 colleges
        have adopted emergency warning system*. USA Today. Retrieved from
        http://www.usatoday.com/education/college/arts/articles/200740415.htm/ on
        November 29, 2010.

Biography

Dr. Jessica L. Buck is an Assistant Professor of Technology in the Department of
Technology (under the College of Science, Engineering, and Technology) at Jackson State
University in Jackson, MS. She also serves as the Program Coordinator of the Technology
Education Masters Degree Program. In addition, she serves as advisor of the Jackson Sate
student chapter of the Association of Technology, Management, and Applied Engineering
(ATMAE) and the trustee for the Delta Beta chapter of Epsilon Pi Tau Technology Honor
Society. Dr. Buck currently serves as Vice-President of the Student Division of ATMAE
(2011-2013).