2010

E-Government Challenge in Disaster Evacuation Response: The Role of RFID Technology in Building Safe and Secure Local Communities

A. Chatfield
University of Wollongong, akemi@uow.edu.au

S. F. Wamba
University of Wollongong, samuel.fosso.wamba@neoma-bs.fr

T. Hirokazu
Kyoto University, tatano@imdr.dpri.kyoto-u.ac.jp

Publication Details

This conference paper was originally published as Chatfield, A, Wamba, SF and Hirokazu, T, E-Government challenge in disaster evacuation response : the role of RFID technology in building safe and secure local communities, 43 Hawaii International Conferences on System Sciences (HICSS), Electronic Government, Emerging Topics, Koloa, Kauai, Hawaii.

E-Government Challenge in Disaster Evacuation Response: The Role of RFID Technology in Building Safe and Secure Local Communities

Abstract

While geographic information systems (GIS) can provide information on the static locations of critical infrastructure and evacuation routes, they do not provide the dynamically changing locations of things and people on the move. In contrast, radio frequency identification (RFID) wireless network technology can automatically identify and track the movement of assets (i.e., fire engines, ambulances, and rescue workers) and vulnerable citizens on the move (i.e., the elderly and the disabled), and hence providing local governments and communities with real-time information and enhanced decision-making capabilities, during chaotic disaster response operations (i.e., evacuation). Although the potential high impact and strategic value of integrating RFID into e-government development and government's comprehensive natural disaster management policy for improved preparedness, response, recovery, and mitigation, very little has been written in the e-government literature regarding the adoption, use, and impact of RFID in building safe and secure local communities for citizens and businesses. This position paper, which is based on a review of the literature and a field case study, intends to contribute to the definition of the e-government research priorities needed to build regional disaster preparedness, as an integral part of e-government development policy.

Keywords

RFID, Disaster Evacuation Response, GIS, GPS, business intelligence, agility, local government, community

Disciplines

Business Administration, Management, and Operations | Business Law, Public Responsibility, and Ethics | Management Information Systems | Physical Sciences and Mathematics | Strategic Management Policy | Technology and Innovation

Publication Details

This conference paper was originally published as Chatfield, A, Wamba, SF and Hirokazu, T, E-Government challenge in disaster evacuation response : the role of RFID technology in building safe and secure local communities, 43 Hawaii International Conferences on System Sciences (HICSS), Electronic Government, Emerging Topics, Koloa, Kauai, Hawaii.

E-Government Challenge in Disaster Evacuation Response: The Role of RFID Technology in Building Safe and Secure Local Communities

Akemi Chatfield
University of Wollongong,
Wollongong, NSW, 2522
Australia
akemi@uow.edu.au

Samuel Fosso Wamba
University of Wollongong,
Wollongong, NSW, 2522
Australia
samuel@uow.edu.au

Hirokazu Tatano
Kyoto University,
Gokasho, Uji, Kyoto, 611-0011
Japan
tatano@imdr.dpri.kyoto-u.ac.jp

Abstract

While geographic information systems (GIS) can provide information on the static locations of critical infrastructure and evacuation routes, they do not provide the dynamically changing locations of things and people on the move. In contrast, radio frequency identification (RFID) wireless network technology can automatically identify and track the movement of assets (i.e., fire engines, ambulances, and rescue workers) and vulnerable citizens on the move (i.e., the elderly and the disabled), and hence providing local governments and communities with real-time information and enhanced decision-making capabilities, during chaotic disaster response operations (i.e., evacuation).

Although the potential high impact and strategic value of integrating RFID into e-government development and government's comprehensive natural disaster management policy for improved preparedness, response, recovery, and mitigation, very little has been written in the e-government literature regarding the adoption, use, and impact of RFID in building safe and secure local communities for citizens and businesses. This position paper, which is based on a review of the literature and a field case study, intends to contribute to the definition of the e-government research priorities needed to build regional disaster preparedness, as an integral part of e-government development policy.

1. Introduction

The "Future Directions for IEEE Conference Business" identifies radio frequency identification (RFID) as one of the ten new and emerging technologies that, when effectively deployed, can offer high impact and high strategic value in addressing key global issues and challenges that are inter-related: disaster preparedness and disaster recovery, security, megacities, energy, environment, and healthcare (p. 1) [2]. Similarly, the Japanese Government's RFID promotion policy considers RFID deployment, beyond the supply chain management context, as critical to address societal issues such as disaster prevention and environment protection [3]. Against these new directions and insights, the RFID literature shows that, while some technological feasibility and maturity has been demonstrated through the proof of concept projects, the adoption, use, and impact of RFID studies, tend to be a single focal firm adoption setting [4-7] and largely in a retailing sector [7-11]. In fact, [12], in their review of academic literature on RFID, found that the highest frequency of peer-reviewed papers on RFID technology was concerned with retail sector. More recently, however, studies on the deployment of RFID across the traditional firm boundaries, at the supplier chain level, are emerging in the private-sector third-party logistics operations in Canada [13] and in Japan [14]. Furthermore, the adoption and deployment of active RFID tags for improving defence logistics and high-value asset management was reported, for example, by the US Department of Defence [15] and the Japan's Self Defense Forces [3]. Despite the economic and social impacts of the recent catastrophic natural disasters on the affected communities, however, there is clear lack of research awareness and studies in the e-government literature, regarding the role of RFID technology in improving disaster preparedness and response and building safe and secure local communities for citizens and businesses. Therefore, this position paper, which is based on a review of the literature and a field case study, intends to contribute to the definition of the e-government research priorities needed to build regional disaster preparedness, as an integral part of e-government development policy.

More specifically, this research draws on prior study on RFID [16] to examine the following three questions:

(1) What are critical challenges facing local governments in improving the level of preparedness and response against catastrophic natural disasters?

Chatfield, A., Fosso Wamba, S. and Hirokazu, T. (2010). E-Government Challenge in Disaster Evacuation Response: The Role of RFID Technology in Building Safe and Secure Local Communities. 43 Hawaii International Conferences on System Sciences (HICSS), Electronic Government, Emerging Topics, Koloa, Kauai, Hawaii.

(2) What is the current status of RFID deployment in disaster evacuation?

(3) What are the potential barriers to integrate RFID technology into a more comprehensive natural disaster evacuation policy towards building regional disaster preparedness, as an integral part of the existing e-government development policy?

In this research, we present and discuss an analysis of the existing natural disaster management literature to address the first question. We then discuss three areas of RFID deployment in evacuation operations. Methodologically, the first case study is an analysis of primary data collected through a field study, while the second and the third case studies are based on an analysis of secondary data. Furthermore, we relate this analysis to prior research on private-sector RFID deployment across the extended enterprise supply chain and value chain networks to identify the potential institutional and technological barriers to integrate the RFID technology into a comprehensive natural disaster evacuation policy that may involve multiple jurisdictions of local governments in the event of a catastrophic disaster. In this paper, we view the IT-enabled government disaster management policy as an integral part of e-government development policy, with the overarching aim being to increase collaborative disaster management capabilities across local governments.

The remainder of this paper is structured as follows: Section 2 presents critical challenges facing local governments in improving the level of preparedness and response. Section 3 is a literature review of RFID technology benefits classification developed in the context of RFID deployment in the private sector. Section 4 discusses the deployment of RFID technology in the public sector for natural disaster evacuation. Section 5 identifies and discusses the potential barriers to integrate RFID and other technological complements, such as GIS, into a comprehensive natural disaster evacuation policy. Section 6 is the conclusion of the study on the role of RFID in government towards building safe and security local communities, research limitations, and future directions.

2. Challenges in disaster preparedness and response

There are five inter-related issues that are emerging in the literature on emergency management and disaster prevention. They are major challenges facing local governments, because many invested in e-government development for better information access and service delivery with limited resources, and at the same time, they are under the growing pressures to improve the jurisdiction's disaster preparedness and response in the event of a catastrophic natural disaster.

2.1. The overarching goal of natural disaster management

The overarching goal of natural disaster management activities is "to reduce, as much as possible, the degree to which a community's condition is worsened by a disaster relative to its pre-disaster condition" (p. 48) [1]. However, the recent catastrophic natural disasters, such as the 1994 Northridge Earthquake, the 1995 Great Hanshin Earthquake, the 2004 Indian Ocean Tsunami, the 2005 Hurricane Katrina, and the 2009 Australian bushfires and floods, have shown so painfully that it is very difficult to achieve this goal because of the very nature of natural disasters (p. 48) [1]:

- Disasters are large, rapid-onset incidents relative to the size and resources of an affected jurisdiction;
- Disasters are uncertain with respect to both their occurrences and their outcomes;
- Risks and benefits are difficult to assess and compare;
- Disasters are dynamic events;
- Disasters are relatively rare.

2.2. Interdependency across the natural disaster management cycle phase activities

A comprehensive emergency management cycle consists of four temporal phases: preparedness, response, recovery, and mitigation [17], which is shown in Figure 1. Here the interdependence across these four linked phases and between the adjacent phase activities should be recognized. For example, what was done or rather what was not done at the preparedness phase, to a large extent, determines the level of government disaster response capabilities at the next response phase. Each phase involves the management and coordination of a wide array of government decision makers, emergency response teams, and community-based non-government organizations. Prior research on RFID has provided strong support for improved management and coordination of multiple stakeholders in business contexts [18]. Therefore, the management and coordination of each phase may be improved by making real-time location-aware information about people and high-value assets available through the use of RFID technology and web-based geographic information systems (GIS). In this paper, we view

RFID and GIS as technology complements, not substitutes. Effective government disaster management needs to integrate these technologies into e-government policy for better disaster management.

- Preparedness: prior to disaster, preparedness activities are designed to plan for unthinkable and increase the readiness of organizations and communities to respond to a disaster timely and effectively. "Disaster plans are often developed by individual agencies, but one challenge of disasters is that they demand action from agencies and organizations that may not work closely together from day to day" (p. 50).
- Response: activities such as search-and-rescue efforts are undertaken immediately following a disaster "to provide emergency assistance to victims. The response phase starts with the onset of the disaster and is devoted to reducing life-threatening conditions, providing life-sustaining aid, and stopping additional damage to property" (p. 52).
- Recovery: short- and long-term activities undertaken after a disaster "that are designed to return the people and property in an affected community to at least their pre-disaster condition of well-being. In the immediate term, activities include the provision of temporary housing, temporary roofing, financial assistance, and initial restoration of services and infrastructure repair. Longer-term activities involve rebuilding and reconstruction of physical, economic, and social infrastructure and, ultimately, memorializing the losses from the event".
- Mitigation: activities undertaken "in the long term after one disaster and before another strikes that are designed to prevent emergencies and to reduce the damage resulting from those that occur, including identifying and modifying hazards, assessing and reducing vulnerability to risks, and diffusing potential losses.

In short, it is a set of sustained activities designed to reduce the impacts of future disasters. Mitigation involves implementing policy changes and new strategies.

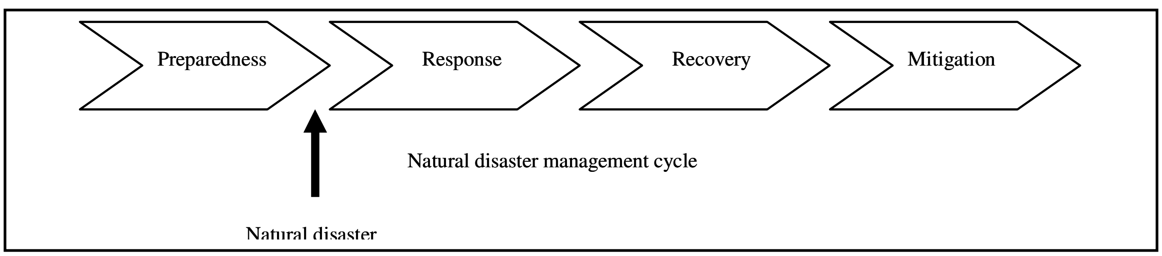

Figure 1 Disaster management cycle (adapted [1])

2.3. High-level collaboration & coordination across multiple jurisdictions at all levels of government

The natural disaster response begins at a local-level, very often requires high-level collaboration and coordination of multiple local government jurisdictions for joint decision-making and joint action, and may, depending on the scale, shift to a state or federal level disaster response [19]. There are at least two issues here. First, the high level of collaboration and coordination required does not exist at the pre-disaster "business as usual" times, particularly at the local government levels of public administration. In Australia and Japan, we often find (large size) city councils` e-government websites that include a natural disaster policy, hazard maps, and an evacuation plan, all of which are limited to the single jurisdiction.

It is doubtful of the effectiveness and efficiency of this current approach to local government disaster management policy, if a catastrophic disaster does strike the local region and overwhelms the jurisdiction's preparedness with limited disaster assets and resources. Second, the instantly formed coalition, across multiple jurisdictions, is unstable and often operates sub-optimally. This is usually demonstrated by slow response times, when time is indeed critical during the response phase of the disaster management cycle, and the speed of rescue and evacuation matters. Therefore, it is imperative for the local governments in the region to improve regional disaster preparedness jointly, by assessing both the potential risks and the relevant infrastructure that may enhance agile response capabilities [20]. In Australia, the local governments play a central role in emergency management planning and disaster preparedness through land use zoning and policy and the enforcement of building control standards, though they are not providers of emergency services [21].

2.4. Economic and Social Costs of Natural Disaster

The economic and social costs of natural disasters are considerable and rising [22], while the attribution of the increasing costs of disaster losses varies from abrupt climate change [23] to the failure to manage societal vulnerability to natural disasters [24]. Figure 2 below shows the reported economic costs of natural disaster damages in 2007. For example, the economic impact of the 2004 Indian Ocean Tsunami on Moldavie was more than 60% of national GDP, and that of the 1995 Great Hanshin Earthquake cost Japan approximately 2% of the nation's GDP [25].

Often social costs of natural disasters are not accurately assessed in the reported economic costs. For example, the 1995 Great Hanshin Earthquake cost 6,437 deaths and 105,000 totally collapsed houses [25]. Moreover, the full recovery to the pre-disaster level among the local communities with lower socio-economic groups has been slow and challenging [36]. Furthermore, a 1997 study found that 10% of those who failed to evacuate identified inadequate economic or social resources as the major reason for their failure to evacuate after a major disaster struck the area [26].

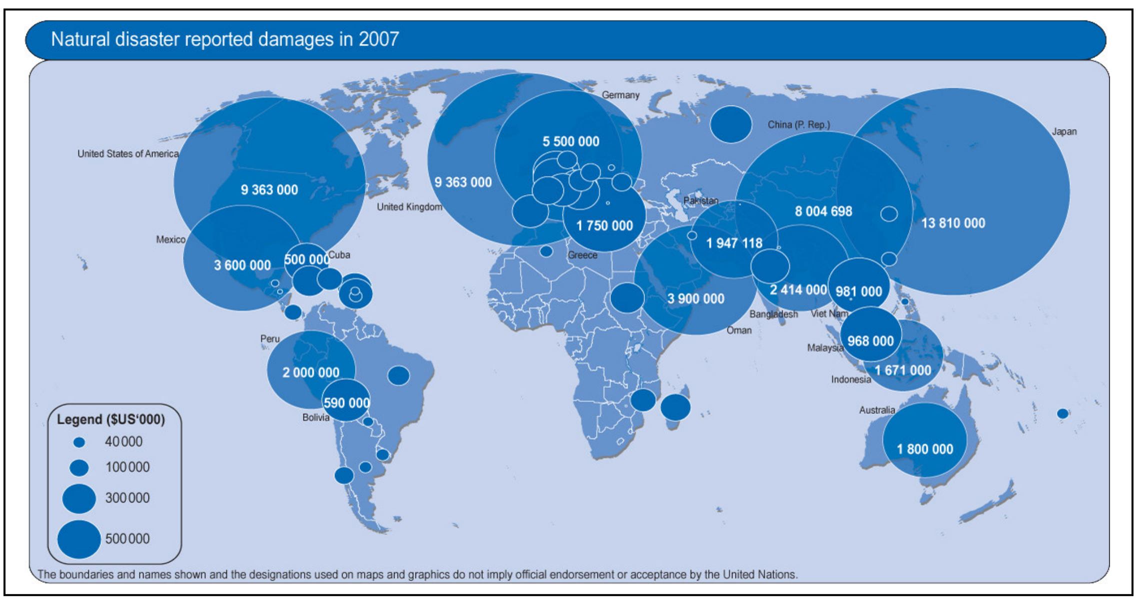

Figure 2 National disaster reported damages in 2007: (http://www.emdat.be)

Similarly, vulnerable populations living outside of the city without economic resources and social networks were among the last to evacuate from the Hurricane Katrina disaster [27]. These studies as well as government publications [28, 29] suggest the need for evacuation research for the vulnerable populations – the socially isolated elderly at home without social networks and patients at hospitals and nursing homes – so as to mitigate evacuation risk and assure their safe and effective evacuation from a major disaster's harm's way. As a result, if we take these social costs into account, real natural disaster damages are likely greater. Furthermore, the figure also shows that the economic costs are not confined to developing countries but are rather wide-spread globally.

2.5. Information on location and movement matters

"Virtually every aspect of emergency management requires knowledge of where" (p. 44) [1]. Governments at all levels use various information systems, such as geographic information systems (GIS), to obtain accurate and timely information on the location of a disaster, the magnitude of its impact on the impacted communities, the locations of the assets that will be required in the immediate response, the locations of critical infrastructure (i.e., power and water) and evacuation routes, and the locations of hospitals and nursing homes where many are confined without own evacuation vehicles, and the nursing home patients.

Lack of the timely and accurate information on the locations was a critical barrier to evacuate those who were impacted by Hurricane Katrina effectively and efficiently.

Therefore, the mitigation or prevention of the potential natural disaster economic and social costs through RFID deployment will create an economic value for the government stakeholders (e.g. policy makers and disaster response teams), as well as to the community stakeholders (e.g. citizens and businesses).

3. A literature review of RFID in the private sector

Little has been written about the strategic value of deploying RFID in disaster management. Yet, in business applications, particularly the supply chain management, the strategic value of RFID deployment has been identified. For example, in the context of supply chain management, [8] identified four types of RFID benefits: response-time, visibility, productivity, and shrinkage. In a case study of RFID impact in utility industry supply chain management, the RFID benefits are classified across supply chain layers: supplier level, distribution center level, store level, operator level, and recycler level [30]. In another supply chain context, five types of shared RFID benefits across the supply chain are identified: reduced shrinkage, reduced material handling, increased data accuracy, faster exception management, and improved inter-firm information sharing [31]. Moreover, this study identifies the unique RFID benefits for each of the supply chain stakeholders: production tracking, quality control, and supply and production continuity for manufacturers/suppliers; material handing, space utilization, and asset management for distributors/logistics providers; and reduced stock-outs, customer service, after-sales service, and lower inventory for retailers. In a different study on the strategic value of the RFID technology in logistics, the RFID benefits are discussed according to the strategic impact of the RFID technology on sourcing and manufacturing logistics, warehousing logistics, distribution logistics, and retailing logistics [16]. Furthermore, prior research identifies three strategic dimensions in analyzing the strategic impact of the RFID technology: process, information, and decision-making [31-33].

Based on an analysis of the literature on the existing RFID technology benefits classification that was discussed above, we have identified three generic types of RFID benefits that may be useful for local governments to develop new organizational information processing and decision-making capabilities in order to meet the challenge for better disaster preparedness and response we discussed in Section 2. They are: [a] critical asset tracking and management [31, 32, 34, 35]; [b] location-aware information availability [31, 36], visibility and information sharing [30-32, 36-38]; and [c] decision-making speed and effectiveness [18, 31, 38]. A framework developed to discuss these benefits was explained elsewhere [39], and is not discussed in this paper.

4. Current RFID deployment in disaster response

Although the deployment of RFID technology in natural disaster management is slowly emerging, the number of RFID applications in natural disaster management is still very dismal in comparison to its rapid growth in defence logistics and supply chain management. In this section, we present and discuss some of the promising innovative applications in the literature.

4.1. State of Texas emergency evacuation SNETS

Nearly every year, thousands of the local community residents in Texas are forced to evacuate when a big storm moves through the Texas Gulf Coast. Based on our field study interview with a senior manager, the State of Texas is the first state government in the US to implement a RFID-enabled emergency evacuation system [3]. The RFID system, referred to as the Texas Special Needs Evacuation Tracking System (SNETS), is capable of identifying and tracing evacuees with special needs, when the State's Governor's Division of Emergency Management (GDEM) calls for a state evacuation. During an evacuation, GDEM dispatches buses, often thousands, depending on the scale of evacuation required, to collect them at pre-designated locations.

Despite their special needs, however, they must make their own way to the collection locations. It is unclear about the distance they have to travel or the availability of alternative collection points mapped, if they were blocked in a disaster. Once they reach the locations, each receives a wristband with RFID passive tags and a back-up bar code. According to a senior manager of the State of Texas Division of Emergency Management, the bar code is added to facilitate local hospitals without RFID readers in case some of the evacuees need to be sent to one of those hospitals. The RFID tag includes a unique automatic identification number, an index, for each evacuee. The bar code is scanned by a State emergency worker, using a handheld computer, to read the evacuee identification number and also enter his/her personal information, all of which will be transferred over the AT&T/Cingular

wireless network to the state database in a secure remote site. In order to address privacy concerns, the State of Texas has adopted "a data-on-network" strategy, rather than "a data-on-tag" strategy [40]. Therefore, the government does not store personal information on the passive tag. Instead, it uses the index stored on the tag to link the evacuee to his/her personal data (e.g. medical record) stored elsewhere.

The movement and location of thousands of buses, which transport evacuees to different evacuation shelters, can be tracked and traced by placing a GPS inside each bus. The Command and Control Center decision makers are enabled by the enhanced visualization of the road traffic conditions and the real-time evacuation progress. The safe arrival of evacuees can be read simultaneously when they pass through one of RFID reader portals installed at the evacuation centers. As long as the RFID bracelets are worn, the GDEM decision makers have real-time access to the critical information on "where" a given evacuee with special needs is located within any evacuation center and even when he/she is moved elsewhere, for example for medical treatment. The SNETS has been tested successfully in three simulated evacuations. However, it was not yet tested in a real natural disaster. The RFID system is a stand alone without an obvious e-government link. Importantly, to date, the state government has not adopted RFID for improving logistics for sourcing, transporting, storing, and distributing emergency supplies such as food, medicines, blankets and other daily necessities. The two key challenges facing the State of Texas Government are: (1) the adoption and diffusion of the SNETS by regional hospitals and emergency medical professionals, and (2) the integration of the SNETS with e-government service to share real-time information with concerned families and relatives about evacuation.

4.2. Harvard Medical School identifies the dead

A major natural or man-made disaster (i.e., 9-11 terrorist attacks) kills a large number of people in a short span of time. This presents a serious challenge to the emergency services and local governments: they must identify the victims as quickly and accurately as possible, under the intensive political and social scrutiny. After the identification of the victims, their bodies must be moved to hospitals, morgues, or temporary cold storages for further processing.

With the recent catastrophic natural disasters, such as the 1995 Great Hanshin Earthquake (6,437 people dead), the 2004 Indian Ocean Tsunami (170,000 people dead or missing), and the 2005 Hurricane Katrina (238 people dead), the need for improved, transparent, and accountable information processing governance has emerged. Families, governments, and societies want to know where the bodies were identified and where they were moved. Meeting this information need, without the use of IT, is daunting.

[41] reported the use of RFID implant chip that is injected into an arm of the dead as a means for automatic body identification. The RFID chip contains a unique number to identify the body. Once the RFID chip is implanted, this project enables Harvard Medical School and other adopters to trace the movement of the several bodies in transit, and the destination of the bodies.

While this application uses an invasive implant chip, alternative approaches, such as RFID bracelets used by the State of Texas, can be used efficiently without an increase in total operational costs.

4.3. Evacuation simulation model validation

Many emergency evacuation simulation models have been developed to understand human evacuation behavior under a chaotic disaster scenario. However, validation of these research simulation models is costly, because it would require the manual recording, by human observers, of repeated experiments, in which human participants evacuate and exit a building – physically, not virtually.

In this innovative use of RFID technology [42], the human participants wore EPC RFID tags. The tag was mounted on a 1/4 inch Styrofoam backing, which was clipped to the fronts of each participant's shirts. A RFID reader automatically recorded the evacuation movements of the five participants during four trials. The experiment findings show that the last two trials achieving 100% accuracy between the simulation model evacuation behavior and the human participant evacuation behavior. This academic research provided support for the value of RFID to validate the existing emergency evacuation simulation models, so as to increase our understanding of better ways to evacuate the general population and the vulnerable populations such as the elderly and the disabled.

The three innovative applications discussed above show that the most likely strategic value for local government and community stakeholders from the RFID technology deployment in the natural disaster response phase is the new real-time availability of information on the locations and the dynamic movement of people. This increased visibility of evacuation operations is, we believe, critical and valuable to multi-jurisdiction decision makers and community stakeholders who are involved in disaster management. While this research did not directly address the question of critical asset tracking and management through RFID, this capability has been demonstrated in the private sector supply chain applications as well as the defence logistics applications discussed earlier in this paper.

5. Barriers to RFID integration into disaster response policy

There are several institutional and technological barriers to wider use of wireless RFID network technology in governments and to the integration of this technology as an integral component of effective government disaster response policy. Institutional barriers include privacy concerns and perceived risk held among citizens and academic researchers about government adoption of RFID [43]. As we have discussed the strategic choice made by the State of Texas, RFID technology provides strategic options with regard to storing personal information on a RFID tag or on a network [40]. Furthermore, advanced RFID tags provide "a kill" function to permanently disable a tag after the purchase of a RFID-tagged product or a "lock" function to lock or unlock the RFID-tagged product to read and update product information [44]. Like any innovative use of potentially pervasive technologies, government at all levels needs due diligence in protecting privacy and security of personal information. However, government can address the privacy concerns and perceived risk issues with careful consideration of technological safeguards. E-government channel provides an effective mechanism for the education and awareness of technological options that need to be better understood by all stakeholders who are involved in disaster management.

Drawing on prior research on the RFID benefits realization, one of the most critical barriers is the lack of leadership vision for the role of RFID technology in transforming the interdependent disaster management processes and activities. There are some notable exceptions, as we have discussed in this paper, such as the State of Texas and the Japanese Government's RFID promotion policy. Our observation is consistent with the leadership and organizational learning literature, which shows strong evidence for the importance of executive leadership for guiding and steering the process of organizational transformation, allocating and committing resources, and supporting second-order organizational learning [45-48]. It is because the effective execution of the interdependent disaster management processes and activities involves high-level collaboration and coordination across a complex network of multiple stakeholders – policy makers, government executive decision makers, emergency response teams, NGOs within a single government jurisdiction. However, in the event of a catastrophic natural disaster that overwhelms a single jurisdiction and affects a wider local area involving multiple jurisdictions. Therefore, in the event of a catastrophic natural disaster, the high-level collaboration and coordination required for the speed in evacuation and rescue becomes nearly impossible without real-time location information about the dynamic movement of assets and the vulnerable populations. .

However, the RFID and information systems (IS) literature has provided strong support for the hypothesis that organizations do not realize the full business benefits from IT when their IT vision is merely to automate the existing processes, through the implementation of a new IT system, and are unwilling to commit further resources to achieve IT-enabled organizational transformation [46, 49]. The same challenge exists in realizing the potential full benefits from e-government development without organizational transformation through e-government [50-53]. This has been shown in the e-government literature on the limited benefits realization from the implementation of only informational web sites at local government levels, without much rapid progress in "the movement toward integrated and transactional e-government" (p. 64)[54].

In order for the local governments to build safe and secure communities at the regional level across jurisdictions, a coalition of executive decision makers from the adjacent local governments need to develop a shared vision for RFID deployment and share economic and non-economic resources, such as technological knowledge resources across the jurisdictions. However, this is not easy given the existing budget administration in the public sector. E-government research needs to pay greater research attention to disaster management and to investigate institutional and technological barriers to better use of RFID technology in disaster response.

6. Conclusion

Despite the economic and social impacts of the recent catastrophic natural disasters on the affected communities, however, there is clear lack of research awareness and studies in the e-government literature, regarding the role of RFID technology in improving disaster preparedness and response and building safe and secure local communities for citizens and businesses. Therefore, this position paper, which is based on a review of the literature and a field case study, intends to contribute to the definition of the e-government research priorities needed to build regional disaster preparedness, as an integral part of e-government development policy.

Based on a review and analysis of the relevant literatures, we found that the deployment of RFID technology is slowly emerging in disaster management and disaster response, such as evacuation, in the unique and innovative ways as discussed in this paper. However, we also argued that the difficult challenges ahead for the local government executive decision makers, if they intend to deploy RFID technology to improve regional-level disaster preparedness and response capabilities and to build safe and secure local communities. They need to address the key barriers to wider adoption and effective use among the stakeholders, including citizens: namely, strategic leadership vision at all levels of government and integration of a RFID system with e-government service.

The major limitation of this study is the nature of exploratory study that required a logical analysis of the relevant and diverse literatures in multiple disciplines: disaster management, e-government, IS, and RFID. In consequence, this study did not generate the scale of empirical data required for further analysis. The future research directions include a large-scale, multi-jurisdiction field survey of executive decision makers on the current status of RFID and GIS technologies in a comprehensive disaster management cycle.

7. References

[1] National Research Council of the National Academies`, "Successful response starts with a map: improving geospatial support for disaster management," Washington, D.C.: The National Academies Press, 2007.

[2] M. Ward-Callan, "Future directions IEEE conference business," Building a Global Conference Business, Canada, July, 2007.

[3] M. Fujihara, "New IT reform strategy and RFID promotion policy of Japan," Commerce and Information Policy Bureau, Ministry of Economy, Trade and Industry, Japan, 2006.

[4] A. García, Y. Chang, A. Abarca, and C. Oh, "RFID enhanced MAS for warehouse management," *International Journal of Logistics Research and Applications* (10:2), 2007, 97-107.

[5] E. Jones, M. Riley, R. Franca, and S. Reigle, "Case study: the engineering economics of RFID in specialized manufacturing," *The Engineering Economist* (52:3), 2007, 285-303.

[6] C. Loebbecke, "Piloting RFID along the supply chain: a case analysis," *Electronic Markets* (17:1), 2007, 29-38.

[7] S. Stroh and J. Ringbeck, "Thinking outside the closed loop," *Strategy+business Magazine*, April 2004, 1-4.

[8] S. Fosso Wamba, L. A. Lefebvre, Y. Bendavid, and É. Lefebvre, "Exploring the impact of RFID technology and the EPC network on mobile B2B eCommerce: A case study in the retail industry," *International Journal of Production Economics* (112:2), 2008, 614-629.

[9] S. Fosso Wamba, L. A. Lefebvre, and É. Lefebvre, "Enabling intelligent B-to-B ecommerce supply chain management using RFID and the EPC network: a case study in the retail industry," in The Eighth International Conference on Electronic Commerce (ICEC) Fredericton, New Brunswick, Canada, 2006, 281-288.

[10] L. A. Lefebvre, É. Lefebvre, Y. Bendavid, S. Fosso Wamba, and H. Boeck, "The potential of RFID in warehousing activities in a retail industry supply chain," *Journal of Chain and Network Science* (5:2), 2005, 101-111.

[11] K. L. Moon and E. W. T. Ngai, "The adoption of RFID in fashion retailing: a business value-added framework," *Industrial Management & Data Systems* (108:5), 2008, 596-612.

[12] E. W. T. Ngai, K. K. L. Moon, F. J. Riggins, and C. Y. Yi, "RFID research: An academic literature review (1995-2005) and future research directions," *International Journal of Production Economics* (112:2), 2008, 510-520.

[13] S. Fosso Wamba and A. Chatfield, "A contingency model for creating value from RFID supply chain projects in logistics and manufacturing environments," *European Journal of Information Systems, Special Issue - Managing RFID Projects in Organizations*, under review (second round), 2009.

[14] A. Chatfield, S. Fosso Wamba, and H. Tatano, "Creating value from RFID technological innovation within Sendai Suisan and across buyer-supplier value chain: a resource-based theory perspective," Wollongong, Australia: Faculty of Informatics, University of Wollongong, 2009.

[15] C. Poirier and D. McCollum, *RFID Strategic Implementation and ROI: a Practical Roadmap to Success*. Florida: J. ROSS Publishing, 2006.

[16] Y. Cheung, K. Choy, C. Lau, and Y. Leung, "The impact of RFID technology on the formulation of logistics strategy," in Proceedings of 2008 PICMET South Africa, 2008, 1673-1680.

[17] National Governors' Association, "Emergency preparedness project: final report," National Governors' Association Office of State Services, Washington, D.C. 1978.

[18] A. R. Cannon, P. M. Reyes, G. V. Frazier, and E. L. Prater, "RFID in the contemporary supply chain: Multiple perspectives on its benefits and risks," *International Journal of Operations & Production Management* (28:5), 2008, 433-454.

[19] H. Shover, "Understanding the chain of communication during a disaster," *Perspectives in Psychiatric Care* (43:1), 2007, 4-14.

[20] D. McEntire and A. Myers, "Preparing communities for disasters: issues and processes for government readiness," *Disaster Prevention and Management* (13:2), 2004, 140-152.

[21] P. Gabriel, "The development of municipal emergency management planning in Victoria, Australia," *The Australian Journal of Emergency Management* (18:2), 2003, 74-80.

[22] R. Pielke, "Misdefining “climate change”: consequences for science and action," *Environmental Science & Policy* (8:6), 2005, 548-561.

[23] P. Epstein and J. McCarthy, "Assessing climate stability," *Bulletin of the American Meteorological Society* (85:4), 2004, 1863-1870.

[24] R. Pielke, "Disasters, death, and destruction: making sense of recent calamities," Oceanography (19:2), 138-147, 2006.

[25] C. Office: “Bousai Hakusho (in Japanese)” White Paper on Disaster Prevention, Naikakufu, Heisei 20 nen ban, Government of Japan, 2008.

[26] J. Riad, F. Norris, and R. Ruback, "Predicting evacuation from two major disasters," University of Delaware Disaster Research Center 1997.

[27] E. Fussell, "Leaving New Orleans: special stratification, networks, and hurricane evacuation,” 2006.

[28] GAO, "Disaster preparedness: preliminary observations on the evacuation of vulnerable populations due to hurricanes and other disasters," 2006.

[29] Government of Japan, Cabinet Office, "“Bousai Hakusho (in Japanese)” White Paper on Disaster Prevention, Naikakufu, Heisei 20 nen ban," 2008.

[30] Y. Bendavid, E. Lefebvre, L. A. Lefebvre, and S. Fosso Wamba, "Key performance indicators for the evaluation of RFID-enabled b-to-b e-commerce applications: the case of a five-layer supply chain," *Information Systems and E-Business Management* (7:1), 2009, 1-20.

[31] M. Tajima, "Strategic value of RFID in supply chain management," *Journal of Purchasing and Supply Management* (13:4), 2007, 261-273.

[32] N. Buyurgan, B. C. Hardgrave, J. Lo, and R. T. Walker, "RFID in healthcare: a framework of uses and opportunities," *International Journal of Advanced Pervasive and Ubiquitous Computing* (1:1), 2009, 1-25.

[33] P. T. J. Mo, S. Gajzer, M. Fane, G. Wind, T. Snioch, K. Larnach, D. Seitam, H. Saito, S. Brown, F. Wilson, and G. Lerias, "Process integration for paperless delivery using EPC compliance technology," *Journal of Manufacturing Technology Management* (20:6), 2009, 866-886.

[34] J. A. Symonds and D. Parry, "Using RFID to track and trace high value products: the case of city healthcare," *Journal of Cases on Information Technology* (10:1), 2008, 1-13.

[35] M. Lampe and M. Strassner, "The potential of RFID for moveable asset management," Auto-ID Labs, 2006.

[36] D. McFarlane and Y. Sheffi, "The impact of automatic identification on supply chain operations," *The International Journal of Logistics Management* (14:1), 2003, 1-17.

[37] S. Fosso Wamba and H. Boeck, "Enhancing information flow in a retail supply chain using RFID and the EPC network: a proof-of-concept approach," *Journal of Theoretical and Applied Electronic Commerce Research* (3:1), 2008, 92-105.

[38] E. C. Ozelkan and A. Galambosi, "When does RFID make business sense for managing supply chain?," *International Journal of Information Systems and Supply Chain Management* (1), 2008, 15-47.

[39] A. Chatfield and S. Fosso Wamba, "RFID deployment in natural disaster management: current focus & future," in Submitted to The Second International Symposium on RFID Technology "RFID in the Real World", of the 5th International conference on Sensors, Sensor Networks and Information Processing (ISSNIP) Melbourne, Australia, 2009.

[40] D. Thomas, M. Adam, and S. Matthias, "Data-on-Network vs. Data-on-Tag: Managing Data in Complex RFID Environments," in Proceedings of the 40th Annual Hawaii International Conference on System Sciences: IEEE Computer Society, 2007.

[41] BBC News, "Implant chip to identify the dead," 2005.

[42] S. Hostikka, T. Korhonen, T. Paloposki, T. Rinne, K. Matikainen, and S. Heliövaara, "Development and validation of FDS+Evac for evacuation simulations," VTT RESEARCH 2007.

[43] F. Thiesse, "RFID, privacy and the perception of risk: a strategic framework," *The Journal of Strategic Information Systems* (16:2), 2007, 214-232.

[44] A. R. Grasso, "EPCglobal network," in RFID Handbook: Applications, Technology, Security and Privacy, S. a. I. Ahson, M., Ed.: CRC Press, Taylor & Francis Group, 2008.

[45] K. Newman, "Organizational transformation during institutional upheaval," *Academy of Management Review* (25:3), 2000, 602-619.

[46] E. Schein, *Organizational Culture and Leadership*, 3 ed. San Francisco, CA: Jossey-Bass, 2004.

[47] J. Kotter, "Leading change why transformation efforts fail," *Harvard Business Review* (85:1), 2007, 96-103.

[48] J. Kotter and L. Schlesinger, "Choosing strategies for change," *Harvard Business Review* (86:7/8), 2008, 130-139.

[49] N. Venkatraman, " IT-enabled business transformation: from automation to business scope redefinition," *Sloan Management Review* (35:2), 1994, 73-87.

[50] A. Chatfield, "Public service reform through e-government: a case study of 'e-Tax' in Japan," *Electronic Journal of E-Government* (7:2), 2009, 135-146.

[51] H. Scholl, "Organizational transformation through e-government: Myth or reality?," in EGOV 2005, LNCS, M. A. W. e. al., Ed., 2005, pp. 1-11.

[52] F. Bannister, "Dismantling the silos: extracting new value from IT investments in public administration," Information Systems Journal (11:1), 2001, 65-84.

[53] U. H. Government, "Transformational government enabled by technology," 2007.

[54] D. Norris and M. J. Moon, "Advancing e-government at the grassroots: tortoise or hare?," *Public Administration Review* (65:1), 2005, 64-75.