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# Disaster Knowledge Management - A Study

**Dr. C. Muthuvelayutham**
**S. B. Arun, PG Scholar**

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**Abstract**

Disasters bring about the loss of lives, property, employment and damage to the physical infrastructure and the environment. The number of reported disasters has increased steadily over the past century and risen very sharply during the past decade. While knowledge management can enhance the process of disaster management, there is a perceived gap in information coordination and sharing within the context of disaster management. Identification of key disaster knowledge factors will be an enabler to manage disasters successfully. This study aims to identify and map key disaster knowledge success factors in managing disasters successfully through capturing good practices and lessons learned. A list of disaster knowledge factors was first identified through a comprehensive literature review, covering the whole disaster management cycle. Based on these literature findings, semi-structured interviews were conducted among few disaster management practitioners to explore the influence and lacking areas relating to these factors in managing disasters. The objective of this paper is to present the interview findings on benefits and challenges related to the disaster knowledge factors. A comprehensive list of benefits and challenges of disaster knowledge factors in managing disasters is identified.

**Keywords**: Disaster Management, Disaster Knowledge Management, Disaster Knowledge Factors, Benefits, Challenges

## Introduction

The economic crisis situations and the complex environmental and societal processes over the past years indicate the need for new mathematical model constructions to predict their effects. The health diagnostic as a multi-parameter and multi-criteria decision making system is one of the models whereas in the previous examples, a risk model should be managed. Haimes (year) gives an extensive overview of risk modeling, assessment, and management. The presented quantitative methods for risk analysis in are based on well-known mathematical models of expert systems, quantitative optimum calculation models, statistical hypothesis and possibility theory. The complexity of the systems increases the runtime factor, and the system parameter representation is usually not user-friend. The numerical methods and operation research models are ready to give acceptable results for some finite dimensional problems, but without management of the uncertainties. The complexity and uncertainties in those systems raise the necessity of soft computing based models.

"The private sector, from Fortune 500 companies to your local grocery store, is an essential member of the team…. Growing strong working relationships between emergency managers and the private sector is a good business decision for everyone – it helps us better serve survivors, rebuild our communities and boost local economies." Please cite the source.

Nowadays the expert engineer's experiences are suited for modeling operational risks, not only in the engineering sciences, but also for a broad range of applications .Wang introduces the term of risk engineering related to the risk of costs and schedules on a project in which there is the potential for doing better as well as worse than expected. The presented case studies in his book are particularly based on long-term engineering experiences, for example on fuzzy applications, which offer the promised alternative measuring of operational risks and risk management globally. The use of fuzzy sets to describe the risk factors and fuzzy-based decision techniques to help incorporate inherent imprecision, uncertainties and subjectivity of available data, as well as to propagate these attributes throughout the model, yield more realistic results. Fuzzy logic modeling techniques can also be used in risk management systems to assess risk levels in cases where the experts do not have enough reliable data to apply statistical approaches.

## Disaster Knowledge Management

Knowledge management is a process by which knowledge is created, shared and utilised (Deshmukh, et al., 2008). While abundant of knowledge about risk and vulnerability to hazards exists, its access and utilisation at community, national, regional and international levels to empower or protect is yet to reach full potential (UNESCO et al., 2005). Kaklauskas, et al. (2009) indicate that in countries affected by Asian tsunami the lack of knowledge management is apparent. By reinforcing this fact, Koria (2009) finds that in Sri Lanka organisations have not been able to capture, retain and/or re-use the learning from similar operations. his resulted in 'reinventing the wheel' in terms of setting up and managing the construction programmes and projects within the tsunami recovery operation (Koria, 2009). According to Pourezzat, et al. (2010), disaster response is dynamic and therefore decision makers need to receive updated information on the current emergency situations. Disaster response is also time-sensitive with little allowance on delay in decision making and response operations. Therefore, any problem or delay in data collection, access, usage, and dissemination has negative impacts on the quality of decisions and hence the quality of disaster response. All these highlight the importance of managing knowledge within the context of disaster management.

## Significance of GIS in Disaster Management

Present disaster management represents a complex set of operations including various pre- and post-disaster measures. Those measures are planned and realized by various organizations such as fire and rescue services, emergency medical services, police, or local authorities. Those organizations have different structures, routines, etc. It brings new problems to disaster management and also increases its complexity. To overcome such problems a new concept, which could be resistant to different types of organization structures and various diversities, seems to be necessary. This concept is based on GIS that is independent on number of participants in disaster management, their structure, routines, and possible changes of those factors. GIS in disaster management can be seen as a cycle, consisting of eight elements: (1) assessment, (2) prevention, (3) mitigation, (4) preparedness, (5) disaster event, (6) response, (7) recovery, and (8) evaluation. Over the classic disaster management scheme, the scheme for GIS

includes new element called ‘evaluation’. This element is added to the cycle to evaluate GIS and its performance in disaster management, and also emergency management itself.

**Benefits of Disaster Knowledge Factor**

Technological factors Respondents identified that early warning systems such as effective flood warning systems and effective tsunami warning systems are enormously helpful in managing disasters successfully. In addition they highlighted the use of satellite images to gather real time data during and aftermath of a disaster. As an example, respondents elaborated the use of satellite images to monitor the actual movement of people during the conflict in Sri Lanka and to plan the resettlement process after the conflict. Similarly Geographic Information System is another technology that is mentioned by the respondents to estimate the scale of damages immediately after a disaster. They suggested the usability of robots technology to access too dangerous areas for humans to access during relief operations. Alternatively they proposed the use of reflective waves like laser or radar technology. According to respondents’ views, the real time data gathered during the relief phase would help to plan and allocate the resources efficiently. Furthermore they pointed out that, this information is useful in planning mitigative measures as it helps to identify the vulnerability of different areas. Moreover, they described the support of ground transport and helicopters to rescue people and distribute goods and services especially during the relief phase. In addition, respondents recognised the importance of structural measures or product modelling to enhance the resilience of built structures. The use of technology for insurance purpose was highlighted by the respondents. For instance, as certain technological tools can mitigate the risk of flooding, these can ensure the successful claim of money.

**Social Factors**

Social factors are seen as essentials in managing disasters by all the respondents. Accordingly, the extent of peoples’ network and the culture of preparedness are two major determinants of the successful disaster management. For example, helping each other is embedded in Sri Lankan culture and that was one of the reasons for successful relief after the

2004 tsunami. Therefore, Japan is among one of the world's developed countries even if a major earthquake takes place in every year. Education, training and awareness raising are stated to be the key factors which contribute to enhanced culture of preparedness.

**Environmental Factors**

According to the respondents' views, natural environmental barriers can prevent or minimise the effects of a disaster. As an example, some of the areas in Sri Lanka had minimum effects from 2004 tsunami, because of the vegetations and mangroves. Nevertheless, they stressed that the environmental factors can also further the effects of disasters. Within this context, the role of the built environment was highlighted by the respondents as built environment shapes the natural environment. In doing so, they argued that people need to consider three things: firstly to decide whether people can live as safely as possible within a particular environment, secondly to plan and regulate the built environment accordingly, and thirdly to build man-made barriers to minimise disaster effects. For example they highlighted the use of the Thames barrier as a flood defense in London and the wall built around the sea of Netherland as the country lies below the sea level.

**Legal Factors**

According to the respondents, implementation of disaster mitigation measures is undoubtedly supported by disaster related laws and regulations. As lack of investment on disaster preparedness and mitigation hampers disaster management, statuary requirements imposed on mitigative measures act as a benefit to the community. In addition, emergency and civic duty laws are considered to be helpful in responding to a disaster. Respondents highlighted the fact that law should get the upmost commitment from the government and further the awareness and incorporation of them into training programmes.

**Economic Factors**

Economic planning measures: Respondents viewed that long term economic planning measures basically help to withstand or reduce the effects of a disaster through safeguarding the

country's wealth generation mechanism. As an example, in most of the flood prone areas in the UK, the government, property developers and mortgage companies enforced people to take insurance as a mitigative effort.

**Financial Factors**

According to respondents, finance is an essential resource in managing disasters. Therefore funding and access to funding is an essential requirement in successful management of disasters. In the UK there is an efficient system to assess the damages and provide the financial support immediately after floods. Lost adjusters, who employ immediately after the floods, assess the losses in monetary terms while working closely with insurance companies to minimise the impact of flooding.

**Institutional Factors**

According to the respondents, institutions and organisations are again essential elements in disaster management as these are considered as the working norm of the disaster management system.

**Political Factors**

Respondents view that making decisions, allocating resources and enforcing statutes and legislations are influenced by politics. As an example they highlighted the confession by US president to institute new laws on oil spill due to recent BP oil spill over, which was one of worst environmental catastrophe in America.

**The Challenges**

A major challenge is to understand what and where the obstacles are and to learn what strategies exist for dealing with these hurdles. The most common barriers are listed below: All phases of disaster management depend on quality data from a variety of sources. Access to the appropriate data is very limited, thus the issue of data standardization in Nigeria and the lack of established Spatial Data infrastructures. The limited availability of trained staff to utilize the

functionalities of a GIS or even the limited ability of disaster officers to use GIS as a tool that will add power to and make disaster management more efficient. The issue of politically define boundaries- Naturalϖ hazards does not recognize political boundaries, yet policies generated to mitigation against disasters inevitably speaks political boundaries. Inadequate administrative systems, it is found thatϖ administrators resist change and therefore an important issue is to gain senior management acceptance and make the necessary arrangements to facilitate sustainability.

It is important that disaster managers recognize that proper planning is a key to a successful GIS. The implementation of a GIS can be a very expensive process however; one should bear in mind that disaster management is an investment, thus the need for adequate budgetary provision by all tiers of government in Nigeria. The lack for greater responsibility and accountability for vulnerabilities and lack of greater emphasis placed on disaster management through greater public education in matters of disaster management by meaningful stakeholder consultation and collaboration.

**Discussion and Way Forward**

This paper has presented benefits and challenges of disaster knowledge factors in managing disasters. Respondents viewed the detection and warning systems and resilient built structures as key benefits of technological factors. While detection and warning systems help to save lives, resilient built structures supports to minimise the effects of disasters. With regard to the social factors, respondents indicated that technology can provide only the information and it would be the human beings who will have to react for disasters. Hence they highlighted the benefits of education, training and awareness raising to enhance the level of preparedness. The benefits of existing natural environmental barriers are highly recognised by the all respondents. Support of legal factors to implement disaster mitigation measures is also highlighted by the respondents. In terms of economic factors, benefits of long term economic planning measures were stressed by the respondents. In addition they viewed the financial, operational/managerial and institutional factors as essentials to manage disasters. Among key challenges, the lack of detection and warning systems, the need for effective education, training and awareness raising

programmes, the need for regular updating of disaster related laws, lack of funds for economic planning measures, poor planning, poor communication, poor leadership, lack of knowledge management and poor institutional arrangement were highlighted by most of the respondents. These clearly show that most of challenges are related to the operational/managerial factors. In order to enhance the management of disasters, these challenges need to be addressed.

## Conclusion

The integration of GIS to Disaster Management requires a careful and well-developed plan, which addresses administrative issues, costs, the range of users and the anticipated information products as well as the need for sustainability. There must be buy in to the need for incorporation of GIS in Comprehensive Disaster Management. It is important to understand that while GIS can enhance the existing disaster management programmes in Nigeria, its integration requires broader management and institutional issues be addressed. Technological advances and extensions of geographic information systems have opened the way for several applications in disaster management. The kind of analysis available to researchers, policy advisors and decision makers were only being dreamed of ten years ago (Amdahl, G., 2001). It is envisaged that disaster management in Nigeria will progress to the point of an automated disaster management information system built on web enabled GIS Technology in a multi-user and multi-agency environment. GIS is not a panacea but can facilitate loss reduction and event prevention in some instances as well as lead to more efficient means of recovery and rehabilitation in disaster management. This is however only possible through much research and education in this field.

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Dr. C. Muthuvelayutham
Associate Professor
Department of Management Studies
Anna University Regional Campus
Madurai 625 019
Tamilnadu
India
drmuthu2009@gmail.com

S. B. Arun, PG Scholar
Department of Management Studies
Anna University Regional Campus
Madurai 625 019
Tamilnadu
India
Sbarun94@gmail.com