

Collaboration of Inter-Agency in Emergency Response Plan Through Flood Catastrophic Management System for East Coast Malaysia

¹A.M. Leman, ²K.A. Rahman, ³M.N.M. Salleh, ¹Dafit Feriyanto and ¹S.N.H. Muhammad

¹Faculty of Engineering Technology Engineering,

²Faculty of Mechanical and Manufacturing Engineering,

³Faculty of Science Computer and Information Technology,

Universiti Tun Hussein Onn Malaysia (UTHM), Batu Pahat, 86400 Johor, Parit Raja, Malaysia

Abstract: Most emergencies follow some recognizable build-up period during which actions can be taken to achieve an appropriate state of maximum readiness. However, it is acknowledged that disasters are unique occurrences which require specific resources dependent upon the type, nature and extent of the emergency. The effect of inter-agency collaboration during a disaster is quite needed. However, it should be accordance with the developed system to ensuring its effectiveness during the disaster event. The main objective of this study is to ascertain the flood catastrophic management system which occurred in East Coast Malaysia; Kelantan, Terengganu and Pahang. New simulation will be generated based on an online simulation system which consists of various related inter-agency their contact and their area. It proposed to fast handling of flood disaster. Approach system resulted various inter-agency in each area was counted and put on the system. The researcher believes that this system will be an efficient system to overcome and cover the catastrophic event due to the adaptability of the system of society.

Key words: Inter-agency, flood management system, emergency response plan, catastrophic simulation, specific resources

INTRODUCTION

Malaysia is one of the developing country with an equatorial climate in which being hot and humid throughout the year. Since, mid-November to February, the heavy seasonal rain and strong wind is occurring especially in east coast of Malaya. Heavy rain has been recorded intensively in Malaysia with the highest record in east coast of Peninsular Malaysia off 341mm at Sungai Labir. It causes the severe flood in the East Coast of Peninsular Malaysia (state of Terengganu, Pahang and Kelantan). Last year the heavy flood has been occurring and according to statistics released by the National Security Council (NSC) or formally known Majlis Keselamatan Negara (MKN) recorded that the number of evacuees in Kelantan were 170,690 victims and 621 families, in Terengganu were 28,795 victims and family 7074 and in Pahang were 28,578 victims and family 7244.

Malaysia is one of the tropical countries which is produce high discharges or high water levels. Therefore, it causes inundation of land adjacent to lakes, rivers and other water bodies (Mohammed *et al.*, 2011). In Malaysia,

the most significant of natural hazard is flood and it more escalated while the country is more developed. There are major floods which occurred in Malaysia since the sixties of the last century such as in the year of 1967, 1969, 1971, 1973, 1979, 1983, 1988, 1993, 1995, 1999, 2000, 2003 (Mohammed *et al.*, 2011) and the current flood is occur at 2014. It affecting >15% of the total population in Malaysia and damage cost is estimated to be a million ringgit Malaysia.

National Security Council (NSC) is the agency acts as coordinator for monitoring and responding the disaster event in Malaysia. There are several agencies under NSC which are the Royal Malaysian Police, the Royal Malaysian Army, Special Malaysia Disaster Assistance and Rescue Team (SMART), Malaysian Meteorological Service (MMS), Drainage and Irrigation Department Malaysia (DID), The Public Works Department (PWD), social welfare department, the local authority, non-governmental organizations (e.g., Malaysian Red Crescent Society and Scout Society), Civil Defense Department and International Cooperation (Billa *et al.*, 2006). NSC has issued the guidelines on the disaster management which consists of the responsibility and

function of each agency of handling the disaster. Now a days, Malaysia has various flood management systems and centers such as Integrated River Basin Management (IRBM), e-Banjir and Drainage and Irrigation Department Malaysia was distributed the information through a Short Message System (SMS).

According to Turoff *et al.* (2004) that the information system of disaster has been developed. However, the simulation system of the catastrophic event has not been fully developed yet. A study by Raman *et al.* (2010) claimed that the lack of universal information system for disasters due to the uniqueness of every disaster. Therefore, in this research approach the new simulation for emergency response plan for not only flood catastrophic management system. It has some superiority such as can improve the collaboration of inter-agencies, faster respond in disaster and easy to operate. It has potential to reduce the number of victims, decrease the damage cost of each disaster area and decrease the recovery cost to affected areas.

Components of emergency management: An emergency is a situation or an impending situation that constitutes a danger of major proportions that could result in serious harm to persons or substantial damage to property and that is caused by the forces of nature, a disease or other health risk, an accident as an act whether intentional or otherwise. These situations could threaten public safety, public health, the environment, property, critical infrastructure and economic stability.

Emergency management consists of organized programs and activities taken to deal with actual or potential emergencies or disasters. It is based on a risk management approach and includes the following five components.

Prevention: Prevention refers to the actions taken to prevent the emergency itself and can greatly diminish the response and recovery activities required for certain emergencies. It may result in a long-term, cost-effective reduction of risk. Prevention measures are broadly classified as either structural or non-structural and include capital improvements, regulations, building codes and public education programs.

Mitigation: Mitigation refers to the actions taken to reduce or eliminate the effects of an emergency. It can also greatly diminish the response and recovery activities required for certain emergencies and may result in a long-term, cost-effective reduction of risk. Similar to prevention, mitigation measures are broadly classified as either structural or non-structural and include capital improvements, regulations, building codes and public education programs.

Preparedness: Preparedness refers to those measures taken prior to the emergency or disaster to ensure an effective response. Preparedness measures include plans, training, exercises, public education, alerting and notification systems, procedures asganization, infrastructure protection and standards.

Response: Response refers to measures taken to respond to an emergency. The aim of these measures is to ensure that a controlled, coordinated and effective response is quickly undertaken at the outset of the emergency to minimize its impact on public safety. When an emergency occurs, the immediate focus of operations is on meeting the emergency needs of people, saving lives and protecting property and the environment. This effort may last from a few hours to several days or longer, depending on the situation. As response activities begin to taper off, the operational focus begins to shift from response to recovery. The transition from response to recovery must be as smooth and as seamless as possible.

Recovery: Recovery refers to those measures taken to recover from an emergency or disaster. The aim of these measures is to assist individuals, businesses and communities to return to a state of normalcy. Recovery measures include environmental clean-up, return of evacuees, emergency financial assistance and critical incident stress counseling. Recovery activities usually begin almost as soon as the response begins and continue after the response activities cease.

Literature review: Normally, flooding is occurring when there is continuous rain with larger than normal quantities which led to overflow from the river (Balkema *et al.*, 1993). Besides that, according to Bradley and Potter (1992) mention that the shallow river bed in downstream areas causes the flooding. Furthermore, the properties, clay is impermeable, absorbs faster saturated and less water which causes the water spill over river bank when large rain (Bradley and Potter, 1992; Ward and Trimble, 2004). In addition, Gasim *et al.* (2007) identified the flooding occurred in Dungun, Terengganu caused by four factors such as high rainfall, river flows slowly and sea wave towards the shore as well as the wind velocity and direction to the mainland.

The process of emergency management consists of four phases which are mitigation, preparedness, response and recovery (Azuddin *et al.*, 2008). The mitigation phase is aimed to reduce the harmful effects of a disaster in order to decrease the effect to the human health, community function and economic infrastructure. Preparedness, phase is to structure the disaster response prior to the occurrence of a disaster. The response, phase is the actual implementation of the disaster plan. The recovery

Table 1: Advice from the NSC before flood, during flood and after the flood

Preparations before flood	While flood happen	After flood disaster close
Avoid constructing a building in flood-prone areas	Make sure all electrical switches and main switch is turned off to prevent electrical shock	Be sure to drink water that has been cooked and avoid drinking water that has been contaminated
Maintain ditches/drains/storm water so that it is not blocked	Follow the instruction of the authorities	Do not eat food that has been contaminated by flood waters
Keep important contact numbers such as the number of family members, neighbors, the nearest police station, fire brigade for use in an emergency time	Immediately evacuate (to the evacuation center/relative's home/high places) as instructed by authorities	Wash hands with soap before touching food, also while preparing food or holding items that have been contaminated by flood waters
Be alert to environmental conditions, sound/warning signals and identify high and safe routes to evacuation centers	Make sure the house is locked and items stored in high and safe place before making the transfer	Dispose of food left in the container/refrigerator that has been contaminated with flood water or that have turned smelly and discolored
Be ready to move if instructed by authorities	Identify individuals who have special needs such as the chronically ill, disabled, sick, pregnant and so on to be prioritized for transfer	Use sterile water to wash food containers bathing, preparing meals or providing infant formula milk
Get current weather updates and flood situation through the radio, television and the internet	Always be cautious when driving in rainy season/flood and use safe routes that have been identified	If run into wild animals that are poisonous call the authorities for help
Keep all your important documents in a container/bag/file in high place and easily-retrieved if it becomes necessary to move to evacuation centers	Do not drive through the flood due to the concern that vehicles will be drifted away	Make sure all electrical sources are safe and not exposed to water sources before turning on the main switch to avoid electric shock
Provide basic necessities that are most important like baby's milk, medicines, flashlights, clothing bags and other equipment before being instructed by authorities to move	If caught in a flood, contact the authorities for help by reporting your condition and position	If the power is not connected, use a flashlight as a light sources
Keep valuables in high places that wouldn't be reachable by water in the event of flooding	Supervise children and do not let them play in flooded areas or along river/ditch/drain/rapid water passag	If there is suspicion of a gas leak, close the gas source open all windows and doors and exit the house immediately
Save sterile water in the bottle for cooking and as drinking water	Do not leave home by wading the flood weather for concern of being swept away by flood	
Save/seal tightly goods placed outside the home such as garden furniture, bicycles, garbage cans and so on to avoid being washed away by flood		
Ensure vehicle and repair equipment for your vehicle in good condition as preparation to move		
Secure your pets in a safe place for animals are not allowed to be brought to evacuation centers due to hygiene and health concerns		

phase focuses on the stabilization and recovery community and health care system (Herrmann, 2007).

Now a days, there are two flood management systems in Malaysia such as IRBM and e-Banjir. The main functions of IRBM method are to ensure clean water, ensure sufficient water, reduce flood risk and enhance environment conservation. Meanwhile, e-Banjir is the system to accelerate shipping and processing information related to floods such as rainfall distribution, number of casualties transfusion and number of deaths. The concept of this system is using centralized data. However, it has some weaknesses such as difficult to use, lack of disaster management systems and slow respond (Razi, 2009). There are several inter-agencies in disaster management which are rela, bomba, police, Hospital, Klinik kesihatan, JPA and MKN. They have different roles in flood management. In the sample, the inter-agency which handle flood disaster are bomba, police and Hospital. In addition, for earthquake disaster are bomba, JPA, Hospital and Police as well as for landslides are bomba, JPA, police, hospital and rela agencies.

Unfortunately, flood, disaster has given various effects to the victims such as psychology and healthy

effect. Psychological studies related flood disaster has been investigated and its focus on the trauma of evacuees (Panyayong and Pengjuntr, 2006; Uguak, 2010; Badiah *et al.*, 2010) and mental health problems especially lifelong traumatic (Dorji, 2006). According to Rao (2006) found that flood victims is dominated by lack knowledge of flood disaster management and no preparation in facing flood disaster. There are three main factors that effect from psychological caused flooding which are the clutter, depression and health (Ofrin and Salunke, 2006). Clutter and depression are involved in the damage of home structures, home content, discomfort and stench. Health is linked to the children and the elderly (Badiah *et al.*, 2010).

Advice for national security council: This is the advice from the National Security Council (NSC) before flood, during flood and after the flood (Table 1).

MATERIALS AND METHODS

This research develop the simulation system in flood management whichh based on online system. It

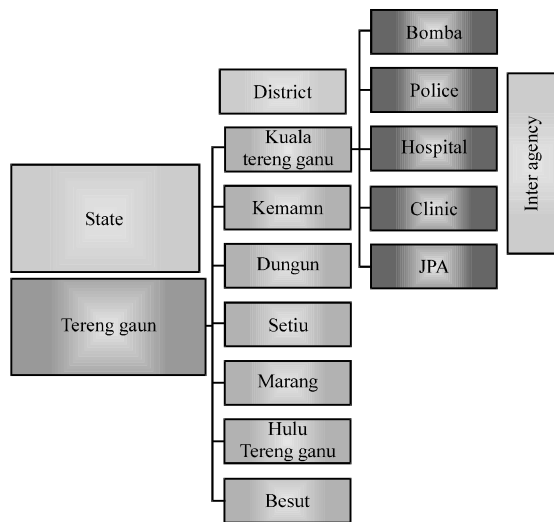


Fig. 1: Simulation of inter-agency for flood catastrophic management system in terengganu, Malaysia

prepared by computing program. First outlook of the system as shown in Fig. 1. It is shown the system applied in Terengganu state which consist of 7 districts such as Kuala Terengganu, Kemaman, Dungun, Setiu, Marang, Hulu Terengganu and Besut. The related inter-agency are involved in this disaster include bamboo, police, hospital, clinic and JPA.

Approached simulation system as emergency response plan to decrease the possibility of major floods in Malaysia and to reduce the cost damage and recovery cost caused by disasters. In addition, our system is developed based on the logical view on online system which supported by web-based system and it linked to the National Security Council (NSC) webpage. These systems consists of the various inter-agency, contact number for emergency response and it's divided into the state, district and area in Malaysia include the Peninsular Malaysia, Sabah and Sarawak state. Various inter-agencies involved in this system which are police, bomba, hospital and clinic, JPA and rela.

RESULTS AND DISCUSSION

In this developed system consist of the various inter-agencies which collated by using the survey method. Most interagency data are collected through the existing system. It included the state of whole Malaysia. However, in this study focused on the major flooding area, i.e., in East Coast of Malaysia (Terengganu, Kelantan and Pahang). This data is used as primary material which filled with the simulation system regarding to the state, district and area. The various inter-agencies in Terengganu state which consist of 7 districts is listed in Table 2.

Table 2: Number of inter agency in Terengganu

State/inter agency	Bomba	Police	Hospital	Clinic	JPA
K. Terengganu	3	8	1	40	2
Kemaman	4	8	1	30	2
Dungun	3	7	1	25	1
Marang	2	5	-	22	1
H. Terengganu	1	4	1	23	1
Besut	2	5	1	29	3
Setiu	1	5	1	17	1
Total	16	42	6	186	11

Table 3: Number of inter agency in Kelantan

State/inter agency	Bomba	Police	Hospital	Clinic	JPA
Kota bharu	2	18	1	44	3
Tumpat	1	11	1	25	1
Bachok	2	8	-	30	1
Pasir mas	2	9	1	29	1
Pasir puteh	1	7	1	23	1
Tanah merah	2	13	1	25	1
Machang	1	8	1	22	1
JELI	1	6	1	15	1
Kuala krai	2	10	1	24	1
Gua musang	1	4	1	22	1
Total	15	94	9	259	12

Table 2 shows the total inter agency in Terengganu which consist of 7 districts which are Kuala Terengganu, Kemaman, Dungun, Maran, Hulu Terengganu, Setiu and Besut. The total number office of the fire factor station was 16 units, the number police headquarters and police stations were 42 units, the numbers of hospitals were 6 hospitals. A hospital has been placed in every district in Terengganu except Marian district which only has health clinics and rural clinics. The numbers of clinics in Terengganu were 186 clinics and it covers health clinics and rural clinics. While the number office of civil defense department officials was 11 officials. The various inter-agencies in Kelantan state which consist of 10 districts is listed in Table 3.

Table 3 shows the number of inter agency in Kelantan which consists of 10 districts which are Kota Bharu, Tumpat, Bachok, Pasir Mas, Pasir Puteh, Tanah Merah, Machang, Jeli, Kuala Krai and Gua Musang. The total number office of the fire factor station was 15 units, the number police headquarters and police stations were 94 units, the numbers of hospitals were 9 hospitals. A hospital has been placed in every district in Kelantan except Bachok district which only has health clinics and rural clinics. The numbers of clinics in Kelantan were 259 clinics and it covers health clinics and rural clinics. While the number office of civil defense department officials was 12 officials. Table 4 shows the number of inter-agency in Pahang state which include to the east coast of Malaysia.

Table 4 shows the number of inter-agency in Pahang consists of 11 districts which are Rompin, Pekan, Kuantan, Bera, Maran, Termeloh, Bentong, Raub, Jerantut, Lipis and Cameron Highland. The total number

Table 4: Number of inter agency in Pahang

State/inter agency	Bomba	Police	Hospital	Clinic	JPA
Rompin	2	14	1	34	2
Pekan	2	10	1	35	2
Kuantan	3	17	1	33	2
Bera	1	10	-	23	1
Maran	1	12	1	47	3
Termeloh	1	9	1	36	4
Bentong	1	17	1	19	1
Raub	2	18	1	26	2
Jerantut	1	12	1	35	1
Lipis	2	14	1	32	2
Cameron highland	2	8	1	6	1
Total	18	141	10	326	21

office of fire factor station were 18 units, the number police headquarters and police stations were 141 units, the numbers of hospitals were 10 hospitals. A hospital has been placed in every district in Pahang except Bera district which only has health clinics and rural clinics. The numbers of clinics in Pahang were 326 clinics and it covers health clinics and rural clinics. While the number office of civil defense department officials were 21 officials. From the data above can summarized that the primary data is valid in each state, district and area in Malaysia. It will face that the developed simulation system is relevant to the condition of inter-agency in east coast of Malaysia and it will generate to the whole Malaysia. This system will help the coordination of inter agency in flood catastrophic event.

A widespread emergency is one that impacts a large geographic area and affects a large number of jurisdictions simultaneously. Such an emergency could be further complicated if it is of extended duration. Given that many jurisdictions are affected simultaneously, it may not be possible to deploy the necessary number of staff to deal directly with each individual community. These teams will coordinate directly with the upper tier for those emergency responsibilities that fall within the upper tier mandate, using the upper tier as a conduit to identify priority requirements among lower tier communities. The staff may encourage the establishment of an upper tier coordination group to exchange information and share resources.

CONCLUSION

In order to define the different requirements of the stakeholder's key involved in emergency response management in Malaysia, flood catastrophic management system offers the following features that address to the community needed and the national security agency. The command system will be disseminate by communication through the system that has been developed. The prototype is close ready to generate in Malaysia.

ACKNOWLEDGEMENTS

The research would like to thank the Ministry of Higher Education Malaysia and Universiti Tun Hussein Onn Malaysia (UTHM) through the funding supported Fundamental Research Grant Scheme Flood Grant under vote 1522, Office for Research, Innovation, Commercialization and Consultancy Management (ORICC) and Centre for Graduate Studies.

REFERENCES

- Azuddin, B., H. Hanum and A. Razli, 2008. Workplace: A study of the emergency preparedness of the emergency response team vis-A-vis the Occupational Safety and Health Act 1994. UniMAP Library Digital Repository, Kuala Lumpur, Malaysia. <http://dspace.unimap.edu.my/xmlui/>.
- Badiah, Y., Y. Sulaiman, H. Rohaya, M.M. Zaidi and R. Rohailina, 2010. Psychological effects on flood victims in Johor. Community Health J., 15: 79-87.
- Balkema, A.A., Rotterdam and Brookefield, 1993. Hydrology and water management of deltaic areas. Center for Civil Engineering Research and Codes, Netherland, Europe.
- Billa, L., M. Shattri, R.A. Mahmud and G.A. Halim, 2006. Comprehensive planning and the role of SDSS in flood disaster management in Malaysia. Disaster Prevention Manage. Int. J., 15: 233-240.
- Bradley, A.A. and K.W. Potter, 1992. Flood frequency analysis of simulated flows. Water Resour. Res., 28: 2375-2385.
- Dorji, C., 2006. Mental health and psychosocial aspects of disaster preparedness in Bhutan. Int. Rev. Psychiatry, 18: 537-546.
- Gasim, M.B., J.H. Adam, M.E.H. Toriman, S.A. Rahim and H.H. Juahir, 2007. Coastal flood phenomenon in Terengganu, Malaysia: Special reference to dungun. Res. J. Environ. Sci., 1: 102-109.
- Herrmann, J., 2007. Disaster response planning and preparedness: Spiritual care and mental health for disaster response and recovery. New York Disaster Interfaith Services, New York, USA.
- Mohammed, T.A., S. Said, M.Z. Bardaie and S.N. Basri, 2011. Numerical simulation of flood levels for tropical rivers. Proceedings of the IOP Conference Series on Materials Science and Engineering, Vol. 17, October 17-22, 2011, IOP Publishing, Bristol, England, pp: 1-11.
- Ofrin, R. and S.R. Salunke, 2006. Disaster preparedness in the South East Asia region. Int. Rev. Psychiatry, 18: 495-500.

- Panyayong, B. and W. Pengjuntr, 2006. Mental health and psychosocial aspects of disaster preparedness in Thailand. *Int. Rev. Psychiatry*, 18: 607-614.
- Raman, M., T. Ryan, M.E. Jennex and L. Olfman, 2010. Wiki technology and emergency response: An action research study. *Int. J. Inf. Syst. Crisis Response Manage.*, 2: 49-69.
- Rao, K., 2006. Psychosocial support in disaster-affected communities. *Int. Rev. Psychiatry*, 18: 501-505.
- Razi, A.F., 2009. Disaster Management in Malaysia. Universiti Putra Malaysia, Seri Kembangan, Malaysia,.
- Turoff, M., M. Chumer, V.D.B. Walle and X. Yao, 2004. The design of a dynamic emergency response management information system (DERMIS). *J. Inf. Technol. Theory Appl.*, 5: 1-35.
- Uguak, U.A., 2010. The importance of psychological needs for the post traumatic stress disorder (PTSD) and displaced children in schools. *J. Instructional Psychol.*, 37: 340-352.
- Ward, A.D. and S.W. Trimble, 2004. Environmental Hydrology. CRC Press, Boca Raton, FL., pp: 62.