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BAHAGIAN 2

Environmental & Physical Impact (EPI)

Governance & Capacity Building (GCB)

Health & Clinical Science (HCS)

Disusun oleh:
Prof Zulkifli Yusop (UTM)
Nurliyana Mahpof (UTM)

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HEALTH & CLINICAL SCIENCE (HCS)

ENVIRONMENTAL & PHYSICAL IMPACT (EPI)

DISASTER RELIEF AND PREPAREDNESS: MECHANISM OF MEMBRANE FOULING AND CLEANING IN MOBILE ULTRAFILTRATION PLANT FOR WATER TREATMENT

Project Information

Project Leader	: Dr. Nur Awanis Hashim
University	: University of Malaya
Address	: Department of Chemical Engineering, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur
Contact number	: 019-6888638
Email	: awanis@um.edu.my
Project Members	: Dr. Nur Awanis Hashim, Prof. Dr. Mohd Kheireddine Aroua Prof Dr. Mohd Azlan Hussain, Prof. Dr. Abdul Latif Ahmad Dr. Fathiah Mohd Zuki

1.0 Introduction

Flood disaster in December 2014 has affected the clean water supply in Kelantan. More than 16 water plants under Air Kelantan Sdn. Bhd. was shut down caused of flooding that submerged motor of water treatment system. Meantime, people looking for immediate water supply for daily used, since the supply is difficult to obtain. Therefore, University Malaya researchers have installed mobile ultrafiltration membrane system in Kuala Krai and Gua Musang (Kelantan) to provide immediate solution for clean water. Nevertheless, to ensure that ultrafiltration takes its rightful place in community to assists flood victims, the performance of the membrane must be on the top. The large part that needs to be enhanced and improved is the structure of membrane itself. The upgraded of the system can be achieved by optimizing the operating conditions of ultrafiltration to obtain maximum flux by studying the fouling mechanism of the installed mobile ultrafiltration membrane system. Membrane fouling is not easily removed. However, there are many methods that can be used to prevent the fouling to occur such as pre-treatment of feed water and membrane cleaning. Pre-treatment methods include sand filter, coagulation followed by sand filter, activated carbon adsorption and dosing of oxidant agents or anti-fouling agent before filtration. The membrane can be cleaned with using chemical or by backflushing pure water or permeate along with chemical cleaning. It is necessary to get well known mechanism information about membrane fouling before use it. This is important to maintain the performance of the membrane for specific lifespan of the membrane. The objectives in this study are to investigate the fouling mechanism of the installed mobile ultrafiltration membrane system and to perform analyses on permeate water quality.

2.0 Methodology

Ultrafiltration membrane system by recording the data of transmembrane pressure and flow rate or flux of the filtered water after pass through the membrane. From the data that been collected, a few graph were plotted that indicate fouling mechanism of the filter membrane. Basically, the system work by feed flood water flowed to the system of ultrafiltration membrane for 90 minutes for filtration process. After that, back wash need be done to remove the foulant that attach the membrane during filter of flood water. Regular back wash process very important to ensure the performance of the filter membrane can withstand as long as possible.

The method for second objective is to perform analysis on permeates water quality. The filtered water can be consumed by all the flood victims for their daily and household used. Before the water being used by local residents, the quality test of water been done to ensure the filtered water qualified and follow standard of World Health Organization (WHO) and Ministry of Health Malaysia (MOH). In this project, test kit was used to detect the some of the parameters in filtered water such as the presence of bacteria (coliform and E.coli), water turbidity, pH, Iron and manganese. Besides that, researchers also did confirmation test for filtered water by brought collected water sample to the laboratory to check whether the water qualities comply as WHO and MOH.

3.0 Results and Discussion

During filtration of flood water, some parameter were recorded such as flux, flow rate, transmembrane pressure (TMP) and time taken for water filtered pass through membrane ultrafiltration. Flux decline over time and often changing in selectivity due to concentration polarization (CP) and fouling are generally observed during ultrafiltration operation. Fouling is defined as a process resulting in loss of performance of a membrane due to the deposition of suspended or dissolved substances on external surfaces, at the pore openings or within it pores, whereas CP is the build-up of the solute concentration at the membrane surface due to selectivity of the membrane. Even though CP is reversible process it can facilitates irreversible membrane fouling by altering interaction among solvent, solute and membrane. Fouling can also be classified with respect to the flux decline over filtration time. The profile of flux decline over time can be classified into three regions as shown in Figure 1 (i) started by a rapid initial drop from the flux of pure water filtration, (ii)followed by a long term gradual flux decrease, and (iii) ended with a steady state flux. As shown in Figure 1, the permeate flux decreased sharply to 1.75 L/m^2 min of the initial permeate flux after 10 minutes. Some solute could be expected to be adsorbed onto the inner pore of membrane. After 55 minutes, it gradually decreased to about 0.9 L/m^2 min. The phenomena of slowly decreasing permeate flux during the last part can be cause the cake thickness to be nearly constant. The permeate flux could also remain constant because of the shear force of the crossflow inhibiting the increase of the cake thickness.

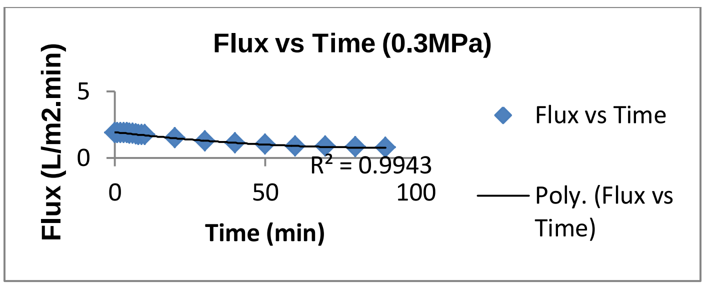

Figure 1: Profile of time dependent on flux

Figure 2 shows the profile result of the ultrafiltration membrane after flood water being flow to the membrane. It was observed that the surface of the filtration cake appeared to be intact and compact without any surface cleaning. This phenomenon indicates that the feed flow could flush away the filtered cake until it reach equilibrium thickness and that resistance would be increased after 90 minutes of filtration.

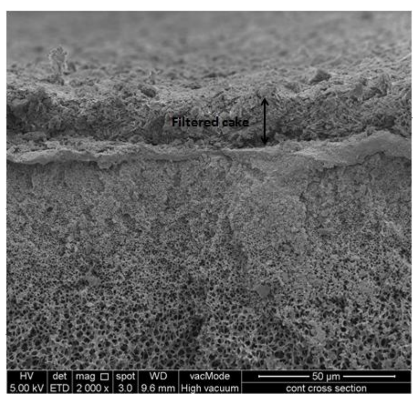

Figure 2: FESEM profile result of ultrafiltration membrane cleaned with pure water (magnified 2000)

Table 1: Water quality for flood water and filtered water after pass through ultrafiltration membrane

Parameter	Flood Water	Filtered Water	Removal (%)	Standard Specification for Drinking Water in Malaysia
Bacteria	Present	Absent	-	Absent

Turbidity (NTU)	55.4	0.298	99.5	< 5.0
pH	6.54	6.81	-	6.5-9
Iron (mg/L)	1.36	0.006	99.6	<0.3
Manganese (mg/L)	0.434	0.045	89	<0.1

Table 1 indicates the water quality before and after ultrafiltration. It was observed that the removal of turbidity, iron and manganese were 99.5%, 99.6% and 89% respectively. The iron and manganese may be oxidized and can be removed after pass through ultrafiltration membrane. It was also observed that the bacteria were present in the flood water but after the membrane filtration the bacteria were absent. The colony counts exceeded the acceptable level of respective bacteria. Comparison of the result obtained with WHO and MOH guidelines showed that UF treated flood water complies with standard from WHO and MHO hence can be used as drinking water and daily used.

4.0 Conclusion

The efficiency of the installed mobile UF system has been investigated.

4.1 Although flux decline over time could be seen from the results, automated backwashing system after certain transmembrane pressure have resulted in the reversible fouling and maintain the efficiency of the mobile UF system.

4.2 Permeate water quality of the system indicated that the water is safe for daily use and drinking purpose, though it is still advisable to be boiled before drinking.

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THE USE OF METAGENOMICS APPROACH TO STUDY THE SPECTRUM OF WATER MICROBIODATA TOWARDS ENSURING THE POST-FLOOD PATHOGEN-FREE WATER SOURCES

Project Information

Project Leader	: Assoc. Prof. Dr. Siti Suraiya Md Noor
University	: Universiti Sains Malaysia
Address	: Medical Microbiology Dept, School Of Medical Sciences, USM
Contact number	: +60172005521
Email	: ssuraiya@usm.my
Project Members	: Prof. Dr Zeehaida Mohamed Asooc. Prof Dr Azian Harun Assoc. Prof Dr. Zakuan Zainy Deris

1.0 Introduction

In December 2014, Kelantan state has been shocked by the massive flood which involved almost all districts. During flood many of the water supply points and sewerage were submerged in flood water leading to contamination and mixture of 'clean' and 'dirty' water. The population of Kelantan receives water supply from many sources. Treated piped water is supplied to most population by Air Kelantan Sdn Bhd. However, a large number of Kelantan population obtain water supply from wells, gravity feed water or directly from the nearby river. Tube wells are commonly used as alternative to piped water, and in many instances used as a sole source of potable water. Given the considerable time taken to improve post-flood water quality and sewerage management, a significant number of Kelantan populations are at risk of developing food and water-borne diseases during this critical period. The general effect of flood on water quality has been well-known. However, given the magnitude of the recent flood in Kelantan, a great deal of changes are expected namely in the rates and severity of microbial contamination and microbiological profiles of the water sources.

The ecological distress due to the contaminated water sources by the flooding lead to importance of monitoring the water sources quality. The microbiological water quality is conventionally done by culture method followed by counting the fecal coliforms (Monica 1991). These conventional microbiological studies do not reflects the magnitude of contamination especially if it involves the uncultivable organisms.

Metagenomics is the study of genetic material recovered directly from environmental samples. The earlier genome sequencing rely upon cultivated clonal cultures, cloned specific genes (mostly 16S rRNA gene) to produce a profile of diversity in a natural sample. Such work revealed that the vast majority of microbial biodiversity had been missed by cultivation-based methods. Recent studies use either "shotgun" or PCR directed sequencing to get largely unbiased samples of all genes from all the members of the sampled communities. Because of its ability to reveal the previously hidden diversity of microscopic life, metagenomics offers a powerful lens for viewing the microbial world that has the potential to revolutionize understanding of the entire living world (Marco, 2011).

Thus, in this project, we aimed to determine the microbiological profiles of the water sources in Kelantan following the massive flood of December 2014 by using shortgun next generation seguencing.

2.0 Methodology

2.1 Sample selection

Water samples were collected in December 2014 from flooded area in Kuala Krai, Kelantan. Kuala Krai is a suburban area in Kelantan, a North-eastern state of Malaysia (Fig 1).

2.2 Metagenome Extraction

A water samples during the flood and a repeat sample at the same locality 6 months after the flood were taken (Figure 1A). The samples were maintained at 4°C for less than a week before metagenomic extraction. A 100-mL sample was centrifuged at 1000 × *g* for 5 min to remove coarse particles, and the water was filtered using a 0.45-μm pore size filter (Sartorius, Göettingen, Germany). The filter membrane was then sliced and subjected to metagenome DNA extraction using the Metagenomic DNA Isolation Kit (Epicentre, Wisconsin, USA), according to the manufacturer's suggested protocol. The integrity of extracted DNA was evaluated by 1% w/v agarose gel electrophoresis. A Nanodrop™ 1000 spectrophotometer (Thermo Scientific, Wilmington, DE, USA), and a Qubit® 2.0 Fluorometer (Invitrogen, Merelbeke, Belgium) were used to measure the amount and the purity of the DNA. Metagenomes extracted from the same sampling site were subsequently analyzed by 16S rRNA sequencing and shotgun metagenome analyses.Whole Metagenome Shotgun Sequencing and Data Analysis Whole metagenome shot- gun sequencing was performed using the Illumina HiSeq 2500 sequencer (San Diego, CA, USA) available at the Malaysian Genome Research Centre, Kuala Lumpur. The data were delivered in a FASTA file analyzed.

3.0 Results

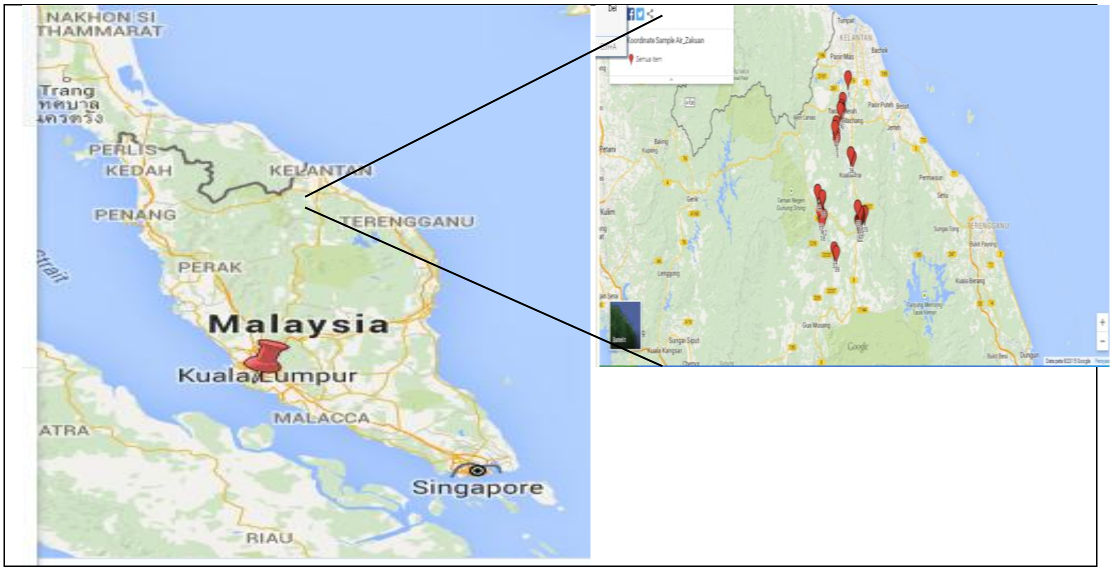

Figure 1: The Malaysia map and the locality of the sampled flood water. The coordinate of the sampled water for this study is Long 5.656552, Lat102.102881

3.1 The Quality control of the extracted DNA

Table 1: The Amount and the purity of the Nanodrop™ 1000 spectrophotometer (Thermo Scientific, Wilmington, DE, USA) Qubit® 2.0 Fluorometer (Invitrogen, Merelbeke, Belgium)

No	Sample Name	Vol (µl)	Nanodrop				Qubit	
			Con (ng/ul)	Total (ug)	A260/280	A260/230	Conc (ng/ul)	Total (ug)
1	DNA/GSA00002-a/16-10-2015	60	130.8	7.85	2.14	1.66	18.6	1.12
2	DNA/GSA00002-b/16-10-2015	60	164.9	9.89	2.07	1.76	54.6	3.28

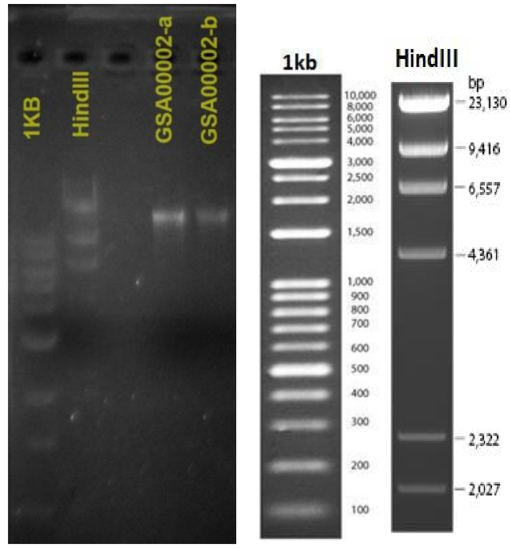

Figure 2: Integrity of the extracted DNA from the water sample

3.2 The percentage of unassigned equal read of the samples

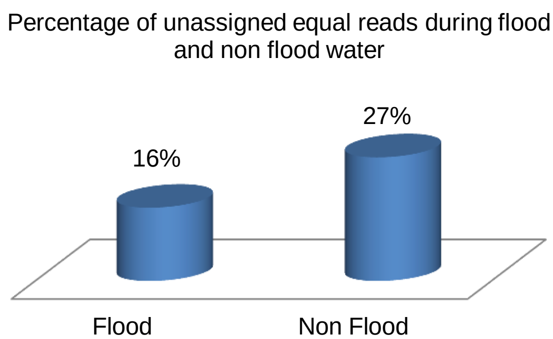

Figure 3: Unassigned Equal Reads that do not align significantly to any NCBI database sequence. The figure compare the unassigned equal reads of the microbiotome from flood water as compared to non flood at the same locality

3.3 The types of organisms identified during the flood as compared to non-flood situation

Table 2: The organisms identified from flood water and non-flood water

	Bacteria	% Read pair mapped
1	P.fluorescens_A506	11.01
2	B.cereus_group	2.42
3	P.putida_group	1.78
4	B.thuringiensis	1.21
5	P.putida_HB3267	0.92
6	P.entomophila_L48	0.79
7	P.putida	0.79
8	Enterobacteriaceae	0.6
9	P.putida_GB-1	0.5
10	Pseudomonas	0.49
11	P.putida_NBRC_14164	0.43
12	Pseudomonas sp._TKP	0.42
13	P.putida_W619	0.38
14	P.putida_H8234	0.37

	Bacteria organism	% Read pair mapped
1	P.fluorescens_A506	9.56
2	A.hydrophila.ATCC_7966	2.52
3	A.hydrophila_ML09-119	2.49
4	A.veronii_B565	2.04
5	A.hydrophila	1.54
6	B.cereus_group	1.12
7	E.cloacae	1.11
8	Enterobacteriaceae	1.03
9	A.salmonicida_A449	0.84
10	K.pneumoniae	0.78
11	E.coli	0.71
12	Aeromonas	0.53
13	Klebsiella	0.52

15	B.thuringiensis_MC28	0.37
16	P.fluorescens_SBW25	0.36
17	Pseudomonas_sp._VLB120	0.35
18	Comamonas_testosteroni	0.35
19	E.coli	0.34
20	Clostridium saccharoperbutylacetonicum	0.34

A

14	B.cereus	0.5
15	E. cloacae_EcWSU1	0.47
16	Pseudomonas_sp._TKP	0.36
17	E.cloacae_ATCC_13047	0.33
18	E.cloacae	0.32
19	Pseudomonas	0.32
20	P.fluorescens_SBW25	0.30

B

Table 1A represent the types of organisms identified during flood whereas table 1B is the types of organisms identified from non- flood water Pseudomonas species are predominant in both water samples. *Escherichia coli*, which is the indicator of the fecal contaminant is present in both samples with different percentage. In this study, apart from common gram negative organisms that commonly found in water sources, it is interesting to know that the amount of *Bacillus cereus* is 4 times more in flood water as compared to non-flood water. This organisms is pathogenic and can cause acute food poisoning and other gastrointestinal tract infection.

4.0 Discussion and Conclusion

Flood events are a natural occurrence that can have significant detrimental impacts to health, environmental and economy. The change in the water microbiota following massive and prolong flood can have a major impact related to water quality and public health. The impact is even greater if the same water system is used for consumption. In this study, the analysis of microbial diversity in paired samples (immediate post-flood and recovery phase) has been conducted using culture-independent molecular methods (clonal library analysis and fluorescence in situ hybridization) [Jump, 2007,Marco 2011]. The findings confirmed that the flood water contained detrimental organisms like *Bacillus cereus* that that cause acute food poisoning and *Bacillus anthracis* that have potential to cause anthrax that require special attention. Obviously, metagenomic analyses of the flood water addressed the potential gaps in the data regarding changes in contaminating pathogens.

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SIMULATION OF POLLUTANT DISTRIBUTION DURING FLOOD IN JOHOR RIVER

Project Information
Project Leader : PM Dr Razali Bin Ismail
University : Universiti Teknologi Malaysia
Address : Jabatan Kimia, Fakulti Sains, Universiti Teknologi Malaysia, Skudai, Johor
Contact number : 016-7580715
Email : zali@kimia.fs.utm.my
Project Members : Prof. Dr Zulkifli Yusop
Dr Hasmerya Maarof

1.0 Introduction

During stormflow, the water level of river is increased and contains higher loads of pollutants. The previous study stated that the pesticides concentration is increased during stormflow and a massive mobilization of pesticides was noticed during floods (Rabiet *et al.*, 2010). The use of pesticides is causing threat to the water quality in agricultural areas because the component of pesticides may pass through the soil and flow into the surface water and groundwater (Ormad *et al*.,2008). The concentration of heavy metals during stormflow also showed significant increase in both dissolved and particulate associated phases which controlled by antecedent hydrological conditions, mobilization and sediment dynamics of the system (Blake *et al.*, 2003). Stormwater runoff can be a main contributor to river pollution and degradation of water quality.

The fast development of agricultural and modern farming were implemented to satisfy the economic demand and to generate constant income. The Government also focused on urbanization to reflect the growth and success of the country (Liza, 2010). As development of agricultural and urbanization is rising, the country are facing the degrading level of the pollution. The increased populations in this country will increased the residential area and cause an increase in water demand.

Sungai Johor is the major source for water supply in Johor which is about 55% of total state needs. The treatment plants in Sungai Johor supply treated water to fast growing Iskandar Malaysia and works of PUB with capacity 250 MGD to supply treated water to Singapore. Currently, the deficit yield from Sungai Johor becomes a major problem due to sharing abstraction between 2 countries which is Johor and Singapore. The shortage of resource for Johor Bahru, Kulaijaya and Kota Tinggi required new source works and new water treatment plant. High demand of water and the development of agricultural and urbanization near Sungai Johor definitely gives adverse impact to quality of Sungai Johor basin particularly.

2.0 Methodology

The methodology was shown in Figure 2.1 below. Several water quality parameters were obtained in-situ while carrying out water sampling includes turbidity, dissolve oxygen, pH, temperature and others. Those parameters were measured by using YSI Multi Probe Professional Plus. The turbidity meter used is HACH 2100Q Portable Turbidimeter and the velocity was measured by using a current meter (SWOFFER ™ Meter 2100). The laboratory instruments operated in this research included DO Meter, HACH DR/4000 Spectrophotometer, Graphite Furnace Atomic Absorption Spectroscopy (GF-AAS), Mercury Hydride Generation, Inductively Couple Plasma with Optical Emission Spectrometer (ICP-OES), Gas Chromatography with Electron Capture Detector (GC-ECD) and Capillary Electrophoresis with Diode Array Detector (CE-DAD).

This study was carried out at Sungai Johor, which is located at the central part of south Johor and the main city is Kota Tinggi, Johor. Three catchments from agricultural area are selected for this study; Sungai Sebol (A1), Sungai Penggeli (A2) and Sungai Rantau Panjang (A3). The selected rivers comprise of two small and 1 huge catchments which are fully covered by oil palm plantation and agricultural area. The nearest residential area is Bandar Tenggara, Felda Sungai Sebol, Felda Penggeli and Felda Inas. Three catchments from urban area are also selected; Sungai Kemang (U1), Sungai Kampung Kelantan (U2), and Sungai Pemandi (U3). All these catchments are located near residential area at suburban area. U1 is surrounded with large number of shops operating as small scale industries such as workshops, salon and restaurant. U2 is covered with a small scale of oil palm plantations and housing area while U3 is surrounded by residential area, workshop, food shop and construction of new building. The coordinates of the sampling areas were shown in Table 2.1. Figure 2.2 shows the map of Sungai Johor and the location of six selected rivers.

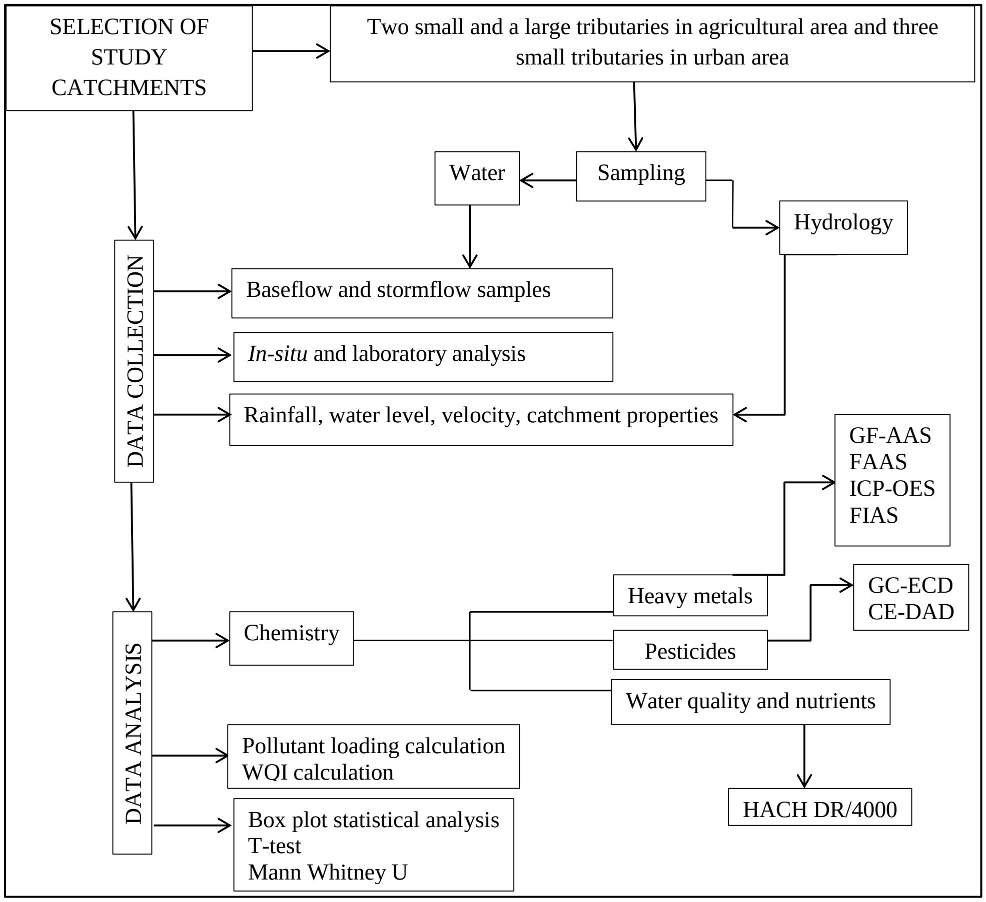

Figure 2.1: Methodology and whole of plan work in the study

Table 2.1: The coordinates of the sampling areas

Sampling area	Coordinates
Sungai Sebol (A1)	1’50’32’N 103’37’46’E
Sungai Penggeli (A2)	1’54’45’N 103’34’23’E
Sungai Rantau Panjang (A3)	1’46’50’N 103’44’45’E
Sungai Kemang (U1)	1’44’14.54’N 103’53’31.87’E
Sungai Kg Kelantan (U2)	1’43’40.53’N 103’53’33.25’E
Sungai Pemandi (U3)	1’44’13.44’N 103’54’34.79’E

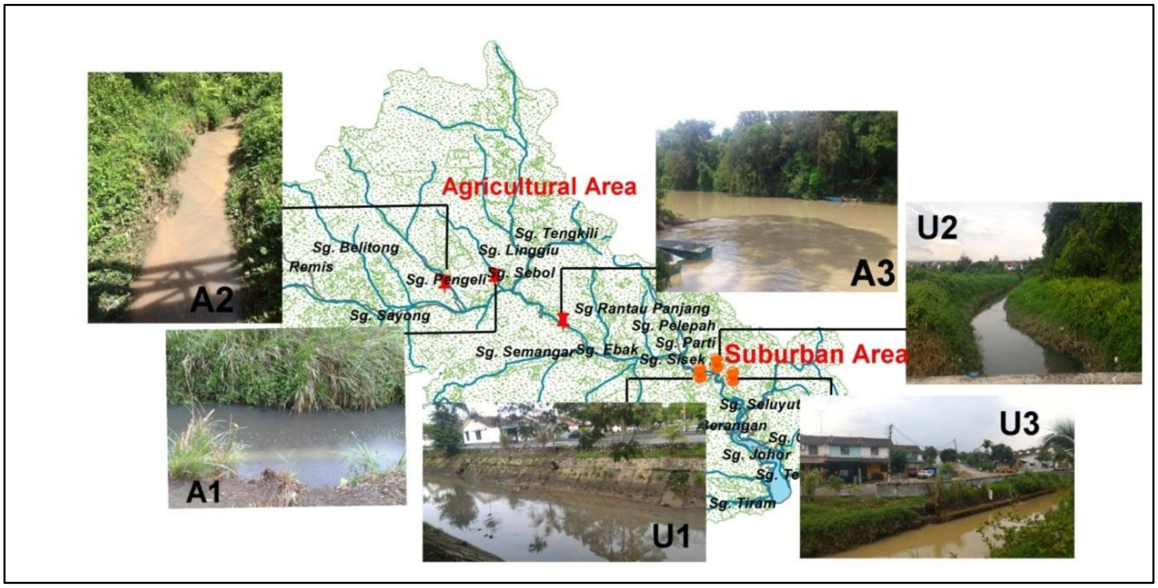

Figure 2.2: Sampling location at suburban and agricultural area

3.0 Results and Discussion

In each catchment, 5 storm events were sampled between April 2015 to February 2016. Sampling in A1 and A2 were carried out between April to May 2015 whereas for U1, U2 and U3 between December 2015 to February 2016. There was no rainfall data for A3 due to the existence of previous data collected from Department of Irrigation, Malaysia. The characteristics of the storm events are shown in Table 4.1. The rainfall for the sampled runoff in all catchments ranged from 0.10 to 42.5 mm.

Site	Storm Events	Total Rainfall Depth	Rainfall Duration (Hour)	Mean Rainfall Intensities (mm/hour)	Antecedent Dry Days (Day)
A1	1st April 2015	66.7	5.5	12.13	ND
A2	20th April 2015	1.2	5.0	0.24	0.708
U1	10th December 2015	32	3.1	10.32	5
U2	23rd December 2015	30	7.75	3.87	9
U3	4th February 2016	23	2.53	9.09	0.792

Water Quality Parameters

From the value of EMCs, it can be seen that most of the water quality parameters levels during stormflow are varies based on their land use. The EMC of DO during stormflow at both agriculture and urban area were in range 1.24 to 6.27 mg/L whereas during baseflow were between 2.07 to 5.94 mg/L. Generally, the normal value of DO is aroung 7 mg/L and above (JAS, 2008). DO is an important parameter and appropriate value of DO is needed to support aquatic life (Amneera *et al.*, 2013). The lowest value of DO was recorded at A1 (2.12 mg/L) during baseflow and the concentration is decreased (1.70 mg/L) during stormflow. Low flow condition during baseflow is less conducive to the diffusion of oxygen from atmosphere (ref). Therefore, the DO can become low during baseflow. The temperature of A1 catchment is high (28.9 º), thus it decrease the oxygen solubility in water (Idris *et al.*, 2009). When the water become warmer, the kinetic energy will increased and the gaseous oxygen in the river will evaporate thus, reduce the amount of DO. A1 catchments is located near palm oil mill and during rainfall the pollutant from organic fertilizer flow into the river, thus high DO is needed to decomposition process. DO and BOD had inversely proportional relationship. BOD value will increased when DO value is decreased. As example, the EMC of BOD during stomflow at A1 is 15.2 mg/L while the DO value is very low which is 1.70 mg/L.

The EMC of BOD in A2 during stomflow is 3.62 mg/L while during baseflow is 1.94 mg/L which is very low and still below the quality standard of NWQS. The EMC of BOD for U1, U2 and U3 during stormflow is ranging from 4.12 to 16.8 mg/L while during baseflow the value is in range 3.15 to 15.0 mg/L.

The BOD value for urban area is very high due to domestic discharge from the nearby residential area. The residential households in Kota Tinggi are fitted out with two kinds of wastewater outlet system; blackwater (toilet waste) and greywater (bathing and laundry waste). Greywater is flowed directly to the stormwater drains without treatment while blackwater is biologically and chemically treated (Said *et al.*, 2009). However, overflows from the septic tanks also occurred during storm event. The runoff that enter the river water during stormflow contain more organic waste which indirectly comes from those sources. The contamination of organic matter consists of feces and urine that overflows during stormflow can increase the BOD value and depleted the water quality of river.

COD measure the amount of oxygen that require for bacteria to decompose biodegradable and non-biodegradable while BOD measure only biodegradable. Therefore, the value of COD is always higher than BOD. There is a relationship between these two variable but there is no statistically significant correlation between them ($r = 0.515$, $p>0.05$). During stormflow, the EMC of COD at urban catchments is higher compared to agricultural catchments with 230.4 mg/L and 172.4 mg/L, respectively. The EMC value for COD during baseflow is in 41 mg/L in agricultural catchments and 57.3 mg/L in urban catchments. The maximum concentration of COD during storm was recorded in U1 (395 mg/L). It can be relate to accumulated pollutants in the antecedent dry days (5 days) would get into the river along with the rainfall runoff, thus, the pollutant concentrations reach a high value. The organic and inorganic pollutants that accumulated in the sediments and water is very high during dry days, thus, during the storm, the runoff bring along that accumulate pollutants (Said *et al.*, 2009). This COD value is exceeded the quality standard of NWQS.

The EMC of TSS during baseflow at all catchments is in range 5 to 127 mg/L while during stormflow were ranging from 20 to 119 mg/L. There is no significant correlation and negative relationship between TSS value during baseflow and stormflow at all catchments ($r=-0.345, p>0.05$). The rainfall-runoff decreased the TSS concentration due to dilution of pollutant in the river (Amneera *et al.*, 2013). Therefore, the concentration of TSS during stormflow is low compared to baseflow in the urban area. However, in agricultural catchments, the concentration of TSS during stormflow is high compared to baseflow. This is due to soil erosion that occurs to agricultural land and carrying away soil as well as pesticides, fertilizer, and other plants. Figure 4.1 shows the condition of the river during rainfall in agricultural catchment. There is strong relationship between turbidity and TSS with positive and significant correlation. ($r=0.985$, $p<0.05$).

Figure 4.1: River condition during storm events in agricultural catcment (A1)

The pH concentration was recorded in range from 4.78 to 7.70 at all catchments during baseflow and 5.16 to 8.36 during stormflow. A2 river water showed acidic pH during baseflow (4.78) and stormflow (5.16). The previous study stated that application of fertilizer can accelerate the soil acidification and then leaching to the groundwater or surface water (Wang *et al.*, 2010). The decreasing value of pH will increase the acidity in the river. Most of the metals will become more water soluble when acidity increased.

Level of Nutrients

The previous study indicated that agricultural activities contribute to the increasing concentration of nutrient in surface water (Fadiran *et al.*, 2008). The study at Tenneesee River Basin record that 157,000 tons of nitrogen and 37,300 tons of phosphorus came from fertilizers, nitrogen fixation by leguminous crops and livestock waste (Woodside & Hoos, 2001). The nutrients result was recorded in Table 4.2 and 4.3 below.

Ammonia is a toxic substance and not regulated by Safe Drinking Water Act. The permissible limit by NWQS for ammonia for general use surface water is 0.3 mg/L. In water, ammonia is present in its ionized form (NH^{4+}) with a very small percentage of neutral ammonia (NH_3). The sum of both concentrations creates total ammonia. The maximum concentration recorded at all catchment during baseflow is 0.35 mg/L (A1) and the minimum concentration is 0.017 mg/L (U1 and U3). During stormflow the ammonia value in A1 decreased to 0.096 mg/L whereas the maximum ammonia concentration recorded in A2 which is 0.47 mg/L. The ammonia concentration recorded in U3 increased to 0.03 however it is the lowest concentration detected during storm events. The result indicate that runoff from agricultutre contain more NH_3 compared to suburban runoff. As shown in Figure 4.1, the location of A1 and A2 is near to oil palm plantation (Ladang Cenas and Ladang Ulu Sebol A), lemongrass cultivation and school area. Therefore, the nonpoint pollution that produce from fertilizer and anthropogenic activities contain high concentration of NH_3. There is no significant correlation between the value of ammonia during stormflow and baseflow ($r = 0.455$, $p>0.05$).

Nitrite (NO_3^-) is more toxic compared to nitrite (NO_2^-), however, NO_2^- concentration in water is usually low because it easily converted to NO_3^- through nitrification process (Wolff and Wasserman, 1972). The permissible limit by NWQS for NO_3^- is 7.0 mg/L and 0.5 mg/L for NO_2^-. The EMCs of NO_3^- and NO_2^- at all catchment is over the permissible limit during stormflow, 10.17 mg/L (A1) and 0.1776 mg/L (A2), respectively. The lowest concentration of NO_3^- and NO_2^- were detected in suburban areas. High concentration of NO_3^- in agricultural area is due to leaching of fertilizer in oil palm plantation in the river during storm. The highest recorded value of NO_3^- and NO_2^- during baseflow is still below the permissible limit. There is strong relationship and significant correlation between NO_3^- and NO_2^- during baseflow ($r=0.803$, $p<0.05$). The high value of NO_2^- contributes to the high value of NO_3^-. NO_3^- is also had strong significant correlation with NH_3 ($r=0.421$, $p<0.05$).

Total nitrogen (TN) is the sum of all forms of nitrogen in the water sample. The highest TN concentration was recorded at A2 (50.18 mg/L) which is during stormflow. During baseflow, the concentration of TN was recorded at A1 (22.05 mg/L). Based on the result, strong relationship and significance correlation were detected between TN and NO_2^- ($r=0.873$, $p<0.05$).

Orthophosphate (PO_4^{3-}) is one forms of phosphorus and total phosphorus (TP) is a measure of all forms of phosphorus found in water. The highest concentration of PO_4^{3-} and TP were recorded at A1, which is during stormflow (4.23 mg/L and 5.86 mg/L, respectively). The lowest value of PO_4^{3-} and TP were detected at suburban areas. PO_4^{3-} is dissolved phosphate which is attach to biota and retained in the sediments (Mainstone and Parr, 2002). High contamination of PO_4^{3-} and TP come from the large amount of fertilizers and pesticides used on the crops. The oil palm plantation near the sampling area put fertilizers and pesticides at every 14 days interval. Therefore, during storm events, the waste of plantation drain into the river and increase the concentration of nutrients include PO_4^{3-} and TP. There are strong relationship and positive correlation between NH_3 and TP ($r=0.703$, $p<0.05$). Both of the nutrients is a product of decomposition of animals and from fertilizers.

Heavy Metals Quality

Heavy metals come from some source includes natural sources, mining activities, smelting, fertilizers, agrochemicals, wastewater irrigation and livestock manures. The previous study has proposed that As and Hg are come from manure application, combustion of fossil fuel and sewage irrigation. The contamination of As come from the use of herbicides (dimethylarsenic acid, disodium methyl arsenate and monosodium methyl arsenate) in oil palm plantation (Niefaizal *et al.*, 2004). Al enters the environment from anthropogenic source and wastewater treatment. Cu and Zn are common elements of pesticides and manure. Cd, Pb, Zn, Cu and As are mostly from anthropogenic activities such as agriculture, transportation and industry (Meng *et al.*, 2014; Smedley and Kinniburgh, 2000). Overall, the high concentration of heavy metals is greatly influenced by an anthropogenic source which includes municipal sewage, industrial effluents, herbicides, and fertilizer.

This pollutant would lead to a serious problem because it cannot be removed easily from the water but accumulate and enter the food chain (Ong *et al.*, 2009). There are agrochemicals that containing Cu and Zn as the previous study in China which is tons of Cu and Zn were applied in agrochemicals product to agricultural land annually (Liu and Li, 2001). Cu, Zn and As were added to animals feed due to their antimicrobial and growth stimulating effects to animals (Zhang *et al.*, 2012). While in the suburban area, the heavy metals pollutants are typical pollutants due to industrial and discharging municipal wastewater (Kumar Sharma *et al.*, 2007). In this study, a total of 11 heavy metals were studied in river catchments near the agricultural and suburban area, during baseflow and stormflow. The recorded data were compared during baseflow and stormflow at all catchments and comparison concentration between agricultural and suburban catchments.

The stormwater runoff changing the volume of flow, the velocity of the river, the pattern and quality of flow as well as the quantity of pollutants (Li *et al.*, 2015). The increased concentration of pollutants during stormflow is a very serious problem, however, it is difficult to identify the source of the pollutants because it is related to rainfall, land use and stormwater runoff quality. All of the heavy metals concentration at agricultural catchments is increased during storm except for As. While in suburban catchments, almost all of the heavy metals concentration also increased except for Cd, Ni, Pb and Hg. Low concentration of metals during stormflow indicates that dilution of metal occured in runoff and high concentration of metals indicates that acidification occurred during stormflow. Acidification occurred when acid rain enter the river water, directly or through the catchments. The previous study in souther Sweden resulted that acidification cause high concentration of Zn and Cd in the brooks and also in the river (Johansson *et al.*, 1995). Refer to Figure 4.1, the sampling location of agricultural catchments are located near oil palm plantation and workshops. During rainfall, the runoff brings all the pollutants into the river and the metals in the soil leaching to the surface water. The heavy metals accumulated and adsorb in the sediments and exist in suspended and colloidal form (Emoyan *et al.*, 2006). The contamination of heavy metals in the river increased during stormflow is resulted from the runoff that gives a great disturbance to the sediment, thus the heavy metals were transported. Generally, during stormflow, all the heavy metals concentration are below the guidelines for untreated water except for Fe and Hg. The highest concentration of heavy metals during baseflow and stormflow detected is Fe and Al, (3016 mg/L and 14,095 mg/L, respectively).

Overall, all metals studied at suburban area is higher than agriculture area, except for Mn and Al Mn and Al were high in agricultural area can be related with the low pH value in the river (acidification). pH values in agricultural area are ranging between 4.78 to 7.70 while in suburban area the pH range from 7.76 to 9.84. These metal are insoluble in he neutral pH (6.0 to 8.0) but enhanced the solubility with the presence of complex ligands under acidic condition (Srinivasan *et al.*, 1999). The concentration of Al is also increased with the increasing value of turbidity (Wang., 2004). In the previous study, Jekel (1991) had reported that Al concentration was low if the turbidity was less than 0.15 NTU (Srinivasan *et al.*, 1999; Jekel, 1991). In this study, high turbidity was recorded in agricultural catchments which are in range 14 to 16.92 NTU. Soil erosion that occurred due to rainfall runoff contributes to high turbidity value in the river.

The EMCs of heavy metals during baseflow at agricultural area were in decreasing order of Al>Fe>Mn>Hg>Zn>Pb>Cu>Ni>As>Cr>Cd, whereas for storm event, the order is Al>Fe>Hg>Zn>Mn>Pb>Cr>Cu>Ni>As>Cd. The EMCs of heavy metals during baseflow at the urban area were in the decreasing order of Fe>Al>Pb>Cu>Zn>Hg>Ni>Mn>As>Cr>Cd. The EMCs of heavy metals during stormflow at the urban area were in decreasing order of Fe>Al>Zn>Cu>Mn>Pb>Cr>Ni>As>Hg>Cd. Cadmium concentration was low at all sampling location during baseflow and stormflow. The EMCs of all studied heavy metals were shown in Table 4.2.

Table 4.2: EMCs of all heavy metals studied at all catchments during baseflow and stormflow

Metals	**Sampling locations**											
	A1		A2		A3		U1		U2		U3	
	B	S	B	S	B	PD	B	S	B	S	B	S
Al	157.846	1035.784	1049.228	6047.504	551.052	NA	238.855	931	397.667	291.4	174.800	924.6
As	1.264	1.088	0.288	0.175	1.143	NA	3.658	4.1118	3.309	3.77212	5.222	4.3038
Cd	0.044	0.489	0.187	0.146	0.071	NA	0.469	0.6656	0.591	0.186	0.314	0.211
Cu	0.950	3.970	1.220	2.382	0.864	NA	68.075	116.436	57.703	121.12	54.807	111.8
Cr	0.367	1.534	0.527	7.489	0.492	NA	1.588	4.2584	1.161	3.0196	2.741	2.5148
Fe	923.780	1276.606	161.921	927.579	306.489	4000.0	1280.833	1762.8	1665.000	2080.6	815.833	2046.1

Hg	9.723	25.732	8.399	29.886	7.746	NA	18.941	3.2822	35.903	1.912	25.146	0.569
Mn	15.875	23.696	11.117	15.248	13.716	20.0	3.215	36.784	2.833	56.348	6.543	151.66
Ni	1.602	2.587	0.507	2.385	0.824	NA	5.308	2.8066	3.126	2.5284	3.824	3.477
Pb	1.431	2.579	8.395	22.598	3.624	NA	201.141	50.4	182.167	54.2	163.833	51.2
Zn	8.648	25.731	5.392	18.985	9.396	NA	52.167	141.1	50.667	59	66.500	57.4

***NA: Not available**
***B: Baseflow, S: Stormflow**
***PD: Previous data from DID**

Pesticides

Organophosphorus pesticides include chlorpyrifos and malathion are extensively used in the world to control insect species in the agriculture sector (Ma *et al.*, 2009; Ambavaram *et al.*, 2014). According to Canadian Drinking Water Quality Guideline, the maximum allowable concentration for malathion is 190 µg/L whereas for chlorpyrifos is 90 µg/L. The malathion and chlorpyrifos standard pesticides were detected at retention time of 3.6 minutes and 3.9 minutes, respectively.

Pesticides concentration in water sample

The EMCs of malathion and chlorpyrifos during baseflow and stormflow in water sample at each sampling station are presented in Table 4.2 and illustrated in Figure 4.5 and 4.6. Malathion and chlorpyrifos were low detected in the water sample and none of the samples of agricultural or urban runoff had pesticides concentration that exceeded maximum allowable concentration in drinking water.

Low concentration of both pesticides detected in all water samples during storm events. The maximum concentration of malathion is detected at U3 (45.87 µg/L). The maximum concentration of chlorpyrifos is also detected at U3 (6.08 µg/L). U3 is near to populated residential area plus the residents carry out small scale of agricultural activities such as flowers garden and fruits plantation. The maximum concentration of malathion and chlorpyrifos at agricultural area is 3.45 and 6.01 µg/L, respectively. Pesticides residue and degradates enter the water environment includes through direct runoff, leaching, washing equipment and atmosphere (Leena *et al.*, 2012). They are completely decomposed after exposed to air, water, sunlight, high temperature and bacteria. Their degradability also depends on hydrological condition such as rainfall and geological factor (type of rock, soil and sediment) (Baghfalaki *et al.*, 2013). Therefore, when residue of pesticides remain in water, they tend to exist in very small amount (Baharuddin, 2003). This result also indicate that the occurrence of dilution of the sample during rainfall runoff.

Chlorpyrifos had strong relationship and significant negative correlation with TN ($r=-0.648$, $p<0.05$), due to high content of chlorpyrifos decreased the content of nitrogen in soil by inhibit the process of nitrification and ammonification (Menon *et al.*, 2004; Sardar and Kole, 2005). There is a significant negative correlation between Malathion with Cu and PO_4^{3-} during stormflow ($r= -0.398$, $p<0.05$ and $r=-0.496$, $p<0.05$, respectively). Overall, the detected concentration of pesticides in suburban area is higher compared to agricultural area.

Table 4.2: EMCs of pesticides detected during baseflow and stormflow

	Malathion (µg/L)		Chlorpyrifos (µg/L)	
Site/ Stream flow	**B**	**S**	**B**	**S**
A1	0.097	1.76	0.97	2.91
A2	4.29	2.24	1.51	0.45
A3	1.28	-	1.14	-
U1	0.77	1.59	0.12	1.17
U2	0.99	2.02	0.16	0.29
U3	7.54	16.2	0.12	4.86

*B: Baseflow, S: Stormflow

Distribution of water quality and nutrients loads

The sources of pollution in the river can be categorized into industrial, livestock, domestic and land originated pollutants. The pollutant loading obtained during storm event is the product of EMC which is based on flow weighted concentration average of many samples per event. The result shows that the pollutant loading of most of the parameters during stormflow is higher compared to the pollutant loading during baseflow. The pollutant loadings are strongly dependant on the runoff volume and the catchment area.

The BOD, COD, TSS, NO_3^-, PO_3^{4-} and TN loading from U1 was the highest among all catchment location during baseflow. This was because U1 have the slow flow velocity, shallow river condition and the lowest catchment area compared to other catchment. The NH_3, NO_2^- and TP loading from A1 was the highest compared to other catchments. A1 is located near agriculture area, therefore high contain of ammonia, nitrite and total phosphate were detected due to use of nitrogen and phosphorus based fertilizer. The transportation of ammonia, nitrite and phosphate were increase with the flow of surface water in the river. The COD and TP loading at U1 was the highest during stormflow. U1 is located at urban area which is near the resident area. The untreated sewage from residents can be related to high COD loading. During storm, the rainwater falls onto the surface and remove the pollutants that have been accumulated during normal period (Barco, O.J. , Ciaponi, 1980).

The BOD and PO_3^{4-} loading was highest at U3 whereas TSS, NH_3, NO_3^- and NO_2^- were highest at the agricultural area (A1 and A2). The remaining nitrogen fertilizer converted to nitrate and nitrite through nitrification in the soil and interfere the surface water through leaching, especially during storm event. The nitrate content in drinking water can affect human health (liver, kidney and central nervous system) when absorbed in the intestinal tract (Savci, 2012). During the storm event, the pollutants are being washed into the river and soil erosion occurs, thus TSS loading is very high.

Heavy metals loading

The heavy metals loadings are presented in Table 4.4. The highest metal loading during baseflow is Fe (89.81 g/day) and Al (275.39 g/day) during stormflow. Fe and Al are occurring naturally in the environment however high values of Fe and Al in the river have for some time been considered as issues. High concentration of Fe might induce rust formation on plumbing fixtures and give metallic taste in drinking water (Vuori, 1995). The loading of Fe and Al were increased at 95% during storm event due to high runoff, thus high transportation of metals. However, at urban area, most of the metals loading during baseflow is higher than stormflow.

Storm Hydrograph

Hydrograph shows the storm effects to a river. Storm hydrograph provides understanding on discharge patterns of drainage basin and helps to predict flooding (Kresic and Bonacci, 2010). The hydrograph shows in Figure three major responses of the parameter of pollutants to rainfall amount. The first type shows the concentration of pollutants increased on the rising limb of hydrograph and followed by gradual decreased during the falling limb. The second type shows the dilution with increasing rainfall amount and discharge while the third type shows the concentration of pollutants is varies during rising and falling limb of the hydrograph.

4.0 Conclusion

4.1 Stormflow quality is deteriorated compared to baseflow. Therefore, it can be concluded that if the flood occurs, it will brings more pollutant that accumulates during dry days enter the river.

4.2 The agricultural area is more affected compared to suburban area. The soil in agricultural area is more exposed to soil erosion and indirectly, the pollutants in soil (pesticides and heavy metals) can flow into the river.

4.3 EMC values differ greatly between storm events. The EMC values are not solely controlled by the storm size.

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PREVALENCE AND RISK FACTORS ASSOCIATED WITH FOOD INSECURITY AMONG POST-FLOOD VICTIMS IN PAHANG, MALAYSIA

Project Information

Project Leader	: Khairil Anuar Md. Isa
University	: Universiti Teknologi Mara (UiTM)
Address	: Dept. Of Basic Sciences, Faculty of Health Sciences
Contact number	: +6019-9805501
Email	: khairil996@puncakalam.uitm.edu.my
Project Members	: Mohd Ghazali Masuri, Ajau Danis, Norazmir Mat Nor, Suleyman Murad, Akehsan Dahlan Norazlanshah Hazali, And Anis Fadly Baijunid.

1.0 Introduction

Floods are the most common reported disaster worldwide, with an important impact on the health especially on the human population (Ahern et al., 2005). Their effects are dramatic especially in developing countries such as South-East Asia (Noji, 1997). Evident from epidemiological study showed for increased risk of diseases associated with flooding such as diarrhoea, cholera, and post-traumatic stress disorder (Biswal et al., 2001). However, little and geographically restricted evidence is available on the impact of floods on food insecurity among post-flood victim available especially for our population. Food security can be defined as the condition where people have sufficient access of the safe and nutritious food in which the intake of the foods are met the recommended need in order to live in a healthy life (FAO, 2008). This definition indicates that food security measures dimension of availability, accessibility, stability and utilization of food. Disruption either one of the dimension lead to food insecurity and natural disaster such as flooding events will disturbed the dimensions of food security due to its physical damage in flooding areas.

In Malaysia, food insecurity was estimated at 45% towards 75% in the general population (Sharif and Khor, 2005; Muhamadpour et al.,, 2012). However, there has no study related with flood and it impact on food security status. The most recent floods occurring in several areas in the east coast Malaysia in December 2014 provided an opportunity to explore the strengths of association between flooding and the food insecurity while taking into consideration other variables that directly affect food insecurity status into account.

2.0 Methodology

This study was conducted in Dun Guai, Bera District, Pahang of central Malaysia, which is approximately 130 km from Kuala Lumpur (the capital city of Malaysia). The area was purposely selected for the benefit of a better frame and research infrastructure. A community-based, cross-sectional study was employed between June to December 2015 six months after 2014 flooding. We administered the pretested Malay version of Household Food Security Survey Module (HFSSM) with socioeconomic and post-flood and recovery survey questionnaires to the study participants. The study included a total of 16 villages from which 14 villages were affected by the floods and most of those villages are located about 1.5 km to 2.5 km alongside the river of Pahang. The sample size of the study was estimated using formula for a single population proportion yielding 222 participants with an expectation of 20% anticipated of non response cases. The convenient sampling method was employed to select study households within a given village. We used SPSS version 20 for data entry and analysis (SPSS, Chicago, IL, USA). The results from HFSSM delaine households across the four level of food insecurity, including food secure, marginal food insecure, low food insecure and very low food insecure. Food security status then was further analyzed based on two categories (food secure and food insecure) developed after collapsing food secure and marginal food secure into food secure group and the rest into food insecure group. Hypotheses testing were completed using a chi-square test and logistic regression analysis with statistical significant level as set at $\alpha<0.05$. Prior to initiation of this study, the UiTM human subjects review board approved this study. Ethical issues that were considered during conducting this study were participant safety and all of their information needs to be anonymous.

3.0 Results and Discussion

A total of 247 households were studied. The response rate of participation was 85% where only 210 of those households agreed to participate, and we included 115 and 95 households from flood affected and non-affected villages, respectively. The sample characteristic of the study population is shown in Table 1, and the mean age (year) of the respondents was 51.4(±16.5). The age distribution indicated that 65.6% and 19.4% of respondents were in the age group between 19-65 and more than 65 year, respectively, and the great majority had a low education level (Below SPM)(78.9%), married (62.3%), and almost all of the participant were Malays (99.5%). A third of the participants (76.9%) grouped themselves as having income bracket less than RM 2000 per month. The overall prevalence of marginal food secure, moderate food secure, and low food secure were 31.4%, 21.9%, and 10.0%, respectively (Table1). Food insecure was estimated at 43.3% at study location during at the time of study. However, the prevalence of food insecurity was 80.3% in the flooded area compared with 58.1% in the non-flooded area. Table 2 shows the association between food insecurity and age, education level, marital status, household income, household composition, health status, adequate grocery store status, variety of food at grocery stores, food choice availability at grocery stores, transportation problem for going to grocery stores, quality of food, and whether the village exposed to floods or not. In the bivariate model, elderly, married participants, monthly income, inadequate grocery store, and unaffordable food choice were associated with food insecurity. Our study represents a first attempt to understand the role of exposure to natural disasters as a risk factor for food insecurity especially in Malaysia. The prevalence of food insecurity in flood affected area (80%) was relatively higher than study conducted in Malaysian general population among poor households (Sharif and Khor, 2005; Muhamadpour et al.,, 2012). This suggest that the natural disaster could lead to food problem especially food insecurity. Six months after the floods, education level, adequate grocery stores, variety of foods at stores and transportation were not significantly contributed to food insecurity after the multivariate analysis. In contrast, a higher risk of food insecurity was detected in married participants. This is in agreement with our finding that suggested the higher number of family composition the higher the risk of getting food insecurity. Several studies also found similar finding with us (Sharif and Khor, 2005; Muhamadpour et al.,, 2012). This condition make worse with natural disaster like flood. This finding underlines that exposure to floods as a risk factor for food insecurity in study area. One limitation of this study is a direct consequence of its cross-sectional design, which did not allow us to establish causal relationship. Second, this study was conducted six month after a flood. As a consequence, low prevalence of food insecurity may be observed compared if we survey soon after waters started to recede in a heavily flooded area. Nevertheless, the present study has captured relevant information pertaining risk factors of food insecurity especially during natural disaster.

Table 1. Demographic characteristics of study population

Characteristic	n(%)
Age	
Adult(19-65 year old)	162(77.1)
Elderly(>65 year old)	48(22.9)
Marital status	
Single	16(7.6)
Married	154(73.3)
Widow	38(38)
Divorced	2(1.0)
Education level	
Low (Below SPM)	195(92.9)
High (Diploma and above)	15(7.14)
Household size, Mean(SD)	5(2.2)
Food security	
Household food secure	77(36.7)
Marginal food secure	66(31.4)
Low food secure	46(21.9)
Very low food secure	21(10.0)
Food insecurity status	
Food secure	119(56.7)
Food insecure	91(43.3)

Table 2. Factors associated with food insecurity in the study location

Variable	Crude OR	P-value	Adjusted OR	Statistics (df)	p-value
Age					
Elderly(>65 year old)			1		
Adult(19-65 year old)	0.237	<0.001	0.189	9.455(1)	0.002
Education level					
Low (Below SPM)	1				
High (Diploma and above)	0.634	0.421			
Marital status					
Single	1		1		
Married	7.373	0.010	58.82	10.016(1)	0.002
Widow	7.000	0.225	7.22	1.081(1)	0.311
Divorced	2.172	0.360	21.832	5.602(1)	0.019
Household income/month					
<RM1000			1		
RM1000-2000	0.737	0.327	0.41	4.417	0.036
RM2000-3000	0.185	0.010	0.025	13.083	<0.001
Household composition	1.467	<0.001	1.64	20.459(1)	<0.001
Health composition					
Excellent			1		
Very good	0.393	0.271	0.007	8.737(1)	0.003
Good	0.703	0.653	0.015	6.850(1)	0.009
Fair	0.375	0.235	0.012	7.094(1)	0.008
Poor	0.750	0.858	10++	0.000(1)	1.000
Adequate grocery stores					
Yes	1				
No	2.806	0.003			
Variety of foods at grocery stores					
Yes	1	0.239			
No	1.406				
Food choice affordable					
Yes	1		1		
No	2.571	0.007	6.360	11.706(1)	0.001
Don’t know	10++	1.000	10++	0.000(1)	1.000
Transport problem					
Yes	1				
No	1.519	0.340			
Don’t know					
Flooding status					
Non-flood area	1	0.149	1	5.290(1)	0.021
Flooded area	1.502		2.47		

4.0 Conclusion

4.1 Food insecurity is prevalence in flood affected area.

4.2 Exposure to flood, elderly, marital status, bigger household composition size, health status, and unaffordable food choice were associated with food insecurity after multivariate analysis.

4.3 This finding underlines that exposure to floods as a risk factor for food insecurity in study area.

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DETERMINING NOVEL AND ALTERED PKS METABOLIC PATHWAY GENES IN ACTINOMYCETES CAUSED BY FLOOD LEADING TO NEW BIOACTIVE COMPOUND DISCOVERY

Project Information

Project Leader	: Dr. Khomaizon Abdul Kadir Pahirulzaman
University	: Universiti Malaysia Kelantan
Address	: Faculty of Agro-Based Industry, Universiti Kelantan Malaysia, Jeli Campus, Locked Bag No. 100, 17600 Jeli, Kelantan, Malaysia.
Contact number	: 099477163
Email	: khomaizon@umk.edu.my
Project Members	: Prof. Madya Dr. Seri Intan Mokhtar Dr. Ainihayati Rahim Nor Farahani Ali Othman

1.0 Introduction

The natural habitats of microorganisms are exceedingly diverse. Any habitat suitable for the growth of higher organisms can also support the growth of microorganisms. However, in addition, there are many habitats where, because of some physical or chemical extreme, higher organisms are absent yet microorganisms exist and occasionally flourish (1). Actinomycete, a high guanine and cytosine gram-positive bacteria are common throughout the soil. With the diverse metabolite characteristic that is advanced metabolic differentiation, actinomycetes are regarded as a major potential source of new bioactive substances. Secondary metabolites which are natural products proved to be a valuable source of bioactive agents for use in the pharmaceutical and agrochemical industries. Secondary metabolites have attracted more attention and are extensively studied, since many are of pharmaceutical or agrochemical importance. Sixty percent of successful drugs have been derived from natural products (2). Compounds such as penicillin (antibiotic), cyclosporine (immunosuppressant), statins (cholesterol-lowering agents) and cephalosporin (antibiotic), are examples of the most widely sold natural-product-based drugs; evidence that natural products took on a significant key role in the production of drugs or drug leads (2, 3, 4). Actinomycetes antibiotics are not restricted to antibacterial antibiotics but include antifungal, anticancer antibiotics and also antiviral antibiotics. Screening of actinomycete cultures for decades yielded novel industrially important products and pharmaceuticals (5). Besides, identification through molecular analysis is important too. The variety and richness of secondary metabolite structures has encouraged the exploration of compounds produced by plants, bacteria, fungi and every other type of living thing. Most secondary metabolites are complex molecules that require a large number of specific enzymatic reactions for synthesis (2). Some are derived from polyketides, which are biosynthesized by the polymerization of acetate and malonate units in a similar process to fatty acid synthesis. Polyketides are not grouped together because they share a common structure; they are classified by the metabolic pathway that produces them. This metabolic pathway is identified by a specific ketone intermediate. An essential enzyme in the pathway for polyketide production is polyketide synthases (PKS). Polyketide macrolides are a common secondary metabolite of actinomycetes. Many actinomycetes contain PKS gene clusters and this group of bacteria has long been recognized as an important source of bioactive molecules. Hence, identification through molecular analysis is important. The present study was carried out to identify the biodiversity of actinomycetes in flooded areas and to screen for polyketide synthase genes in isolated actinomycetes. This can discover whether under extreme condition (such as flood), the metabolic pathway which controls the polyketide in actinomycetes will be altered or not.

2.0 Methodology

2.1 Sample collection and pre-treatment process

Soil samples were collected from flooded areas; 27 from Dabong, Kelantan and 20 from Kuala, Lipis Pahang respectively. The soils were collected 10 cm below the soil surface and kept in a zip-lock plastic bag. Soil samples were then air-dried for 1 week in the laboratory and stored at 4 °C for future use.

2.2 Isolation of actinomycetes

Three isolation methods according to Muramatsu, H. et al. (2003) were employed with some modification:

High temperature (HT) method

0.2 g of air-dried soils were placed into a test tube containing 2 ml of sterilized 0.01% polyoxyethylene sorbitan monoelate and vortexed vigorously for 5 min. The suspension was then sonicated for 5 min. 200 µl of the suspension was spread onto 3 growth media; Humic acid Agar, HA (1 g/L humic acid, 1.7 g/L KCl, 0.5 g/L Na_2HPO_4, 0.5 g/L$MgSO_4$, 0.02 g/L $CaCO_3$, 0.01 g/L $FeSO_4$, 10 g/L agar, pH 7.2), Soil Leaching Agar, SLA (0.5 g/L humic acid, 10 g/L agar, 1000 mL soil leaching water, pH7.2) and Soil Leaching Starch Agar, SLSA (5 g/L soluble starch, 1 g/L KNO_3, 10 g/L agar, 1000 mL soil leaching water, pH7.2). All growth media were supplemented with antibiotic cyclohexamide (50 mg/L) and trimethoprim (100 mg/L). The isolation plates were incubated at 30 °C for 3 weeks with daily observation. This method is a selective isolation for Microbispora, Microtetraspora and Streptosporangium genera, which the spores are highly resistant to dry heat (cited in Hayakawa, M et al., 1997).

Centrifugation (CF) method

0.2 g of air-dried soils were gently mixed with 2 ml of sterilized 0.01% polyoxyethylene sorbitan monoelate. Vigorous shaking will isolate the non-motile actinomycetes. The suspension was incubated at 30 ˚C for 1 hr. After incubation, 1 mL of suspension was transferred to a sterile eppendorf tubes and centrifuged at 7000 rpm for 20 min. 200 µl of the supernatant was spread on HA, SLA and SLSA plates. The isolation plates were incubated at 30 °C for 3 weeks with daily observation. This centrifugation method allows isolation of motile actinomycetes such as Actinoplanes and Pseudonocardia.

Chloramin T (CT) method

0.2 g of air-dried soils were placed into test tube containing 2 ml of 4% Chloramin T solution (dissolved in sterile water). The suspension was vortexed vigorously for 5 min followed by 5 min sonication and incubated at 30 °C for 30 min. 200 µl of the suspension was spread on HA, SLA and SLSA plates. The isolation plates were incubated at 30 °C for 3 weeks with daily observation. Chloramin T is a chlorine releasing biocide that will inhibit the growth of non-filamentous bacteria.

2.3 PCR amplification and DNA sequencing

DNA extraction

DNA extraction were performed according to Muramatsu, H. et al. (2003). A small piece of each morphologically selected Actinomycetes strain was inoculated with a sterile toothpick into 100 µl of ½ strength of ISP-Medium 1 with 0.5% glycine and 0.01% polyoxyethylene sorbitan monoelate in a 96 well plate. The plate was incubated at 30 ˚C for 16 hrs and stored at -80˚C until direct PCR amplification.

PCR for selective actinomycetes containing PKS gene

To screen aromatic polyketide producers from all the isolates, the degenerate primers IIPF6 (5′-TSGCSTGCTTCGAYGCSATC-3′) and IIPR6 (5′-TGGAANCCGCCGAABCCGCT-3′) were used to amplify type II polyketide KSα gene fragment (Metsä-Ketelä et al., 1999). Subsequently, the universal bacterial primers 27F (5′-GAGTTTGATCCTGGCTCAG-3′) and 1500R (5′-AGAAAGGAGGTGATCCAGCC-3′) were used to amplify nearly complete 16S rRNA gene of the actinomycete candidates (Woese et al., 1983). PCR was carried out in a 25 µl volume using 1U of i-Taq™Plus (iNtRON Biotechnology) DNA polymerase and i-Taq™Plus PCR buffer. dNTPs and primers were present at 10 µM and 0.5 µM respectively. DNA templates were added at 5 ng per reaction. PCR were performed with a Super Cycler Trinity PCR machine (Kyratec Life Science) with the program: 98 °C for 30 sec (1x), 98 °C for 10 sec, 60 °C for 20 sec, 72 °C for 30 sec (35x), 72 °C for 5 min (1x).

3.0 Results and Discussion

Forty seven soil samples were collected from various flooded areas: Dabong, Kelantan (27), Kuala Lipis, Pahang (5), Kechau Tui, Pahang (2) and Kampung Seberang Jelai, Pahang 13) respectively. A total of 969 acinomycetes were isolated (Figure 1) from the soil samples using 3 methods; Centrifugation (270 isolates from Kelantan, 175 isolates from Pahang), Chloramin T (160 isolates from Kelantan, 199 isolates from Pahang) and High temperature (117 isolates from Kelantan, 48 isolates from Pahang) respectively. Aromatic polyketides are known to be produced by a few taxa among diverse actinomycetes. Thus, knowing their taxonomic distribution facilitates the prioritization of strains for aromatic polyketide search and discovery. In this study, 6 out of 16 sequenced results displayed 86-95% maximum similarity to those KSα associated with experimentally characterized biosynthetic pathways. Actinomycete strains generally contain a number of biosynthetic gene clusters, but only a few corresponding metabolites have been obtained until now. Furthermore, the majority of the biosynthetic gene clusters are unexpressed under standardized laboratory conditions, which leads to a low efficiency in the discovery of their secondary metabolites. Twelve out of 16 sequenced results showed 81-98% identity with experimentally characterized actinomycetes. PCR amplification will be carried out on the remaining isolates.

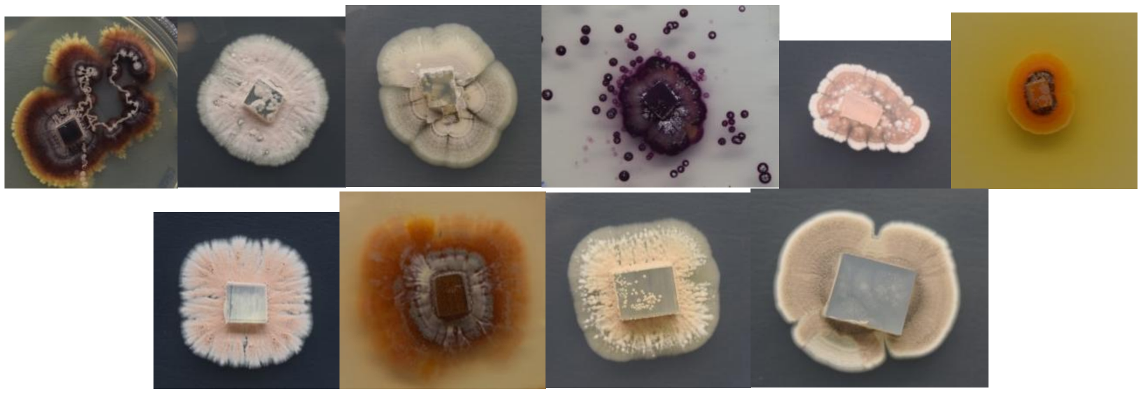

Figure 1: Some of the morphologically different actinomycetes isolated from flooded soils.

4.0 Conclusion

4.1 A total of 969 actinomycetes were isolated from flooded areas of Kelantan and Pahang.

4.2 Only 165 actinomycetes were isolated by heat treatment method, suggesting that high temperature treatment inhibit the bacterial growth thus reducing the number of non-filamentous bacteria on the isolation medium.

4.3 PCR amplifications were performed on 125 isolates; 6 out of 16 sequenced results displayed 86-95% maximum similarity to those KSα associated with experimentally characterized biosynthetic pathways.

4.4 Twelve out of 16 sequenced results showed 81-98% identity with experimentally characterized actinomycetes. Most of the isolated actinomycetes were originally isolated from mangrove, lake and bamboo soils.

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FLOOD IMPACT ASSESSMENT FOR SG. PERAK RIVER BASIN FOR FUTURE DISASTER RISK REDUCTION

Project Information

Project Leader : Ahmad Mustafa Hashim
University : Universiti Teknologi Petronas
Address : Jabatan Kejuruteraan Awam dan Alam Sekitar, Universiti Teknologi Petronas, 32610 Bandar Seri Iskandar, Perak
Contact number : 019-3364747 (05-3687356)
Email : mustafa_hashim@petronas.com.my
Project Members : Khamaruzaman Wan Yusof, Abd Nasir Matori, Muhammad Raza Ul Mustafa, Subarna A/P Sivapalan

1.0 Introduction

The end of 2014 and beginning of 2015 saw an extraordinary floods hit several states in Peninsular Malaysia. The shocking flood event which affected Perak on a scale that had never been experienced before illustrated how most of the inundated areas were within the low lying areas along Sungai Perak. Among the worst hit areas included Perak Tengah district followed by Kuala Kangsar, Hulu Perak and Kerian district with a number of areas inundated for more than two weeks. It was reported that 12115 victims from 2896 families had registered at 77 relief centres, mainly at the above four districts. This research undertook the assessment to determine the causal factors and mechanisms that led to the recent disaster. The comprehensive investigation which covered field assessment and personal interview covering 565 respondents also analyzed the extent of flood damages for the affected area in the state of Perak. The floods caused damage to homes, property, vehicles, crops, livestock and other valuable equipment. Also directly affected were the flood victims' livelihoods, health, safety, psychology and overall convenience of the affected population.

2.0 Methodology

The work involved three main tasks (1) data collection and records from various sources and related agencies, (2) site assessment and field investigation, and (3) data processing and analysis. The survey had involved 565 numbers of respondents which composed of 68% female and 31% male from three districts which experienced flood in 2014 as shown in Table 1. The three districts involved were Perak Tengah, Kuala Kangsar and Hulu Perak. The respondents ranged between 14 to 94 years old. Whereas most of them were aged between 51 to 60 years (23%) and 41 to 50 years (21%) as shown in Figure 1.

Table 1: 565 respondent covering Perak Tengah, Kuala Kangsar and Hulu Perak

Districts	**M**	**F**	**No of respondent**
Perak Tengah	113	275	388
Kuala Kangsar	54	84	138
Hulu Perak	9	30	39
Total			565

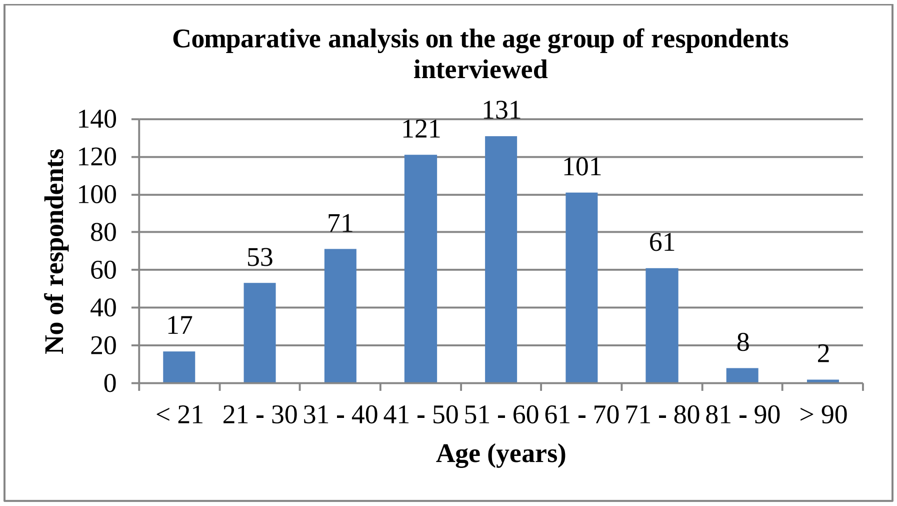


Figure 1: The comparative analysis on the age group of respondents interviewed in Perak

3.0 Results and Discussion

3.1 Flooding event

The previous flood event in Perak generally seriously started from 23rd December 2014 and extended for about a month especially some areas in Perak Tengah district. Most of the victims (29%) experienced the flood for about two weeks as shown in **Figure 2**. Longer inundation period contributed to the higher rate of destruction and damage which included their goods, crops and agriculture. Most of the villagers depended on these crops and agricultures as their main source of income.

National Security Council (NSC) had categorized Perak Tengah as the worst flood area in Perak followed by Kuala Kangsar and Hulu Perak. These three districts located near to the more populated area along Sg Perak. The main driving mechanism causing the flood at this area was heavy continuous rainfall. Other factors are including excessive discharge from the dam, poor drainage and collapsed bund. It was also observed that the area surrounded by the bund had experienced longer inundation period, especially along the Teluk Sena to Bukit Chawi.

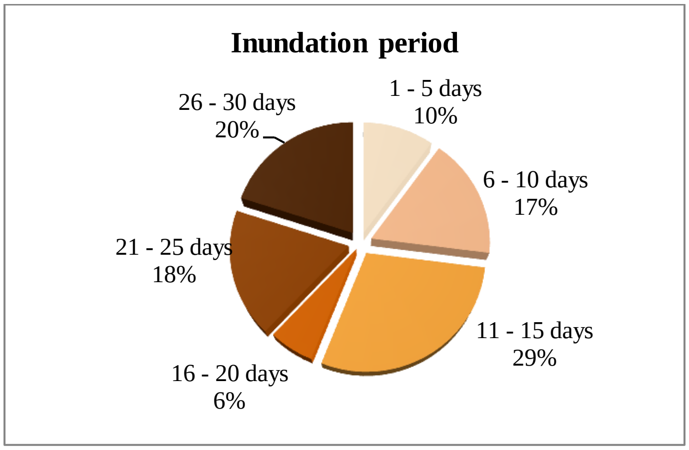


Figure 2: Inundation period in Perak

The highest range of flood depth was between 0.6 m to 1.0 m as reported to affect 215 respondents' house (**Figure 3**). Some of the areas were observed to be at low-lying areas. Most of the villages were built near the riverbank as the river is the source of their living. There were four houses submerged by flood up to about 2.1 m to 2.5 m due to their location of less than 100 m from the riverbank of Perak River. However, the highest depth recorded was up to 3 m which experienced by victims from Sayong Lembah, Kuala Kangsar. Yet again, the area located within low-lying area and exposed to the high density of Sg Perak.

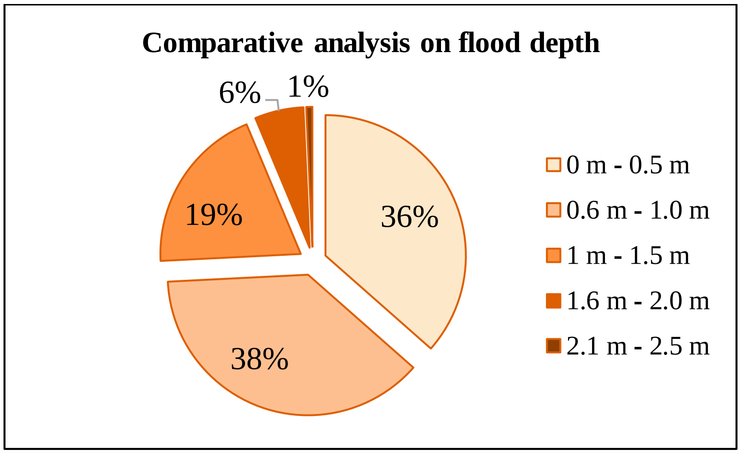


Figure 3: Flood depth in Perak

3.2 Impact on livelihood

The study revealed that the most important livelihood sources for the assessed communities in Perak were agriculture sector (21%) as shown in **Figure 4**. For the agriculture sector, most of the sampled household experienced crops damage especially durian trees which seemed to be more vulnerably sensitive to flood. Based on the survey finding, durian trees are most vulnerable to the flood. In the other hand, matured oil palm is less sensitive to the flood impact; infact some of them were said to be more fertile than before.

The livelihood style which depends on agriculture sector has caused concern as the exposure to floods will exacerbate their lifestyle by compromising their source of income. Furthermore, some of interviewed household faced some difficulties to replant the crop i.e. lack of capital, no seedling supply, etc. Some of the trees took a long time to mature and produce fruit. It was observed that, most of the rural residents are involved in agriculture sector while the residents of the suburb area like Kampong Gajah are more likely owned a business or the government employees. Even though Kampong Gajah was among the worst area affected by flood, but their total lost was not as high as the rural residents. This is because their source of income is barely affected by flood.

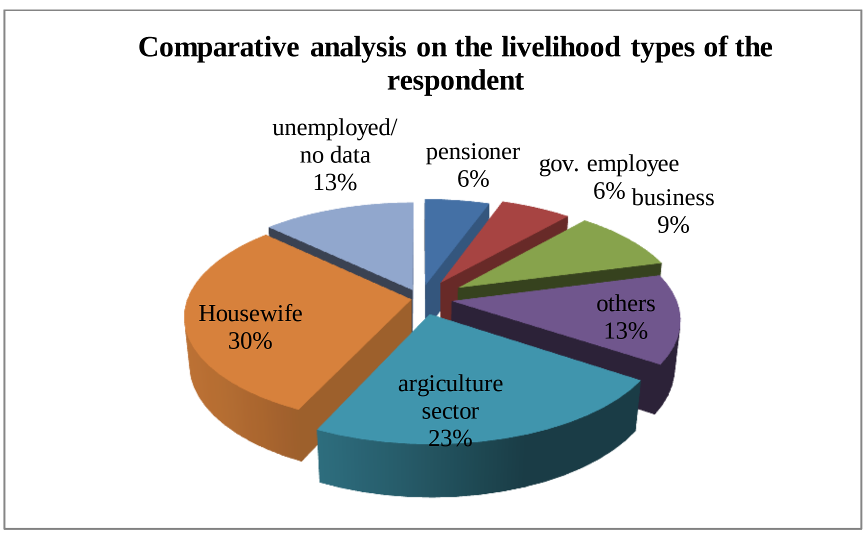


Figure 4: Livelihood types of the respondent

Overall, 59 % of the flood victims experienced the crop damage which is one of their main sources of income **(Figure 5)**, particularly those in sub-districts of Pasir Salak which was the highest (**Figure 6**). The crops included chicken, ducks, fishes as well as cows and goats. These crops were used by the residents for their own consumption and for commercials. There was one chicken farms that had been swept away by the flood at Kg Sayong Tebing, Kuala Kangsar which caused high amount of losses to the farmers.

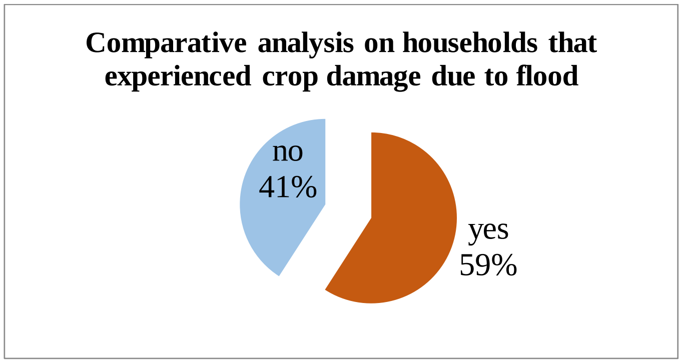


Figure 5: Household that experienced crop damage due to flood in Perak

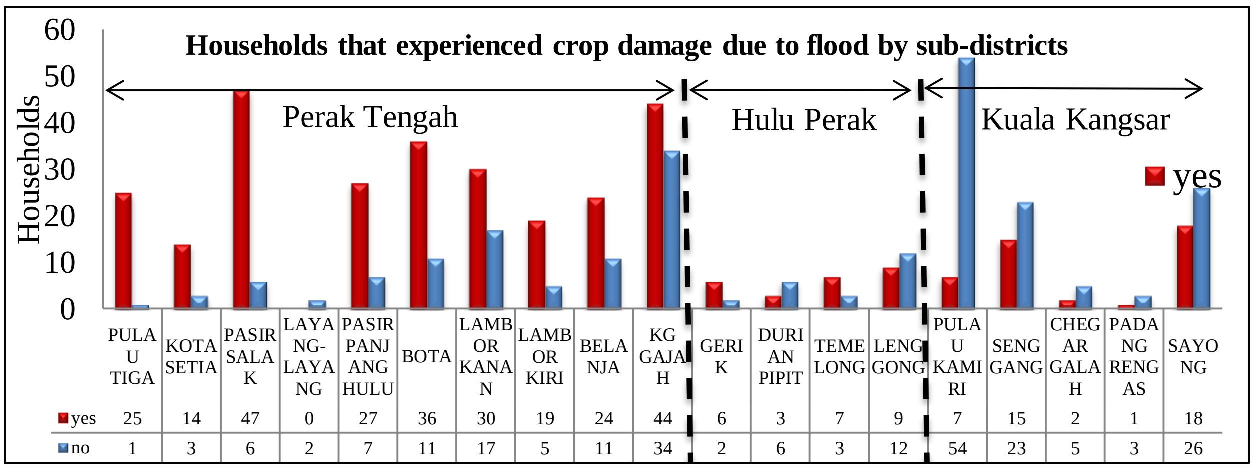


Figure 6: Household that experienced crop damage due to flood in Perak according to their sub-districts

Other than that, flooding contributed to the damages towards vehicles including car, motorcycles, bicycle and others **(Figure 7)**. The largest percentage of 68% was contributed by the common vehicles own by the villagers such as motorcycles. Damages to car and bicycle were 14 % and 13 %, respectively. Another remaining 5 % for other types of vehicle damages includes van, lorry and machinery.

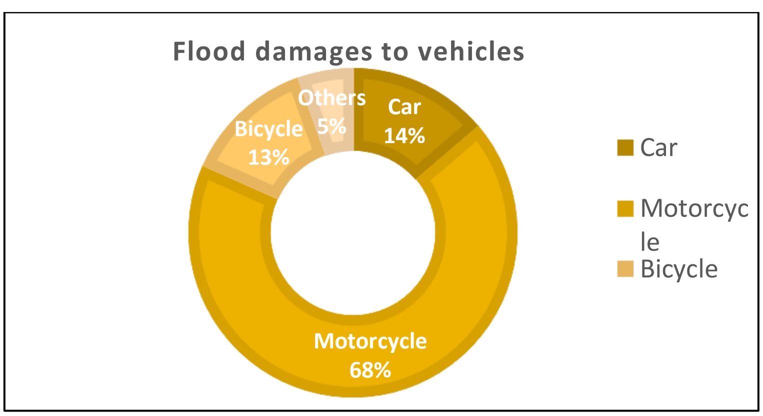


Figure 7: Flood damage to vehicles

Analysis of the overall losses revealed that approximately 7% of the victims experienced losses less than RM10,000 as shown in **Figure 8**. The maximum losses reported by respondents were up to RM 55,000 which was noted by Mr Rizal, the staff from Pasir Salak Resort. All the properties including beds, clothes, kitchen utensils and cushions had been swept away by the flood. The variation of losses may also depend on the intensity of flood and inundation period in the respective places. There is some area reported with minimal losses of RM100, even though the inundation period is high. The water reached up to only few centimetres but retained for about two weeks. Hence, the properties were not being damaged by the flood. However, there are some area such Sayong Lembah which accumulated losses up to RM40,000. The properties were destroyed with high inundation period and flood depth at the same time. The loss reported was in terms of goods, vehicles, crops and live stocks.

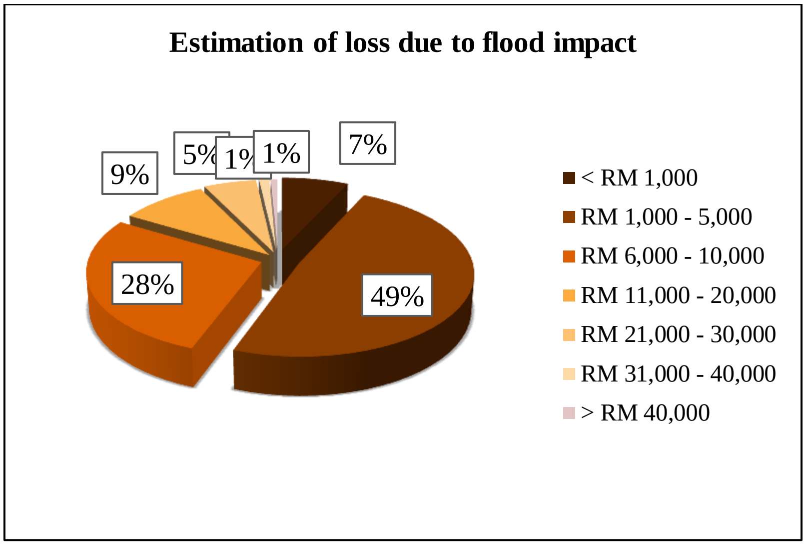


Figure 8: Estimated losses due to flood impact

3.3 Impact on Health

The research revealed that 37% of the household interviewed indicated having at least one member of their household getting sick during the flood period **(Figure 9)**. The most significant diseases experienced among the sampled households were, Upper Respiratory Tract Infection (URTI) (27%). Symptoms of upper respiratory infection include fever, flu and cough. Besides that, the households also suffered from itchiness (4%), varicella (2%) and diarrheal (1%). Furthermore, 3% of the sampled households indicated that they experienced other health problems such as headache, high blood pressure and joint pain during the floods.

The study further revealed that the households who suffered from itchiness were still receiving treatment from doctors. The itchiness believed due to the dirty water. Few of households interviewed claimed that the flood water has also been polluted by chemical fertilizers that widely used in agriculture. Some of the local communities have faced losses after the death of livestock from the skin diseases resulted from the flood. Furthermore, polluted water was also believed one of the major causes of crop damage which was exacerbated by a long inundation period.

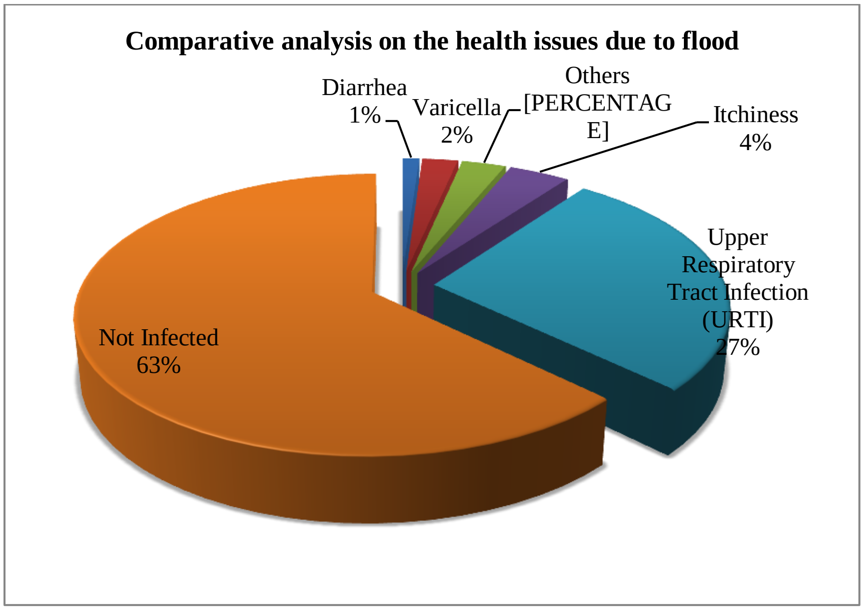


Figure 9: Health issue in Perak during 2014 flood

3.3 Impact on Psychology

Flood disaster in December 2014 also affected the victims psychologically. It was found that 74% of them were stressed by the flood meanwhile the other 26% were able to cope with this stress because some of their places were flooded previously **(Fig 10)**. Most of them reported that they were stressful were due to the crowded relief centre and due to hardship in order to pack and move out their belongings and properties to the higher places. Some of the victims suffered from high blood pressure.About 89% of the victims were worried if the flood event repeats. By June to August 2015, 95% of the victims interviewed expressed that they were already able to adapt with the situation and recover from the flood hit. Meanwhile, the remaining 5% were still recovering and trying to adapt with the situation.

Working through trauma can be scary, painful, and potentially re-traumatizing. Because of the risk of re-traumatization, this healing process needs to be supported by experienced trauma specialist or counselling sessions. Even after about six to eight months after the flood event, about 18% of the victims indicated that they still need counselling session to help them recover from the trauma.

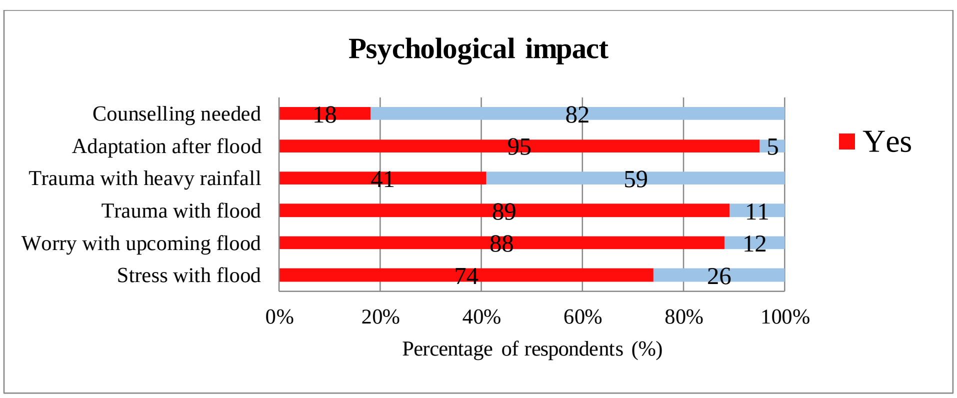


Figure 10: Psychological impact of 2014 post-flood

4.0 Conclusion

In conclusion, findings of the study can be summarized as follow:

4.1 The driving mechanism for this event was believed from the unusual heavy rainfall and the additional discharges from the cascading dams.

4.2 Other local causal factors contributed to the recent flood extent were identified to include properties close to the rivers, low-lying areas, insufficient drainage, breaching of bunds.

4.3 About 36% of the affected area experienced flood depth between 0.6 m to 1.0 m while there were submerged by flood up to about 2.1 m to 2.5 m with cases up to 3 m. These were either their location close to the river i.e. less than 100 m from the riverbank of Perak River and being located within low-lying areas. More than quarter (29%) suffered the flood inundation for about two weeks.

4.4 Most important livelihood sources for the assessed communities in Perak were agriculture sector (21%) and 59% of these victims suffered various levels of crop damages and Pasir Salak was found to be the worst affected sub-districts.

4.5 About half of the victims experienced losses below RM5,000 while more than one quarter suffered up to RM10,000. Maximum losses reported was RM55,000.

4.6 The study revealed that 37% of the households had at least one member of their household getting sick during the flood period with Upper Respiratory Tract Infection (URTI) identified as the most significant diseases experienced among the sampled households (27%).

4.7 It was found that 74% of the victims were psychologically stressed by the flood event with 89% of the victims were worried of future occurrence of such flood.

4.8 The flood event in Perak has resulted significant impacts to the livelihood, property and socio environment of the affected area. If such disaster continues to occur every year, the damage value will possibly increase. Therefore, appropriate planning and management strategies in developing an integrated mitigation framework are inevitable. The cooperation among government agencies as well as the private sectors may further enhance the flood management system.

PORTABLE WATER PURIFICATION SYSTEM

Project Information

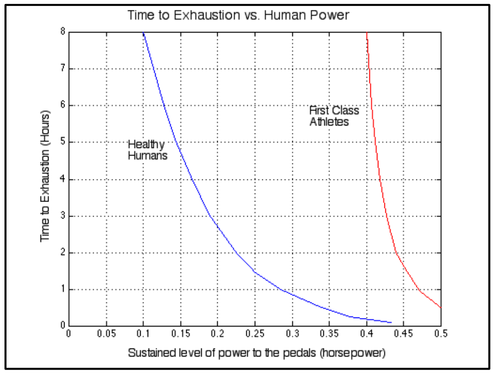
Project Leader	: Mohd Effendi Bin Muhammad Suandi
University	: Universiti Malaysia Perlis
Address	: Kampus Tetap UNIMAP Pauh Putra, 02600 Arau, Perlis.
Contact number	: 012-278 3453
Email	: effendisuandi@unimap.edu.my
Project Members	: Badrul Azmi Abdul Holed
	: Dr. Mohd Sazli Saad
	: Dr. Shayfull Zamree Abd Rahim
	: Mohd Nasir Mat Saad

1.0 Introduction

Water purification can be defined as the act of processes for removal contaminants from untreated water to produce the potable, safe and pure enough water for human consumption. During this process, an appropriate membrane will be removed the contaminant substances such as suspended solids, bacteria, algae, viruses, minerals such as iron, and other chemical pollutants like fertilizers. World Health Organization (WHO) has issued several guidelines for drinking water quality requirement that are generally can be followed in order to have an access to safe drinking water for consumers [1]. During the late 1800s, scientists gained a greater understanding of the sources and effect of contaminants drinking water. In 1855, epidemiologist Dr. John Snow proved that cholera was waterborne disease that linked with a contaminant. In the 1880s, Louis Pasteur explained microscopic organisms could transmit disease through media like water [2]. In 2014, unexpected severe flooding has been occurring in the East Coast region such as Kelantan, Terengganu and Pahang with the number of victims is more than 100,000 people. During or post disaster situation, the difficulty to get a clean and safe water will increase because the water treatment plants are damaged and water cannot be supplied to the disaster area. Beside that an electricity supply also will be lost if it was decided for safety purposes or infrastructure has been destroyed [3]. In an emergency case, an active person needs to drink at least half gallons or 2 liter of water each day. However, children and illness person will require even more. An estimation of clean water usage at least 1 gallon or 3.8 liter per person, per day and the rest were for food preparation and hygiene [4]. After the flood disaster occurs, people are too difficult to find a source of water supply and if the condition persists, it will harmful to the public health. In other conditions, flood victim need to get water from tanker and need have to wait for hours to get better water for survival [5].

2.0 Methodology

Human power is one of the energy suppliers, where the machine is using human motion but it has limited output. The maximum power output for a fit and healthy adult is about 900 watts (W) but this can only be sustained for a few second only. The continuous power output of 60 W pedaling at 50 revolutions per minutes (RPM) for a long duration is reasonable. This is an ideal output for many activities such as water pumping [8]. A healthy human can easily generate up to 75 W of mechanical power and the athletic person can give double to this value [9]. Human Powered Vehicle Association Scientific Symposium, which are presented in figure 1 shows the maximum duration of human effort for various steady power levels. Healthy human can produce a steady 0.1 horsepower (HP) or 745 Watt (W) for a full eight hour period. Each data point on the curves represents an exhausted human [10].



Source : (ohio.edu, 2011)

Figure 1: Time exhaustion vs Human power

Reverse Osmosis (RO) system as a main membrane is the suitable filter to use for this project because it capability to separate the particle in the contaminated water with fast and low pressure required. The type of filtration system is a sediment filter to removes sediment and particles to avoid RO membranes damages, an active carbon filter removes chlorine and other chemical contaminant, 0.35 micron Ultra filter to removes fine particles and some bacteria and RO membranes to removes fine particles 0.0005 microns were selected. The purpose of this filter usage is for easy to maintenance, low energy and capability to fast produce drinking water appeal another technique filter water. The pressure relief valve is used in order to limit the system pressure as set value shown in pressure gauge.

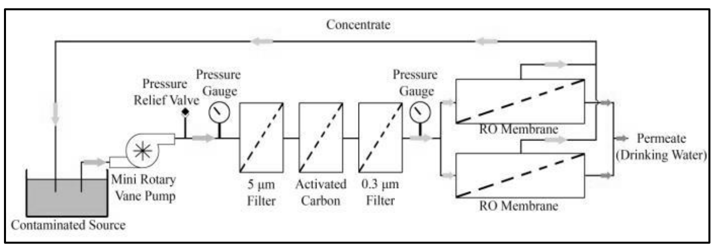


Figure 2: Schematic illustrating purification system circuit

Pressure at 120 Psi is a maximum indicator need to be handled and the use of relief valve is to prevent the system from damage because the pressure will produce a large capacity during the pumping process. Figure 2 is shown a complete purification system schematic.

The final drive train design has three stages. The stage is pedaling, middle sprocket and pump drive. The system of sprocket used to increase rotational speed of pedaling to the pump drive. During literature search, a human can produce the 50 RPM with 60 W of power output by pedaling for water pumping. Other research a healthy human can generate with easily up to 75 Watts. By calculation, given 75 Watts can produce the 90 RPM of pedaling rotational.

$$N_1 \frac{W_1}{W_2} = N2 \tag{1}$$

Rotary vane pump is a positive displacement pump which is a device or component that moves fluid by mechanical action. It is used to pump contaminated water to the filtration system. That means the output of flow rate is approximately proportional to rotation speed. A rotary vane pump is well suitable to the application when the system required relatively low flow and will operate at low RPM. To calculate the flow rate of the pump, Qpump, from the design and the membrane recovery rates is taken to count.

$$Qpump = \frac{Q_{output}}{r_{RO} \times r_{MF}} \tag{2}$$

3.0 Results and Discussion

Based on numerical analysis, the result for details specification is shown in table 1 as follow:

Table 1: Result of analysis for whole system

Result	Value
Max Flow Pressure	115 Psi
Pump Flow Rate	195 LPH
Sprocket Ratio	6:1
Water Production Output	0.5-0.7 LPM
Sustainable Human Power Output	20 Minutes
Max RPM Output	1080 RPM

The components of the final design have 3 main categories which are body frame design, drive train system and the purification filtration system. The first and main component of this project is body frame structure. To fulfill the objective about portability, the body structure should be designed to be easy to fold, carry and storage. Figure 3 shows the Portable body frame and case design.

Figure 3: Portable body frame and case design.

The drive train system is the second component to ensure this design is fully function to drive the rotary pump. Based on the calculation done, the drive train system is functioning properly and easily boost up the water pressure into 115Psi is the maximum and enough capacity to ensure the filtration system are not damaged. Figure 4 shows the drive train system.

Figure 4: Drive train system.

The purification filtration system is the component that has been chosen for each membrane and this system are designed including with storage system to ensure the overall system can be safe and easy to maintenance and also can be stored and carry to flood relief area. Figure 5 show the purification system setup.

Figure 5: Purification system setup.

In this study, the water quality testing was evaluating 3 factors which are pH, nitrate and phosphate level. Five water samples are taken from different areas to ensure the content of the substance are vary. Table 2 and 3 is to show the different level of the contaminant water before and after filtration process and the results are:

Table 2: Raw Water Quality Data

Samples of Water	pH Level	Nitrate Level	Phosphate Level
Kangar (River)	7	0 ppm	2 ppm
Arau (River)	6.5	0 ppm	2 ppm
Kuala Perlis (Trench)	8	0 ppm	2 ppm
Unimap Pauh (Lake)	8	0 ppm	1 ppm
Utan Aji (Trench)	7	0 ppm	2 ppm

Table 3: Clean Water Quality Data

Samples of Water	pH Level	Nitrate Level	Phosphate Level
Kangar (River)	7.5	0 ppm	1 ppm
Arau (River)	7	0 ppm	1 ppm
Kuala Perlis (Trench)	8	0 ppm	1 ppm
Unimap Pauh (Lake)	7	0 ppm	1 ppm
Utan Aji (Trench)	7	0 ppm	1 ppm

4.0 Conclusion

4.1 This project was focused on design & development of portable water filter using human power and Reverse Osmosis filtration membrane.

4.2 The system capable to produce potable water at 0.5 until 0.7 liter per minute (LPM) and the whole system is designed with a portable mechanism with folding body for use elsewhere.

4.3 This system also operates without electrical source while the facility is damaged.

4.4 This system is using the drive train generate by pedaling system using human powered source at 90 RPM, the water pump can be pumped with the sprocket ratio 6:1 at maximum speed 1080 RPM.
4.5 The analysis proves that pressure at 115 Psi is acceptable to operate this system.
4.6 5 selected membranes are the most efficient due to the current issues.

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FLOOD WASTE MANAGEMENT AND REMEDIATION

Project Information

Project Leader	: Prof. Agamuthu Pariatamby
University	: University of Malaya
Address	: Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur
Contact number	: 03-79676756
Email	: agamuthu@um.edu.my
Project Members	: Dr. Fauziah Shahul Hamid Dr. Pozi Milow

1.0 Introduction

In Malaysia, flood disaster is the most frequent natural disaster occurring in the country (Mustafa et al., 2014). Almost every year, Kelantan and Terengganu which are located at the east coast of Peninsular Malaysia experience flood. The main factor that causes flood in Malaysia is due to the monsoon seasons which induce convective rainfall. Furthermore, 9% of Malaysia's land area are prone to flood event (DID, 2007). In recent years, the frequency, magnitude and impacts of flood has increase significantly. The 2014 flood event was one of the worst floods ever recorded in Malaysian history. The flood hit five states in Peninsular Malaysia involving Kelantan, Terengganu, Pahang, Perak and Johor. It caused 25 fatalities and involved more than 500,000 victims (Ibrahim, 2015).

According to The Minister of Urban Wellbeing, Housing and Local Government, Datuk Abdul Rahman Dahlan, total flood waste generated in the whole country during flood disaster in 2014 was more than 300,000 tonnes (The Star, 2015). These enormous amount of flood waste required competent flood waste management system and coordination, to prevent detrimental impacts to environment and human health. However, in Malaysia there is still no guideline on the management of flood waste. All the flood waste was handled in an *ad hoc* manner where it was basically 'cleaning and dispose' actions. Moreover, the crucial data (flood waste generation and composition) for better flood waste management planning are not available even though flood is a reoccurring event in Malaysia. Therefore, this study was carried out to estimate the waste generated during and after the 2014 flood, to determine the waste composition and identifying possible option in its management, to propose a waste handling matrix, to calculate the economic potential from the waste, and to formulate a practical guidelines for future flood waste management in Malaysia.

2.0 Methodology

This study covered the flood waste management in Kelantan and Terengganu as these two states were the most affected area. Five districts from Kelantan and two districts from Terengganu were selected as study areas, based on the severity of the flood disaster and the number of victims involved, obtained from district officers and data from the National Security Council.

Data collection involved flood waste analysis, face-to-face interviews with the authorities and public survey via questionnaires distribution. The flood wastes generated were quantified and separated to determine their composition. This was done through observations at study sites and waste sampling and analysis at affected areas and waste disposal sites.

3.0 Results and Discussion

3.1 Flood Waste Generation

Figure 1 shows the total amount of waste generated during the 2014 flood in selected Kelantan districts. Among the five districts in Kelantan, Kuala Krai generated the highest amount of flood waste (29,851 tonnes), followed by Tanah Merah, Tumpat, Gua Musang and lastly, Kota Bharu. According to the data obtained from National Security Council, Kuala Krai has the highest number of flood victims, and was recorded as the most severely affected district during the flood. This might be the reason why Kuala Krai generated the highest amount of flood waste. The flood in Kota Bharu was kess severe as compared to other districts. Thus, lower amount of flood waste was generated in Kota Bharu (XXX value here)

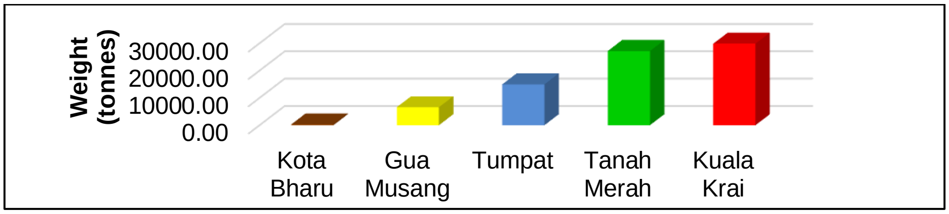

Figure 1: Tot al amount of waste generated during the flood event in Kelantan districts

3.2 Flood Waste Composition

Figure 2 shows flood waste composition in Kelantan. Approximately 44% of the total waste generated during the 2014 flood is C&D waste that consists of woods. The main reason is that most of the affected areas are rural areas that predominantly consist of wooden houses. This is agreeable to the findings by Brown et al. (2011). The strong water currents during the floods brought down many of these wooden houses, and consequently generated high amount of C&D waste. The second highest flood waste generated is also C&D waste i.e. concrete. Even though the area affected by flood were mostly rural area, concrete is still a fundamental construction material in Kelantan. The vigorous water current of the floods has caused major damage to the buildings, especially old buildings, thus resulted in the high volume of concrete waste in the waste stream.

In Kuala Krai alone, it is estimated that 25,000 tonnes of C&D waste was generated in the 2014 flood (Figure 2). Tanah Merah also generates a huge amount of C&D waste, which is approximately 22,000 tonnes. A study conducted by Karunasena et al. (2012) states that the largest component of disaster waste generated in most cases is C&D waste, which is similar to the flood waste composition in Kelantan. Similar scenario during 2004 tsunami event in Banda Aceh, Indonesia, resulted with the generation of C&D waste that more than 725 000 m^3 of land was used for disposal purpose (Agamuthu et al., 2012). C&D wastes that arise from disaster can be divided into recyclable materials (wood, concrete, masonry, and metal), non-recyclable materials (organic materials, inert materials) and hazardous waste (chemicals) (Jang and Townsend, 2001).

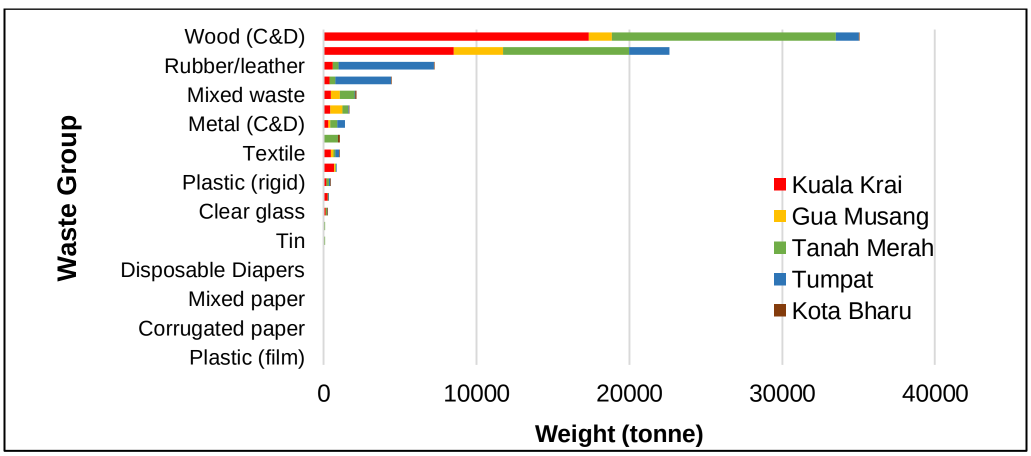

Figure 2: Composition of flood waste generated in Kelantan districts

3.3 Recycling Potential of Flood Waste

Flood caused many victims to incur additional economic burden due to the damage to their properties (Brown et al., 2011). The management of flood waste in Kelantan had seriously impacted the Kelantan government financially since waste clearing and disposal required immediate attention to avoid health and environmental hazard. It has been reported that disaster waste disposal can cost to about 27% of total disaster management cost (FEMA, 2007). In the case of Hurricane Katrina, the total cost of waste clean-up totalled to more than $ 4.4 billion (Stephenson, 2008). However, recycling has given them opportunity to lessen the disposal cost and obtain some revenue.

Price of recycling materials in Malaysia is considered low as compared to other countries. A kilogram of paper purchased only RM 0.20, while a kilogram of metal, glass, wood, and concrete will only be at RM 0.40, RM 0.10, RM 1.25, and RM 0.08, respectively. Even though the price is not highly attractive, but the enormous amount of recyclable waste indicates that significant amount of revenue can be generated. Potential revenue estimated from recycling activity is almost RM 7 million.

4.0 Conclusion

4.1 Kuala Krai generated the highest amount of flood waste which was 30,000 tonnes followed by Tanah Merah (27,000 tonnes), Tumpat (14,000 tonnes), Gua Musang (6,000 tonnes) and Kota Bharu (300 tonnes).

4.2 Construction and demolition wastes such as wood and concrete were the highest type of flood waste generated due to the damages to buildings in the affected area.

4.3 Based on the average amount of waste generated per house the total revenue from recycling activity in the state of Kelantan can reached up to RM 7 million. These untapped economic gains can be obtained if flood waste generated were managed in a proper waste management system.

4.4 Waste handling matrix and flood waste management guideline were prepared to promote sustainable and more efficient flood waste management system. Waste handling matrix formulated from this study can facilitate the management of future flood waste based on its potential reuse and hazardous characteristics. The matrix showed that most non-hazardous waste can be recycled and stringent waste disposal method should be implemented for hazardous waste disposal due to its harmful properties.

4.5 The guideline was divided into three different sections which are the immediate actions, short term actions and long term actions. Results acquired through this study can be developed as a reference and guidance for establishment of sustainable flood waste management in Malaysia.

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THE EFFECT OF MONSOON ON FISH LARVAL (ICHTHYOPLANKTON STAGES) ASSEMBLAGE CHANGES IN KUANTAN RIVER

Project Information

Project Leader	: Akbar John
I/C Number	: H3755424
University	: International Islamic University Malaysia
Address	: Inocem Research Station, Kulliyyah Of Science, IIUM, Kuantan 25200, Pahang
Contact number	: +60109019245
Email	: akbarjohn@iium.edu.my
Project Members	: Noor Faizul Hadry Bin Nordin, Mohammad Mustafizur Rahman, Ahmed Jalal Khan Chowdhury, Kamaruzzaman Yunus, Zaleha Binti Kassim

1.0 Introduction

Malaysia has faced severe northeast monsoonal hit from mid-December 2014 to January 2015 with at least >60% above the normal precipitation rate. This has led to the uncontrolled discharge of organic and inorganic substances in to the river stream which are believed to be the limiting factor of sensitive organisms such as juvenile and Icthyoplankton fishes. Numbers of studies have explained the significant effect of environmental variability on the larval distribution, abundance, assemblage structure and their biotic interactions (Harvey, White & Nakamoto, 2004). Due to harsh Environments and extreme environmental conditions during flood, the Icthyoplankton distribution and assemblage is strongly influenced by abiotic factors (Fritz & Dodds, 2005). Though, many lotic organisms are adapted to harsh environmental conditions, many sensitive forms tend to get displaced during land runoff (Dodds et al., 2004). This is due to the alteration in water channel morphology due to heavy runoff which might kill or displace biota downstream and remove potential resources (Tripe & Guy, 2002). Floods also can increase abundance and richness of fish where the water bodies are disconnected by sand bars or other disturbances by increasing the movement of fishes between water bodies which were previously impeded by barriers (Taylor & Warren, 2001).

Icthyoplankton are more sensitive life history stages exposed to number of environmental stresses in the aquatic water body (Sabatés et al., 2007). In fact, the Icthyoplankton distribution and in estuaries are more complex in terms of composition and abundance due to an interactive effects of various physical, chemical (Faria et al., 2006) and biological factors (Azeiteiro et al., 2006) and hence they are sensitive to ambient water quality parameters. Identifying juvenile and Icthyoplankton fishes is challenging due to overlapping morphological characters and non-differentiability between adult fishes. Accurate identification of Icthyoplankton by DNA barcoding is an important tool for various conservation practices by implementing various management strategies. At present, no study had been carried out to determine the fish distribution in Kuantan river except a study conducted by Jalal et al., (2012) where the authors sampled adult fishes. However, no studies on Icthyoplankton and juvenile fishes in Kuantan river had been carried out in the past. Hence, the present study was aimed to identify juvenile and Icthyoplankton of Kuantan river and its immediate tributaries using DNA barcoding techniques. The study also addresses the impact of recent flood on Icthyoplankton assemblage changes and effect of environmental parameters over their distribution.

2.0 Methodology

Icthyoplankton sampling was carried out in Kuantan river and its immediate tributaries during ebb tidal cycle (Fig 1). Water quality parameters such as Temperature, Salinity, pH, Dissolved oxygen, conductivity and turbidity were recorded using hydrolab 4.0. Due to technical constrains such as high turbidity, uneven water depth in Kuantan river (varied from 4m to 13m) besides inefficiency of plankton sampling net (mesh size 500µ), a modified bubu light trap (Fig 2) was used during sampling from April to December 2015. Modified Bubu light trap used in this study is 5x4x3feet (LxWxH) size having conical shaped opening in one side towards the interior section of the trap. The skeleton is made up of bamboo or cylindrical wood which in turn covered completely by 2mm thickness stainless steel wire meshes with the mesh diameter of $2.5cm^2$. An underwater light was placed in transparent plastic container and the lid was sealed with commercially available silicone gel and parafilm to ensure maximum light emission. An anchor was tied at the bottom of the cage to make sure the cage does not wash away during water current. The complete

set up (modified bubu light trap) was cover by plastic window mesh sheet (mesh size <1mm) (Fig 2). The net was deployed under water at the depth of 4meter in sampling stations for 16hours overnight.
Icthyoplankton and juvenile fish samples were measured under Dino Capture 2.0 portable microscope (or) standard scales (15cm) respectively and stored in 70% ethanol for further downstream application. Samples were identified morphologically to the lowest possible taxon using standard references (Islam et al., 2006). Taxonomic classification was according to Ahlstrom and Moser (1980). Size classes of larvae were tabulated with observed physicochemical parameters of the ambient water for Pearson's correlation matrix analysis. Size class variation of Icthyoplankton was represented in Mean ± SD.

DNA barcoding
Total genomic DNA was extracted using Geneaid DNA tissue isolation kit™. The 5' end of cytochrome c oxidase subunit I gene region was amplified using the primer pair Fish F1: 5'-GGTCAACAAATCATAAAGATATTGG-3' and Fish R1: 5'-TAAACTTCAGGGTGACCAAAAAATCA-3'. The PCR condition includes, hot start with 94˚C for 1 minute, 5 cycles of 94˚C for 30 seconds, annealing at 45˚C for 40 seconds, and extension at 72˚C for 1 minute, 35 cycles of 94˚C for 30 seconds, 51˚C for 40 seconds, and final extension at 72˚C for 10 minutes. The PCR products were gel eluded and sequenced based on the standard protocols previously described. DNA sequences were trimmed using chromas lite software v2.1.1. All the sequences were subjected to BOLD and NCBI BLAST analysis.

Data analysis
Scree plot and Pearson correlation Matrix (PCM) was used to determine the significant factors influencing Icthyoplankton and juvenile fish distribution. Paired sample *t* test was used to check the differences physicochemical parameters between sampling stations. Size class variation of Icthyoplankton was expressed in percentage. All data were expressed in Mean±SD. Probability value ($P < 0.05$) were considered statistically significant. All data analysis was conducted using Graph Pad prism v6.

3.0 Results and Discussion
A total of 28 species belong to 15 families were successfully identified to the species level from the total of 58 barcodes generated from 372 larval/juvenile samples (Table 1). BOLD and BLAST analysis clearly segregated individuals to their respective species with high percentage similarity score (> 90-100). The dominant families were cyprinidae (35%), toxotidae (24%), ambasidae (18%) and eleotridae (11%) compared to the previous report by Jalal et al., (2012), where they observed dominance of Ariidae (23%), Lactaridae (11 %) and Lutjanidae (8%). However, in the present study 28 species were recorded unlike the previous report where only 19 species belong to 12 families were recorded (Jalal et al., 2012). Significant variation in physicochemical parameters between sampling stations were observed (Table 2) where salinity and suspended particles played a key role in altering Icthyoplankton distribution as shown in scree plot and correlation matrix ($P<0.05$). The importance of hydrological disturbance in lotic environments has been broadly recognized because it produces a larger number of indicators and induces the reproduction of species with different reproductive strategies (Poff & Allan, 1995). Many studies have shown the significant influence of salinity, DO and temperature on the larval abundance and temporal distribution in rivers (Agostinho et al., 2004; Thomaz et al., 2007). Although the differences in environmental variables influence the abundance and composition of the Icthyoplankton among the reproductive periods, they also observed some differences in larval assemblage composition among sections (Reynalte-Tataje et al., 2012).

Mean standard length of larvae captured under the light trap was 9±5.3 mm which was significantly smaller than the samples caught from plankton net (0.5mm msh size). The advantage of this light trap method used in this study includes 1. The samples collected were not physically damaged and hence used for DNA isolation without other species contamination, 2. The efficiency of this light trap over bongo net or other plankton sampling net in order to get larval samples from areas were water depth and turbidity are the limiting factors for sampling. Most of the Icthyoplankton samples collected were between 0-10mm in total length with the percentage abundance of 34%, 60%, 17% and 10% in Kuantan river, belat river, Sg. Pandan and Riau river respectively (Figure 3).

4.0 Conclusion
In conclusion, all the fishes sampled from Kuantan river and its tributaries were identified to the species level by DNA barcoding technique. A significant shift in species composition has occurred after the recent

flood which is believed to have positive impact on Kuantan river fishing in near future. Unlike the previous study, Ariidae fishes were not found during the present sampling which might be the effect of monsoonal run off which eventually shifted Ariidae fishes towards the sea as they are tolerance to the salinity variants. Constant monitoring would be a paramount important for sustainable fishery management practice in Kuantan river.

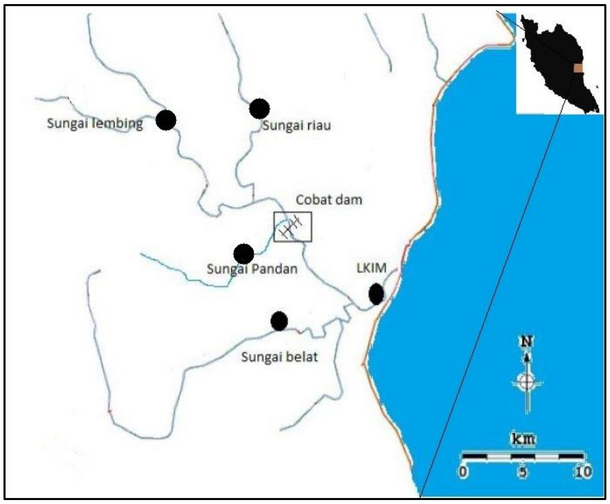

Figure 1: Location of the sampling sites at Kuantan river.

Figure 2: Modified bubu light trap and the prepared internal light source used to attract the Icthyoplankton during sampling.

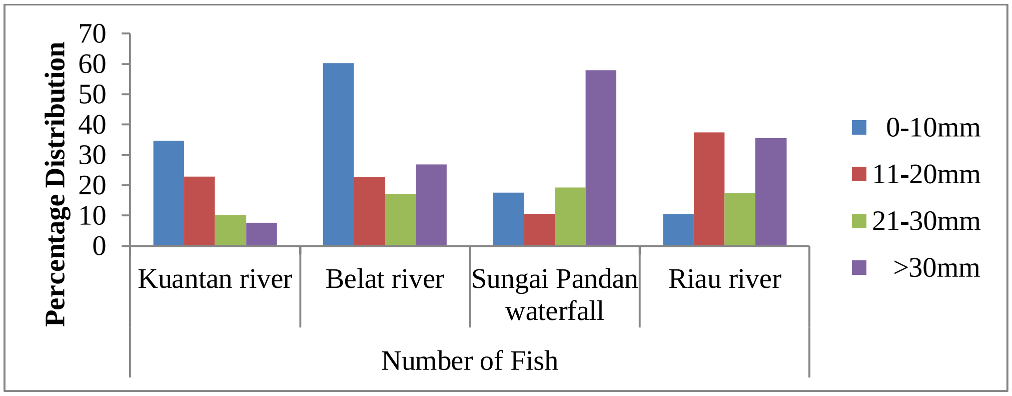

Figure 3: Percentage distribution of different size class Icthyoplankton/juvenile fishes in sampling zones

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CHARACTERIZATION AND SOURCE DISTRIBUTION OF PARTICULATE MATTER (PM) IN KELANTAN STATE, MALAYSIA: POST-FLOOD

Project Information

Project Leader	: Associate Professor Dr. Marzuki Ismail
University	: Universiti Malaysia Terengganu (UMT)
Address	: School of Marine Science and Environment, Univeristi Malaysia Terengganu, 21030, Kuala Terengganu, Terengganu
Contact number	: 096683548
Email	: marzuki@umt.edu.my
Project Members	: Dr. Nurul Adyani Ghazali

1.0 Introduction

In the end of year 2014, an unexpected flash flood hit Kelantan affecting approximately 200,000 people with a death toll of 21 (Brown, 2015). The aftermaths of flood are usually much un-sanitized and health concerns are of great attention (Kinnard, 2015). With the whole city stained yellow, with watermarks on building and mud residue on treetops; these dried up mud tends to crumble to dust and re-suspense the air with particulate matter (PM). PM is also the main cause of numerous health issues including irritation to the eyes, nose and throat, coughing, reduced lung function, asthma attacks and premature death (AirNow, 2015). Chemical characterization technique in identifying the ionic species presence is vital as the latter analysis of source apportionment model will be able to estimate the ambient air pollution sources. Sources of PM can be categorized into soil crustal, marine aerosol, vehicle exhaust, secondary aerosols, traffic aerosols, and biomass burning, each occupying their constituent element that represent their sectors (Tahir et al., 2013).

This study is also crucial as it serves as a fingerprinting analysis to identify and estimate the true culprit behind the so called "banjirkuning" that hit Kota Bharu, Kelantan on December 2014. Many researchers had look into the flood of Kelantan in the aspect of hydrology, lithosphere and biosphere but few research was conducted in the aspect of atmosphere. By determining the composition of air present at the site, using receptor modeling to infuse ambient air into the filter paper which represents what we inhale in our lungs and applying chemical characterization on the ions present, this study will be able to estimate the sources that contributed to the PM surrounding Kelantan. In addition, understanding the composition of PM will allow the policy maker to design effective PM control strategies at source in the effort to reduce concentration of PM. It can also be benefited as vital information for further abatement effort to control pollution at source.

2.0 Methodology

Loaded filter paper samples of pre and post flood event from July 2014 to June 2015 were obtained from Malaysian Meteorological Department (MMD) for the study area. . The monitoring station is situated at SMK Tanjung Chat, 3.43km away from Kota Bharu city with lat-long 6º8'54.62'' N and 102º14'22.77'' E. The water soluble ionic species analyses were carried out in accordance to the Standard Operating Procedure for the Analysis of Anions and Cations in $PM_{2.5}$ Speciation Samples by Ion Chromatography (SOP MLD 064). Principal Component Analysis was performed on the ionic species concentrations to identify the sources contributing to the PM10 in the study area during pre and post flood event.

3.0 Results and Discussion

Figure 3.1 shows the concentration of PM with the permissible limit (annual mean concentration of PM, 50µg/m^3) set by RMAQG.By inferring to the average concentration obtained, there is a significant increase from December 2014 to January 2015 and the concentration remained high until a steady trend was illustrated after March 2015. The increase of level of PM concentration in January 2015 can clearly be related to the aftermath of flood that brings in marine aerosol and depositing sea salt at the site. As according to Furusjö et al., (2007), muds and sand that was washed up to the mainland could be driven over by vehicles that lead to re-suspension on the surrounding site. The significant high level of that of PM from January to March 2015 could be associated with the scrubbing and cleaning activities conducted by the resident and relief team to clean their homes and property due to the re-suspension of debris from flood water into the surrounding of the site.

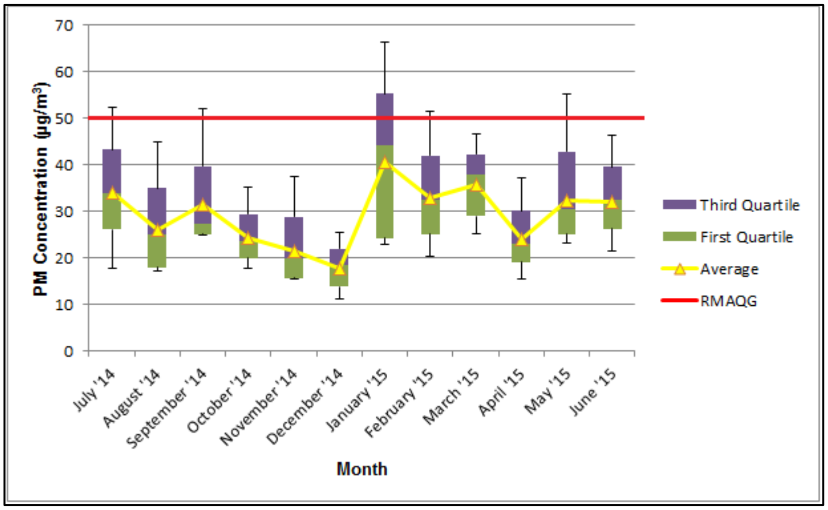

Figure 3.1 Concentration of particulate matter with compliance limit

The ionic species that are present in pre and post flood is shown in Table 3.1 from the extraction of ions using Ion Chromatography (IC) analysis

Table 3.1 Ionic species present in pre and post flood

Ions present in pre flood event	**Ions present in post flood event**
Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}, F^- , NO_2^-, Cl^-, NO_3^- and SO_4^{2-}	Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}, NO_2^-, Cl^- and SO_4^{2-}

Table 3.2 Particulate matter concentrationin Kelantan

Ionic Species	Mean	Median	Range
Na^+	66.74±36.80	56.45	18.01 - 200.03
NH_4^+	29.17±5.88	27.77	20.95 - 41.31
K^+	17.23±5.42	16.71	5.46 - 33.89
Mg^{2+}	5.67±3.98	3.93	1.79 - 15.32
Ca^{2+}	12.24±7.91	11.50	3.34 - 33.96
F-	3.22±1.02	3.45	1.67 - 4.41
Cl^-	76.80±67.88	48.10	17.94 - 266.68
NO_2^-	11.09±0	11.09	11.09 - 11.09
NO_3^-	39.59±10.33	38.97	20.95 - 67.07
SO_4^{2-}	93.85±28.72	93.00	29.87 - 170.33

Note: concentration in µg/g ; n = 56

According to **Table 3.2**, ranges of concentration in µg per 1g of PM are illustrated. It can be observed that Na^+, Cl^- and SO_4^{2-} have a huge range from minimum to maximum. They were also the top three ionic species with mean value of 66.74, 39.59 and 93.85 respectively.

Principal Component Analysis (PCA) was conducted on the pre flood result from IC. It shows that there were 4 main chemical profile sources which accounted for soil crustal, vehicle exhaust, marine aerosol and secondary aerosol and represent 70.82% of the total variance. PC1(42.08%) is from soil crustal and vehicle exhaust as they presented high factor loading for NO_3^- SO_4^{2-}, Ca^{2+}, K^+ and Na^+. 18.45% for PC2 representing marine aerosol have been associated with high loading on typical marine composition such as Na^+, Cl^- and Mg^{2+}(Seinfeld & Pandis, 2006). PC3 (10.30%) presented high factor loadings for NH_4^+ estimated to be from secondary aerosol Almeida et al., 2005. PCA on the post flood shows an almost similar chemical profile sources with the addition of biomass burning source. There were only two PC but it accounted for 82.14% of the total variance. PC1 (58.012%) represent both vehicle exhaust and biomass burning as it presented high factor loadings for NO_3^-, SO_4^{2-},K^+ and NH_4^+whereas PC2 (24.126%) represent both soil crustal and marine aerosol with high factor loadings for Na^+, Mg^{2+}, Cl^- and Ca^{2+}.

In comparison, PC1 presented high factor loading for SO_4^{2-} and NO_3^- (vehicle exhaust) and accounted for 42% and 58% of total variance in pre and post flood respectively. The pattern of elements indicates the higher percentage could be associated with increase in vehicles entering the site due to relief mission. Potassium ion pre flood event could be associated with biomass burning by residents of the site. Solid waste and property that are out of order were being disposed through burning activity. Therefore, biomass burning was identified during post flood event.During post flood, the reduce in composition of the soil crustal (Na^+, Cl^-, Ca^{2+}) and increase in marine aerosol (Na^+, Cl^- and Mg^{2+}); evidently as Ca^{2+} decrease while Mg^{2-} increases shows that sea salt are being washed into the site. This project the increase in Mg^{2+} ion collected. Although there is no significant difference in the trend for Na^+ and Cl^-, it is observed that there are significant peak in the time frame which was from the beginning of January to mid February 2015.

Conclusion

The study on the composition and contributor of PM during pre and post flood event in Kelantan has been successfully completed.

4.1 Conducting chemical characterization estimated that there were five main chemical profile sources contributing to the flood event. These profiles were soil crustal, vehicle exhaust, marine aerosol, secondary aerosol and biomass burning.

4.2 Increase in level of PM on the aftermath could likely be associated with the increase in vehicles entering the city due to relief mission. A difference in factor loading for SO42- and NO3- representing vehicle exhaust was identified to conclude the reason of PM level increase.

4.3 In order to abate and minimize these sources of pollution a proper route planning should be planned by the local authority that can not only minimize the duration of travel for relief team but also avoid driving over muddy road. Volunteering crew and NGO's should also gather their provision and send them in a big truck to reduce the numbers of journey; this can help reduce the emissions from vehicle exhaust. Local authority should not allow the breakdown of waste management system after the flood as this will promote resident to practice open burning to dispose their damaged property and solid waste.

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AFTERMATH OF DECEMBER 2014 EAST COAST STATES OF MALAYSIA FLOOD. A STUDY ON IMPACT ON CORAL REEF ECOSYSTEMS AND INTERTIDAL BENTHOS POPULATION ECO-SUSTAINABILITY – THE MANAGEMENT TIME

Project Information

Project Leader	: Associate Prof. Dr. Farid Bin Che Ghazali.
University	: Universiti Sains Malaysia, Kubang Kerian,
Address	: Universiti Sains Malaysia, Kubang Kerian, 16150, Kota Bharu, Kelantan
Contact number	: 09-7677539
Email	: farid@usm.my
Project Members	: Profesor Dr Siti Azizah Binti Mohd Nor Associate Prof. Dr. K.N.S. Sirajudeen Dr Maliki Hapani Suriani Binti Addullah

1.0 Introduction

The impact on coastline and aquatic ecosystem from the worst ever North East monsoonal flooding event in Malaysia history in years, December 2014 to January 2015 'Tsunami mud-like' flood, in east coast Malaysia can range from unnoticeable to devastating. Floods can accelerate fluxes; destroy drainage and riverine systems causing raw sewage, nutrients and sediments to spill out into bodies of water that may have detrimental influence to east coast Malaysia coral reef structure and dynamics, especially of its benthic populations and marine ecosystems. The plumes effect coral reefs by burying decreasing light levels of depleting oxygen supplies by introduction of large amounts of organics settlements. In pertinent to this the link between water quality parameters and its plankton species composition and prevalence into the system is also unknown. Globally, floods destroy drainage and riverine systems causing raw sewage to spill out into bodies of water. As such nutrients and sediments from east coast coastal rivers may have detrimental influence and be harmful to the majestic east coast Malaysia marine park coral reef especially on the structure and dynamics of benthic populations and marine ecosystems. In Pertinent to Kelantan, its Kelantan river system flows northward thus passing through such major towns as Kuala Krai, Tanah Merah, Pasir Mas and Kota Bharu, before finally discharging into the South China Sea. The 2014 flood was purported as the most significant natural disaster in Malaysia in terms of frequency, area extent, population affected bad damage.

Coral reefs are often referred to as the 'rainforests of the sea', although, although one could points out equally well and call rainforests the coral reefs of the land (Davidson, 1998). Regardless, these two ecosystems do indeed share several important attributes, most notably high diversity and severe declines worldwide over the last several decades.

Over the past 30 years coral bleaching has become a widespread phenomenon and is now seen by many as one of the most distinct manifestations of climate change impacts on natural ecosystems.
Coral bleaching can be a short-lived phenomenon; and its spatial appearance can vary considerably. Some bleaching events are comprehensive and tightly synchronized (i.e., most species fully bleached at the same time) and these are likely to be easier to detect, particularly in areas of high coral cover. Where only some colonies are bleached, or where the loss of color in bleached colonies is only partial, detection becomes increasingly challenging.

2.0 Methodology

2.1 Field Survey I: (Riverine estuary monitoring survey)

In-situ water parameters field monitoring (salinity, pH, DO, temperature and Turbidity) and sedimentation analysis were conducted. The salinity of water collected was immediately determined using YSI conductivity meter. Duplicate 10 ml subsamples were collected from each bottle, filtered with disposable syringe filters. While Sediment cores was collected, and analyzed microscopically via filed emission scanning electron microscopy (FESEM) and ICP-MS "footprint') to test for coliform diatoms and sediment-associated pathogens incidence that may coincided with increasing nutrient suggesting a cause-effect relationship. This analysis will also be cross-reference and backtracked check with other available local governmental agencies database monitoring data. A backtrack of 5 years was planned. Potential stations such as Kuala Besar, Pengkalan Datu, Kuala Besut, Muara Tok Bali Sungai Terengganu was selected. Meanwhile islands to East Coast state shoreline selected are: Perhentian Island, Kapas Island, & Pulau

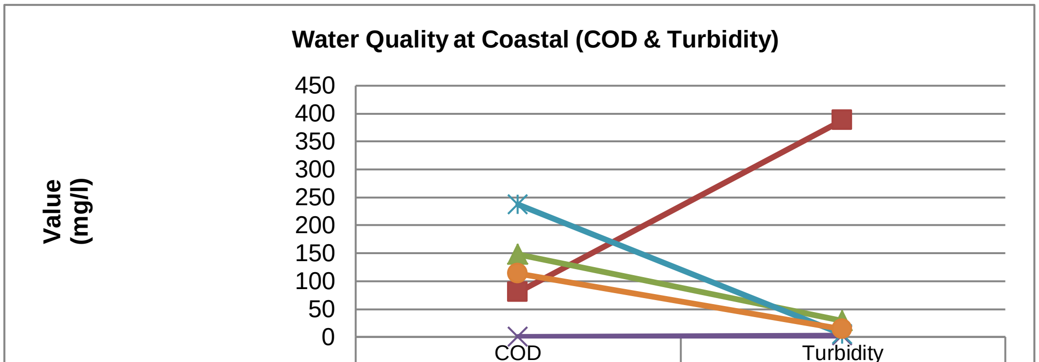
Rawa (Islands under supervision of Department of Marine parks in state kelantan, Terengganu, Pahang and Johor).

2.2 Field Survey II: Coral reefness ecosystem survey and monitoring

The observation is via a video transect survey. Species lists of local corals will be recorded during meandering SCUBA and/or snorkel swims of approximately 100m length at depths of 0 to 3 m, 4 to 7 m and 8 to 12 m below approximate mean low water (m.1.w) level. The video transect will carry out with Video belt-transects of 50 m length were filmed at three depths (1 - 3 m, 4 - 6 m and 9 - 11 m below approximate m.1.w. level) at four sites around the reef perimeter. The sites to be selected haphazardly are within areas known to support the range of major coral community types present. The Sediment collected, was analyzed microscopically via filed emission scanning electron microscopy (FESEM).

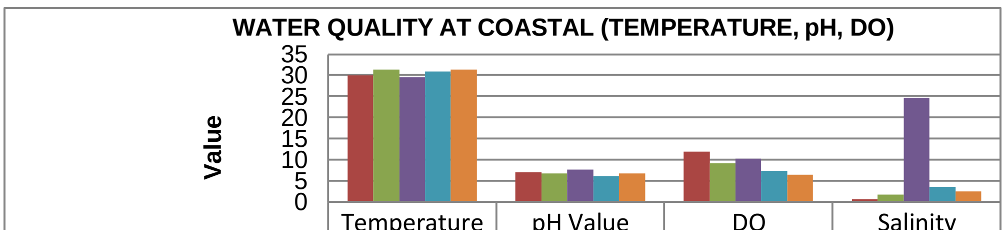
3.0 Results and Discussion

3.1 Site Analysis for Site Survey 1



	COD	Turbidity
Pulau Kerbau, Sg. Kedai Buloh	81	388
Pengkalan Datu, Pulau Melaka	148	28.4
Jeti Sungai Marang	0	3.2
Nibong, Sungai Dungun	237	4.96
Teluk Mak Nik, Sungai Kemaman	114	14.1

Figure 1: Statistic on water quality at coastal (selected location for monitoring) for field survey I



	Temperature	pH Value	DO	Salinity
Pulau Kerbau, Sg. Kedai Buloh	30	7.104	11.99	0.71
Pengkalan Datu, Pulau Melaka	31.3	6.78	9.24	1.75
Jeti Sungai Marang	29.5	7.66	10.18	24.63
Nibong, Sungai Dungun	30.9	6.13	7.34	3.51
Teluk Mak Nik, Sungai Kemaman	31.3	6.722	6.47	2.56

Figure 2: Statistic on water quality at coastal (selected location for monitoring) for field survey I

3.2 ICP-MS

In this study, ICP-MS have revealed presence of heavy metals such Zn Cd, Cr, Cu, Fe, Ni and Pb have been spectrometered identified and detected. Nutrient supply to coastal waters does occurs as a result of geological weathering; however, in recent years, population growth and related human activities (agriculture, urban sewage runoff) have increased nutrient inputs. This kind of pollution is now considered as one of the greatest threats to coastal environmental quality (Glibert et al. 2010).

Heavy metal concentrations in aquatic ecosystems are usually monitored by measuring their concentrations in water, sediments and biota (Camusso et al., 1995), In the present study (Table 3), some heavy metals (Zn Cd, Cr, Cu, Fe, Ni and Pb) have been detected accumulated at various monitored east coast riverine sediments that were associated to the 2015 flood disaster episode. Although the accumulated detected elements was observed and could be considered as sedimentations formed as within the transient period of recovery? Post-flood episode, the finding is still a significant finding of possible outpouring of sedimentations to the east coast coastal regions and river mouth. Rhetorically these riverine have been an important water source for irrigation and as drinking water in the east coast of Malaysia especially in the state of Kelantan.

3.3 FESEM

Qualitative overview inspection of the sediments cores and slimes harvested from monitored sites under the field emission scanning electron microscopy revealed gravels and soft-like organo-trace element adulterated pebbles-like structures aggregation paved on various distinct layers. All FESEM micrograph fragments do not reveal harmful algal blooms associated to coastal eutrophication.

3.4 Video transect analysis

In a natural conducted experiments of this manner, there are no really true replicates, but the consistency of the simple finding of ecological based responses observed around the now identified region leaves little doubt that there are various structures, such as the diatoms, coliforms, crown of thorns etc, that *can be* further explores as keystone species to further extrapolated the relation and after-math of what actually have incurred and possible mitigation needed of the said flood episodes in east coast Malaysia. Indeed, the temporal link legacy between the what seems as a high coral deforestation incidence observed now, and there is COTs blooms and news- media reports of HABs (or algal overgrowth shells foods poisoning) incidents provides some of the best evidence for a the primarily top-down monitoring and further vouchering of bottom-up (nutrients of outpouring episode?) as control of possible algal abundance or return on the east coast of Malaysia.

4.0 Conclusion

The after math impact need to be properly scientific based extrapolated. There are still many unanswered questions regarding the relationship between discharge and the water quality or pollution loads onto the east coast coral reef. However, the presence of diatomand microalgae is an indicator presence related to sea water warming. Phytoplankton dynamics should be investigated further in relation to environmental variables, with a particular emphasis on harmful algal blooms (HABs) incidents in the east coast. Given the current outlook, and assuming the region is not affected by 2014 east coast flood is thus very questionable. Observation of poor presence of marine benthic organism blooms of crown-of-thorns starfish and coral bleaching, of the dived coral reefs sites and high temperature sea water, needs further extrapolation and research whether a normalized curve towards signs of recovery within of some time period (as five years) can be possible. However, the ecological legacy of the impacts from this 2014 east coast flood and its related annual flood episodes is likely to be evident for several decades on nearby coral reefs.

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REPERCUSSION OF 2014 MEGAFLOOD ON NATURAL FOOD WEB IN KELANTAN DELTA: IN VIEW OF STABLE ISOTOPE ANALYSIS

Project Information

Project Leader	: Dr. Syaizwan Zahmir Zulkifli
University	: Universiti Putra Malaysia
Address	: Department of Biology, Faculty of Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor
Contact number	: 03-89466627
Email	: syaizwan@upm.edu.my
Project Members	: Prof. Dr. Ahmad Ismail Dr. Ferdius @ Ferdaus Mohamat Yusuff

1.0 Introduction

River flood is an important natural process in the terrestrial area. Excessive amount of water containing significant amount of dissolved and particulate matters, as well as associated contaminants (e.g. trace metals) will be flushed off to the sea. In certain circumstances, a megaflood event could be formed due to large fraction of riverine discharges caused by extreme meteorological conditions. It is characterized by short, intense flood events lasting for a few hours to weeks (Velasco et al. 2006). Such event occurred recently in Malaysia whereby intense discharge from Kelantan River produced a few times fold of the suspended material and brings significant inputs into coastal areas.

Little is known about the immediate effects of megafloods on coastal waters, mainly because they are episodic and unpredictable. Some ecological studies have focused on floods because they can cause significant mortality of aquatic organisms (Fisher et al. 1982). Food chain length is an important characteristic of ecological communities that may be strongly influenced by disturbance (Post, 2002a). Shifts in food chain length can alter ecosystem function, modify trophic interactions, and affect the biomagnification of contaminants (Carpenter et al., 1987, Cabana and Rasmussen, 1994). The dynamical constraints hypothesis (Pimm, 1982) suggests that longer food chains are less resilient to disturbance and implies that food chain length will be shorter following a disturbance or in frequently disturbed habitats. Disturbance is also expected to strongly influence food chain length when it results in the loss and slow return of upper trophic levels (Menge and Sutherland, 1976; Spiller et al., 1998). Experiments in small container habitats show that long food chains are more susceptible to shortening by disturbance and take longer to recolonize after a disturbance (Pimm and Kitching, 1987). There for, present study aimed to develop a food web model and determine length of trophic level of Kelantan Delta after massive disturbance of 2014 megaflood.

2.0 Methodology

Bimonthly samplings were conducted in Kelantan Delta area. Sediments, water and various types of biological samples were collected from predetermined location within the delta area. All samples were transported to the laboratory and keep frozen at -20◦C for further analysis. In the laboratory, frozen samples were thawed to room temperature. Pre-treatment of samples were based on the method prepared by Nakamura et al. (2008) and Zulkifli et al. (2012). In brief, tissue samples were washed with Mili-Q water and dried in a freeze dryer for at least 24 hrs or until constant weight was obtained. Each dried sample was ground to a fine powder and added 3 ml chloroform and methanol mixture (2:1 ratio) for 3 hrs to eliminate the lipid component. The mixture was centrifuged for 10 min using a high speed centrifuge (760 x g, 4˚C) before the supernatant was discarded and remaining pellet was fumed with 12M HCl for 10 hrs to remove inorganic carbonates. The excess acid contained in the pellet was removed in vacuum desiccator with pellets of NaOH for 3 hrs. The stable carbon and nitrogen (13C/12C, 15N/14N) were determined using a continuous flow isotopic ratio mass spectrometer with elemental analyzer. Carbon and nitrogen isotope ratios are expressed in delta notation (δ13C and δ15N) in units of parts per thousand (‰), where

$$\text{Delta X (ppt)} = [(\text{R of sample} / \text{R of standard}) - 1] \times 1000$$

where, R is 13C/12C or 15N/14N of sample or standard, X is δ13C or δ15N in part per thousand (‰) deviation of the sample from the recognized isotope standard. The analytical precision for the isotopic analyses was better than ±0.2‰ for both δ13C and δ15N. Pee Dee belemnite (PDB) limestone carbonate and atmospheric nitrogen (N2) were used as the standard for carbon and nitrogen isotope ratios, respectively.

3.0 Results and Discussion

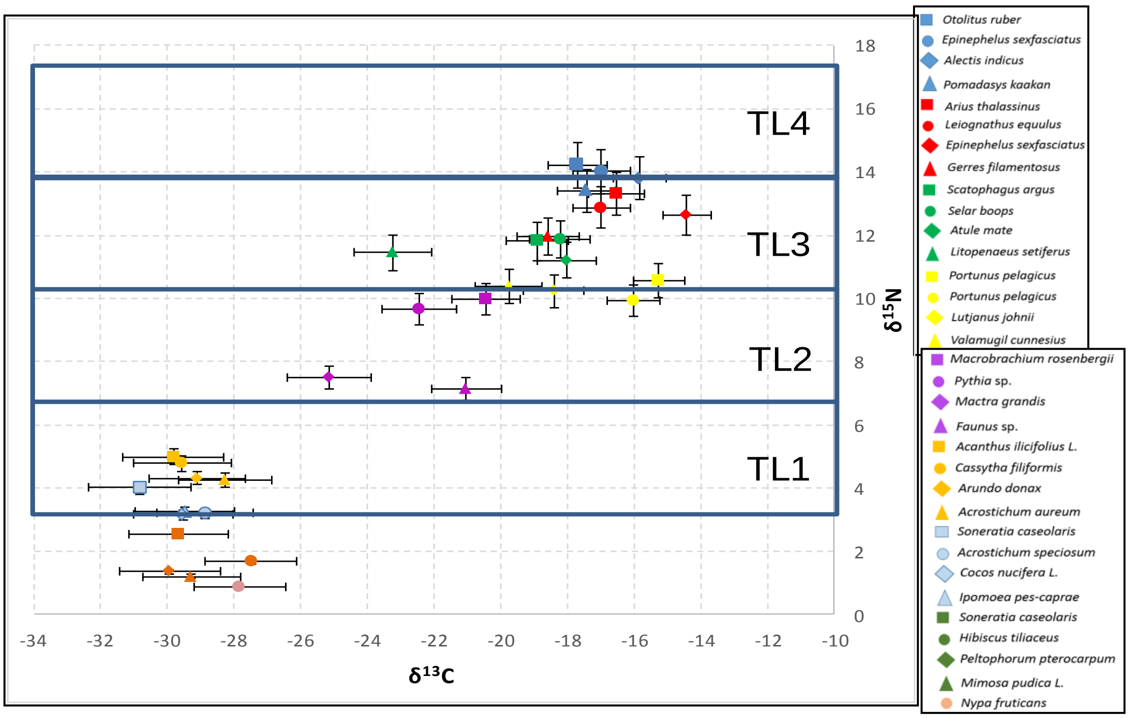

Figure 1: Trophic position of species collected in Kelantan Delta after 2014 megaflood

A total of 35 biological samples were analyzed and determined their stable isotope δ13C and δ15N ratios in their tissues. Combination of both data is demonstrated in Figure 1. In general, data of δ13C are ranging between -31‰ to -12‰, where as data of δ15N are ranging between 0.9‰ to 14.8 ‰. Among the biological samples, the tigertooth croaker (Otolitus ruber) is positioned at the top (mean δ15N = 14.24‰). Global studies on δ15N showed enrichment between 2.8‰ to 4.0‰ (with the mean value of approximately 3.4‰) will distinguish trophic level of one species (Minagawa and Wada, 1984). Based on present amount of samples, δ15N enriched at approximately 3.5‰, thus separate these species into four distinct trophic levels. By comparing with that of Sungai Pulai estuary (a Ramsar site located in Johor), this amount of trophic level is lesser. Organisms at Sungai Pulai estuary formed a complex food web containing five trophic levels. Lower amount of trophic level in directly demonstrate shorter food chains within the food web. This is in agreement with Pimm (1982) who suggested that food chain length will be shorter in a massive disturbance or in frequently disturbed habitats. Shorter food chain has the ability to recover faster after disturbance (Jenkins et al. 1992). Further investigation on factor promoting population recovery after frequent or massive disturbance should be investigated in order to accelerate habitat quality and ecosystem recovery.

4.0 Conclusion

The 2014 megaflood could cause massive disturbance on food web. By having shorter food chains creating the food web in Kelantan Delta, the ecosystem will naturally recover. However, it is still not clear whether the ecosystem will fully recover in time before next 2015 northeast monsoon.

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FLOOD RESILIENT BRIDGE AS A SUSTAINABLE SOLUTION FOR DISASTER RISK REDUCTION IN MALAYSIA

Project Information

Project Leader : Dr. Lau Tze Liang
University : Universiti Sains Malaysia
Address : School of Civil Engineering, USM Engineering Campus, 14300 Nibong Tebal, Pulau Pinang
Contact number : 04-5996284
Enail : celau@usm.my
Project Members : Prof. Dr. Aminuddin Ab. Ghani
Dr. Puay How Tion

1.0 Introduction

The recent flood occurrence in East Coast of Peninsular Malaysia has caused substantial damages to bridges. In Kelantan, it is reported that several tens of bridges in the state has suffered various extend of damages due to the worst monsoon season flooding in three decades. The public losses to infrastructure, roads and bridges would be estimated up to RM 932 million for Kelantan. More than 150,000 people were evacuated at the peak of the disaster. The collapse of Pulau Setelu Bridge across the Nenggiri River and Sungai Tanum Bridge in Kampung Aur Gading in Lipis are the clear examples showing that additional loading due to fast moving flood water and the waterborne debris carried by the current should be considered. The failure of bridges does not only disrupt the mobility of local people but also hampers the emergency response effort which is vital right after the disaster.

2.0 Methodology

This project was carried out using numerical simulation approach. At the onset on the study, related past studies on hydrodynamic and debris forces on bridges were reviewed. The fundamental causes of bridge failure and the failure mechanism were investigated. Numerical simulations were performed to investigate flood flow around bridge deck using CFD program, Flow-3D®. Flow-3D® is developed based on the fractional volume of fluid (VOF) free surface tracking method (Flow-3D, 2007). Under this method, cells are defined with a value between zero and one for empty to fully filled cells with fluid. For partially filled cells, the slope of the free surface is determined by an algorithm that uses the surrounding cells to define a surface angle and a surface location. Three-dimensional modeling on bridges subjected to the flood water and the effect of floating debris on bridge was investigated.

The model constructed in this research is an incompressible and viscous flow model. Flow-3D® employs the finite-volume method to solve the fluid equations of motion of the time dependent Reynolds Averaged Navier-Stokes (RANS). The computational domain is defined in a fixed rectangular grid or structured system. Hydraulic forces that fluid flow exerts on the solid structures are calculated by integrating the pressure acting on these structures over the open surface.

Three-dimensional bridge deck (Fig. 1) was simulated in the computational domain of 60 m long by 22 m high (maximum) by 10 m width as shown in Fig. 5. The mesh size was set as 0.4 m in three axes. A nested block with finer mesh size (0.2 m) was added at the bridge deck area (Fig. 2). Six different boundaries of each block were defined. Sidewalls were defined as free slip/symmetry (S), the bed was no slip/wall (W); the top was continuative (C); the upstream and downstream were velocity boundary (V) and the outlet (O), respectively. The bridge deck was placed at the location of about 23.25 m from the left boundary. Two different deck clearances (*z*) were used in this study, i.e. 3 m and 5 m.

Newtonian viscosity with renormalized group (RNG) k-ε turbulence model was adopted. The inflow properties were input at the upstream (left) boundary with constant velocity and flow depth. Various flow velocities (3 m/s to 10 m/s) and flow depths (5 m to 13 m) were simulated. The other numerical input data were set as 1000 kg/m^3 for fluid density, 1.225 kg/m^3 for air density, 0.001 kg/m/s for fluid viscosity and -9.81 m/s^2 for gravitational acceleration. The simulated flow propagates over a flat bed. Rough wedge debris model as shown in Fig. 3 was included to simulate the flood water flow with debris along bridge deck. Hydrodynamic and the effect of debris on loadings of bridges due to the flood water were investigated. Suggestion for designing a flood resilient bridge was then proposed.

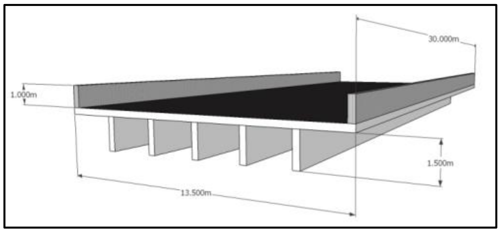

Figure 1: Dimension of Bridge Deck

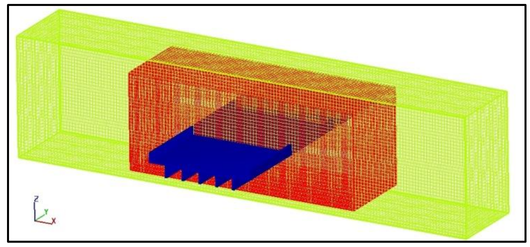

Figure 2: Computational Domain

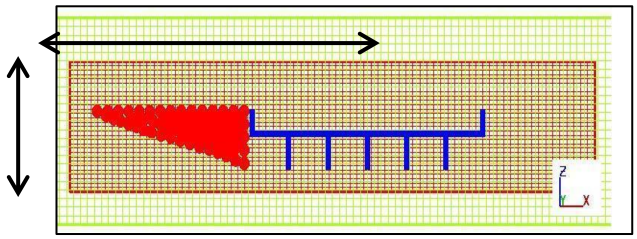

Figure 3: Rough Wedge Debris Model

3.0 Results and Discussion

When the flow depth increases, the flood water hits the frontal face of the deck, splashes upward and drops on the deck. The horizontal flow velocity near the deck decreases but the flood water flow through below the deck becomes faster. Similar phenomena are also shown by other flow scenarios. Highest pressure is observed at the frontal face and top of bridge deck where the flood water hits them. The flow characteristics help the designer better understand this phenomenon and mitigate the probable disaster caused by flooding.

The measured horizontal and vertical force time histories acting on the whole bridge deck for two different flow velocity cases are shown in Figs. 4 and 5. The horizontal force achieves the maximum value at the initial attack of flood water onto bridge deck. The horizontal force consists of impulsive-like force at the initial stage and followed by quasi-steady force. The maximum horizontal force increases with the flow velocity and flow depth. However, the quasi-steady force does not show significant changes for the case with different flood heights but the force still increase with the flow velocity.

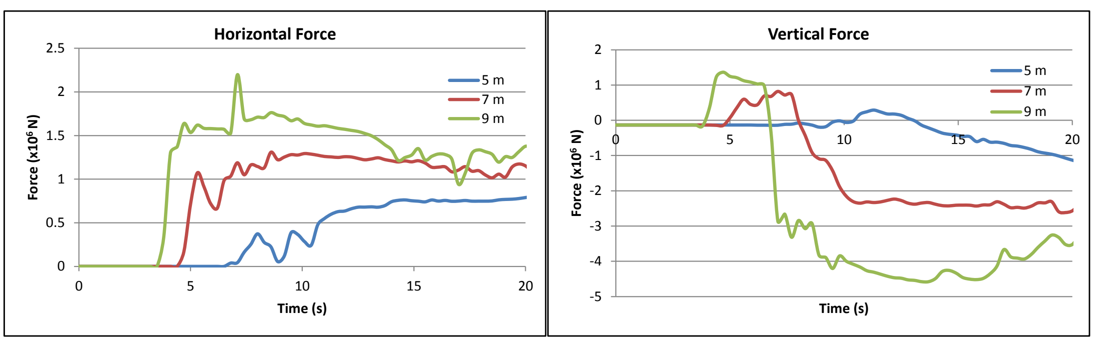

Figure 4: Horizontal and Vertical Force Time Histories (v = 5 m/s and z = 3 m)

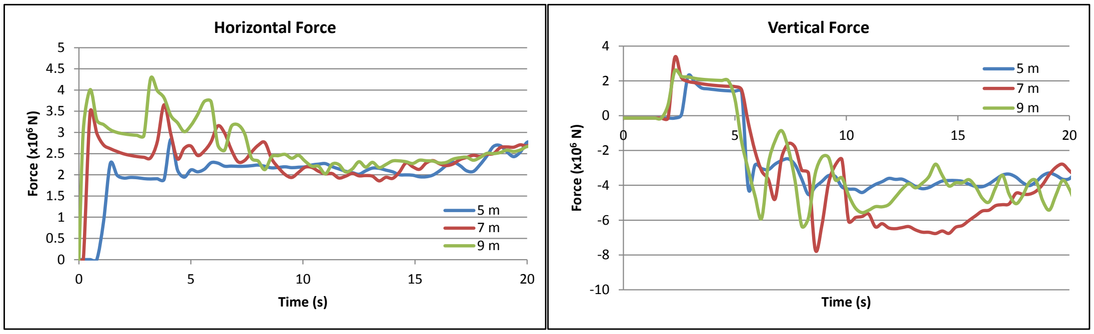

Figure 5: Horizontal and Vertical Force Time Histories (*v* = 10 m/s and *z* = 3 m)

Vertical force time histories demonstrate that the uplift force is observed and it is followed by the additional gravitational force acting downward on to the bridge deck. The vertical uplift force varies with the flood depth and flow velocity. However, the influence of flood depth becomes insignificant when the flow velocity increase from 5 m/s to 10 m/s. The similar phenomenon is also shown in the additional gravity force at flow velocity of 10 m/s.

The hydraulic loading is expressed as drag force, lift force and moment. The coefficients of drag, lift and moment are calculated based on the maximum drag force, lift force and moment for various flow velocities and heights ($0.12 \leq F_r \leq 0.71$). Fig. 6 to Fig. 8 show the variation of the coefficients of drag, lift and moment respectively at different inundation ratios (*h**), proximity ratio (P_r) and Froude number (*Fr*). The minimum drag coefficient was found at *h** around 0.3-0.5 where the bridge deck is partially inundated by flood water. Lower than this inundation ratio, the drag coefficient is about 2 to 3. As the inundation ratio becomes larger, the drag coefficient increases above 3.0 when *h** is 1.4.

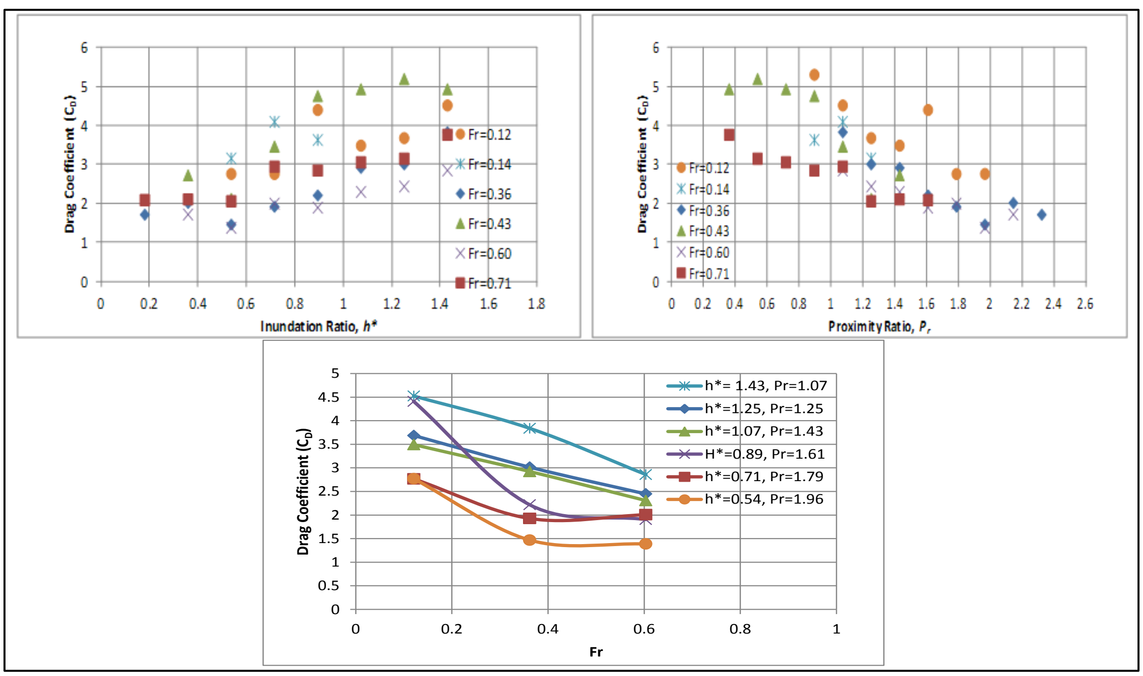

Figure 6: Drag force for bridge deck under the flow without debris

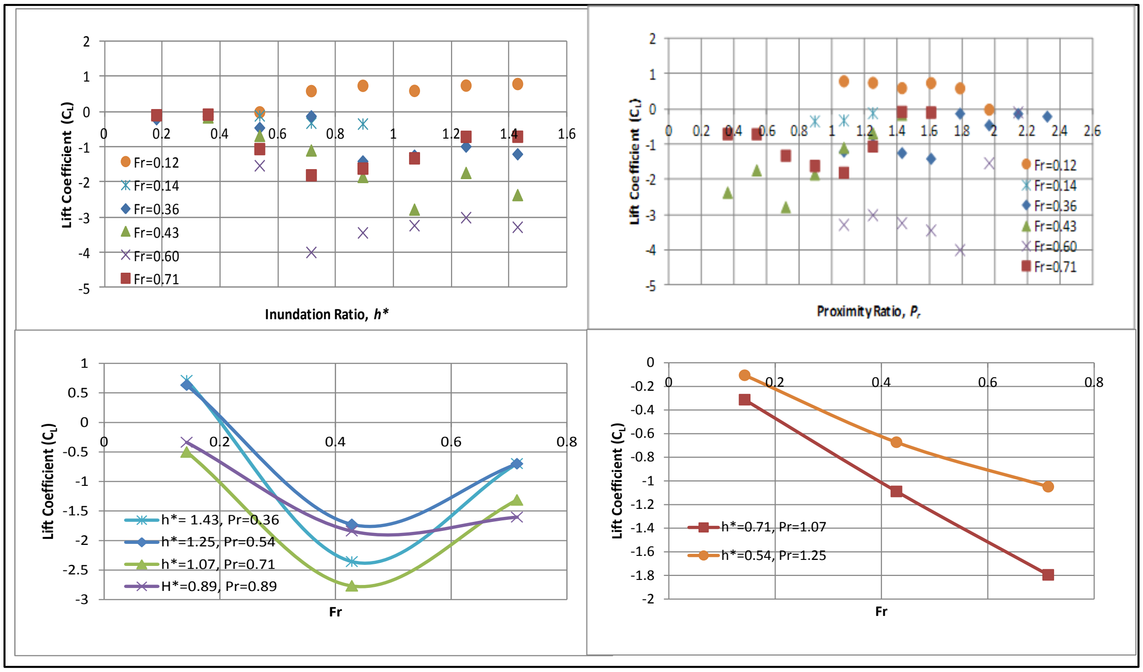

Figure 7: Lift force for bridge deck under the flow without debris

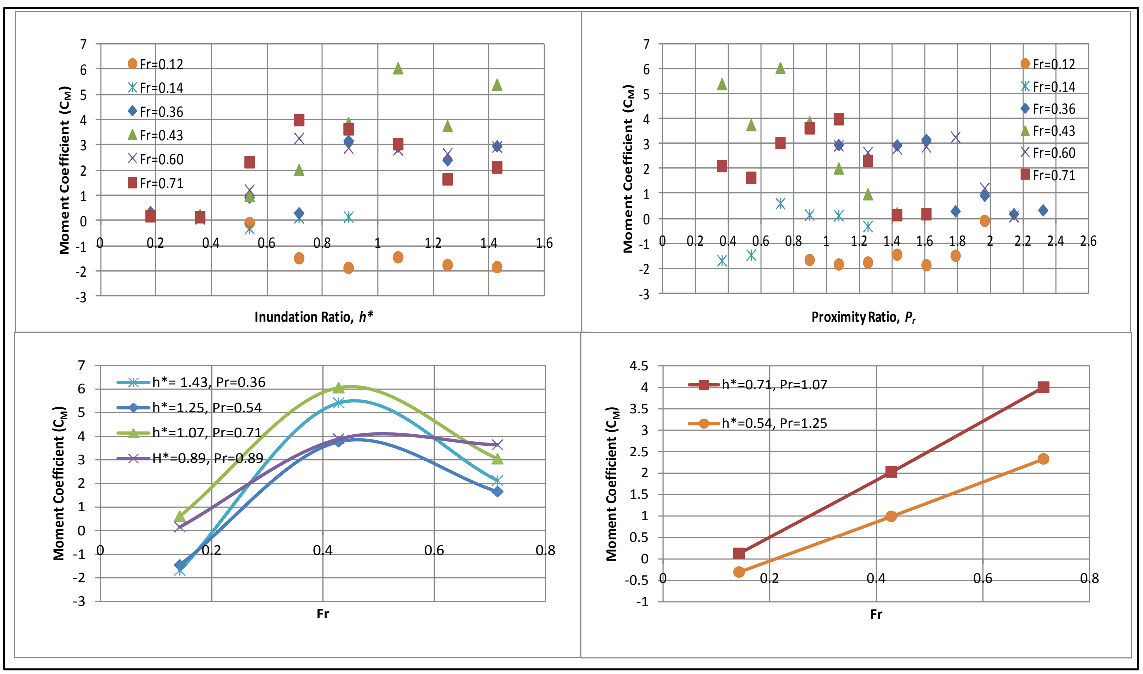

Figure 8: Moment force for bridge deck under the flow without debris

The buoyant force acting on the submerged deck has been excluded from the calculation of lift coefficient. Therefore, the lift coefficients obtained from the simulation shows negative values for all cases. This indicates the forces are acting downward to the bridge deck. The maximum value of lift coefficient is the larger in the inundation ratio ranges from 0.8 to 1.0. Moment coefficients obtained from this study are in the range of 0 to 6. The maximum moment coefficient occurs at h^* between 0.9-1.0. The correlations between drag, lift and moment coefficients with F_r and P_r are also presented in the figures.

The effect of debris on hydrodynamic loadings also investigated. Fig. 9 shows the effect flood water with and without the presence of debris on drag, lift and moment coefficients for flow with F_r = 0.43.

In general, with the presence of debris, the drag, lift and moment coefficients are smaller than the case without debris. However, the effect of debris becomes critical when *h** is larger than 1.

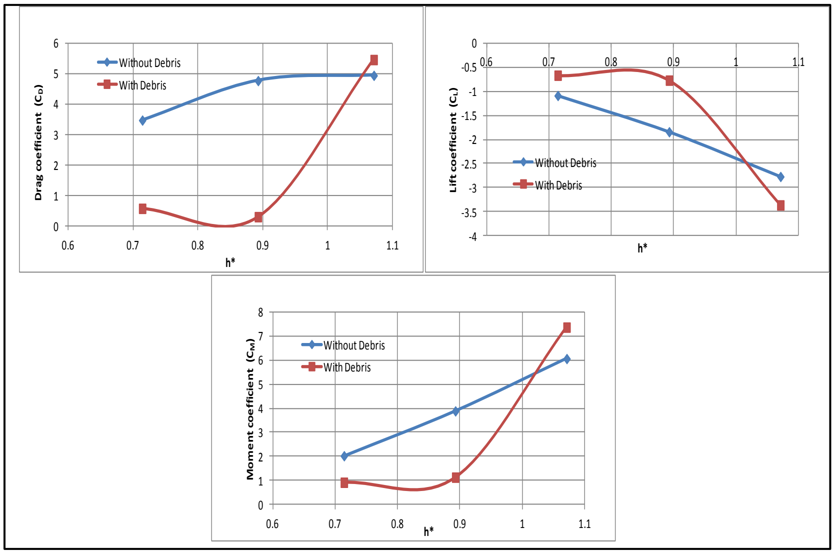

Figure 9: Drag, Lift and moment coefficients with and without the presence of debris

In order to design a bridge that could withstand flood and debris loads, several suggestions have been proposed. Bridges are normally designed to withstand 100-year flood. The design return period should be revised due to the occurrence of extreme event more frequently recently. The 1992 Austroads Bridge Design Code recommends bridges to design for flood up to 2000-year return period. Bridge deck should be designed to withstand both horizontal and vertical forces acting on the bridge deck. The integrity of the bridge girder in particularly the one facing the incoming flood water should be evaluated to mitigate the damage. The bridge deck should be also prevented from excessive horizontal displacement from its original position. The design of shear key would be important in this case. The overall stability of the deck should be checked to reduce the overturning moment effect especially at the moment the flood water strikes the bridge deck at the initial stage as a result of the action from both horizontal and vertical forces.

4.0 Conclusion

The findings of the study are given as follows:

4.1 Hydrodynamic forces on bridge deck vary with the flow conditions and the configuration of the bridge structure which can be expressed in terms of Froude number, inundation ratio and proximity ratio.

4.2 Hydrodynamic forces in both directions (horizontal and vertical) and moment acting on bridge deck should be determined and the stability of the bridge deck should be checked.

4.3 The drag force, lift force and moment would be higher than the case without debris when the bridge is fully submerged.

4.4 Detailed study should be conducted for each bridge design to consider different bridge configuration and different flow condition at specific area.

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ROAD NETWORK VULNERABILITY ASSESSMENT UNDER FLOODING CONDITIONS USING A REVISED ROAD NETWORK VULNERABILITY INDEX

Project Information

Project Leader	: Assoc. Prof. Dr. Law Teik Hua
University	: Universiti Putra Malaysia
Address	: Civil Engineering Department, Engineering Faculty, 43400 UPM Serdang, Selangor
Contact number	: 012-5482088
Email	: lawteik@upm.edu.my
Project Members	: Assoc. Prof. Dr. Hussain Hamid Dr. Zainuddin Md. Yusoff Dr. Alfian Abdul Halin Puan Ng Choy Peng

1.0 Introduction

Road networks are vulnerable to natural disasters, such as floods, earthquakes, tsunamis, cyclones, and forest fires, can result in a massive destruction to the infrastructure. Consequently, this poses a threat to vehicle travel on a degraded road network and prevent access for the emergency services, aids workers and relief supplies. Hence, it is crucial to understand the road network vulnerability, know the most vulnerable links and the consequences to network disruption in order to improve road network design and develop traffic management strategies during disaster. Hopkins et al. (1991) indicated that transportation system is the most critical lifeline facility as its disruption places immense burden on the other lifelines.

Vulnerability in the road transportation system is referred to the sensitivity to disruptions of road network that can lead to a sizeable decrease in road network serviceability (Taylor et al., 2006; Jenelius et al., 2006). Road network vulnerability has two definitions. The first is defined as the connective vulnerability between two nodes, while the second is defined as the access vulnerability of a node. The connective vulnerability refers to the loss of utility as the indicator of vulnerability, while the node access vulnerability is constructed on the concept of accessibility. The main purpose of road network vulnerability analysis is to determine the critical paths of a road network that might have the most serious adverse consequences on the whole network. Determination of critical paths would help to enhance road network robustness via reinforcing the identified critical paths or constructing new alternative parallel paths (Matisziw and Murray, 2009).

Over the past twenty years or so there have been a number of empirical studies on the vulnerability of road networks. Many of these studies developed methods to determine critical road paths. Taylor et al. (2006) employed three different scales of diminished accessibility to analyze the vulnerability in sparse regional networks. These scales include the increase in generalized travel cost, the relative decrease in the Hansen integral accessibility index, and the increase of a ‘‘remoteness” index. There are methods used the increase in generalized travel cost to evaluate the impact of complete disconnection (Jenelius et al., 2006) and the effects of geographical disparities (Jenelius, 2009). Several studies utilized a network robustness index to evaluate the change in travel time in highway networks when the link is disrupted (Chen et al., 2007; Qiang and Nagurney, 2008). The aims of this study were twofold. First, we attempted to construct a new road network vulnerability index. Second, we attempted to develop a traffic diversion plan under flooding conditions in Jeli district and Tanah Merah district using the new road network vulnerability index.

2.0 Methodology

The first step in computing the road network vulnerability index is to establish a road network-based model. This was done by identifying the geographical location of nodes within the study’s road network. The second step is to map a node to the adjacent nodes. The adjacent nodes constitute nodes that directly connect to the targeted node. Next, the shortest path for each origin-destination pair was computed during normal conditions. Similar procedures were repeated to compute the shortest paths during flooding conditions. This was done by removing nodes and edges that were affected in the flooding in 2014. Flooding information was obtained from the Kelantan state government. A Google map-based road network analysis application was developed to perform the road network vulnerability analysis. This application consists of three major components. The first component of the application is the node geographical location identification and coding module. The second component is the node-mapping module, and the third component is an Excel application for determining the shortest path between source and destination nodes.

The impact of floods on road network vulnerability in the districts of Jeli and Tanah Merah in Kelantan was analyzed using betweenness centrality and the average length of the shortest path. Betweenness centrality is a measure of number of shortest paths that pass through a particular node. It can be written as:

$$BC\ v\ =\ {}_{i\neq j\in V}\frac{\rho_{ij}(v)}{\rho_{ij}} \qquad (1)$$

where ρ_{ij} is the number of shortest paths between any two nodes i and j and $\rho_{ij}(v)$ denotes the number of shortest paths between nodes i and j that pass through node υ. A high betweenness centrality of a node indicates the importance of that node for connecting other nodes that would otherwise be unconnected. This measure can be normalized in the interval between zero and one by dividing it by $(n-1)(n-2)/2$, where n represents the number of nodes in the network.

The average length of the shortest path is an indicator of the typical separation between two nodes in a network. This measure can be written as follows:

$$S=\frac{1}{n(n-1)}\ {}_{i\in V}\ {}_{i\neq j\in V}\,d(i,j) \qquad (2)$$

where *d(i,j)* represents the length of the shortest path between nodes i and j, which corresponds to the numbers of nodes in the shortest path. A smaller value of the average length of the shortest path indicates a short path between nodes, which enables the traffic in the network to travel more quickly.

3.0 Results and Discussion

The road closure locations in the Jeli district were located along jalan Sungai Sam-Dabong-Jeli, which is a major road connecting the towns of Dabong town and Jeli. The road closure locations in the Tanah Merah district were in an area of the town of Tanah Merah that has a concentration of residential units. None of nodes in the road closure locations were accessible during the flooding period. Figures 1 and 2 show the node's betweenness centrality distribution of the districts of Jeli and Tanah Merah, respectively. The betweenness centrality for most of the affected nodes is clustered at higher values, which indicates that these nodes act as important intermediaries in the network of traffic flows. Therefore, it is anticipated that the inaccessibility of the affected nodes during floods would result in decreases in the connectivity of the road network.

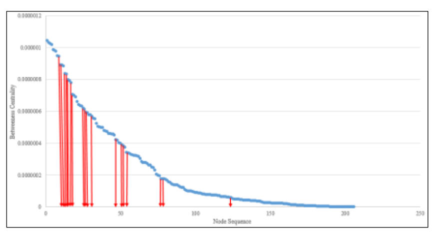

Figure 1: Node's betweenness centrality distributions of Jeli district road network

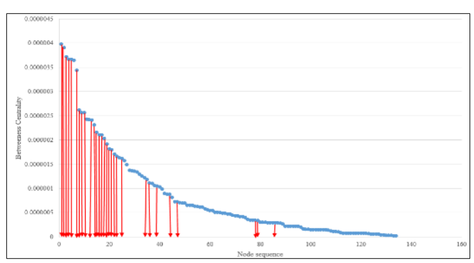

Figure 2: Node's betweenness centrality distributions of Tanah Merah district road network

Traffic was diverted onto alternative routes as a result of some road sections were closed during floods. Consequently, this increased travel distance for motorists. Table 3 reports descriptive statistics for the shortest paths in the road network of the districts of Jeli and Tanah Merah under normal and flooding conditions. As shown, the maximum and average values of the shortest paths for both districts increased significantly during the floods. These results are consistent with what we observed in Figures 3 and 4.

Figure 3: Traffic movement during flooding in Jeli district

Figure 4: Traffic movement during flooding in Tanah Merah district

Table 3: Descriptive statistics for the shortest paths (in kilometer) in the road network of Jeli district and Tanah Merah district under normal and flooding conditions

District	Condition	Average	Std. Dev.	Min	Max
Jeli	Normal	23.22	20.83	0.006	154.13
Jeli	Flooding	60.21	31.26	0.006	292.32
Tanah Merah	Normal	8.98	7.12	0.0028	35.72
Tanah Merah	Flooding	17.42	9.32	0.0028	74.21

As a result of road closures and the anticipated reduction in roadway capacity in the flooding areas, the amount of traffic diversion to alternate routes could become significant. Consequently, as shown in Table 4, several nodes' betweenness centralities have increased dramatically. This is particularly acute for nodes 2 and 3 as they are single-lane junctions[1] with a lower capacity, thereby requiring a greater degree of traffic mitigation to reduce the adverse impacts of traffic diversion on road network capacity and serviceability. We propose a link road between Kampung Ipoh and a junction along route D181 in the Tanah Merah district (a green line as shown in Figure 4) to redirect the traffic to a shorter route. However, there are no suitable locations in the Jeli district to build a link road, as this district is surrounded by mountainous terrain. Therefore, other measures to improve the road's resilience against flooding, such as elevating the road and building a road system with sufficient drainage, should be considered.

Table 4: Critical nodes' betweenness centrality under normal and flooding conditions

Node	District	Betweenness centrality under	Betweenness centrality under
1	Jeli	3.404E-07	4.119E-07
2	Jeli	1.764E-07	2.134E-07
3	Jeli	2.305E-08	2.789E-08
4	Jeli	1.959E-07	2.371E-07
5	Tanah Merah	1.485E-06	1.708E-06
6	Tanah Merah	1.362E-06	1.634E-06

4.0 Conclusion

Important findings of the study are summarized as follows:

1.1 The key finding of this study is that, generally, road network vulnerability was significantly increased during the floods.

1.2 Results also indicated that different districts showed mixed deficiency in the vulnerability of road network.

1.3 The application of the new road network vulnerability indices and the traffic diversion plan developed in this study could be a useful tool to enhance the sustainability and efficiency of road transportation during disaster situations. This, in turn, would reduce loss of life, injury, property damage, and economic and social disruptions due to flooding hazards.

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IMPACTS ASSESSMENT OF FLOOD ON NUTRIENTS, MICRO-COMMUNITIES AND FISH GROWTH IN THE KUANTAN RIVER FOR A PROPER MANAGEMENT

PROJECT INFORMATION

Project Leader	: Mohammad Mustafizur Rahman
University	: International Islamic University Malaysia
Address	: Jalan Sulatan Ahmad Shah, Bandar Indera Mahkota, 25200 Kuantan,Pahang
Contact number	: 09 5705143
Email	: mustafiz@iium.edu.my
Project Members	: Kamaruzzaman Yunus Noor Faizul Hadry Bin Nordin

1.0 Introduction

Rivers influence the livelihood of the people in the east coast of Peninsular Malaysia. The Kuantan river is one of the largest rivers in the east coast of Peninsular Malaysia. This river is very important in term of recreation, ecology and fish supply. It has a wide variety of fishes, which are regularly marketed for human consumption. In addition to these, this river plays an important role as a habitat for many kinds of birds, macro- and micro-organism, and mangrove plants. Many communities in the east coast of Peninsular Malaysia are directly or indirectly dependent for fishing in the Kuantan river and its estuary. However, the Kuantan river experiences floods during monsoon almost every year. Therefore, monsoon floods may have significant effects on the ecology of the Kuantan river.

Flooding not only damages the terrestrial ecology but also damages aquatic ecology including river ecology (Robinson, 2012). Impacts of flood on terrestrial ecology are always given much attention as they are directly related to human wellbeing. Generally, a limited attention is given on the impacts of flood on the river ecology. To date, there is no study on the impacts of flood on the Kuantan river ecology. The factors that make the flood highly important for a river ecology are: changes nitrogenous and phosphorous nutrirnts, and abundance of fish food (zooplankton) and growth and condition of fish (Agostinho et al., 2004). All of these factors are directly and/or indirectly depend on grographical location of the river, and quality and quantity of flood (Bonecker et al., 2005).

Nitrogenous and phosphotous nutrients are very important for river ecology as they influence the primary production, which subsequently influences the secondary production, and the growth and production of other river communities. Zooplankton makes a very important link between primary producers and carnivores in the aquatic food web (Rahman et al., 2008a,b; Rahman, 2015a,b). Abundance of zooplanktons is a very useful indicator of future fisheries health (Rajkumar et al., 2013). Growth and condition of fish are also important factors that indicate the ecological suitability of river as the fish habitat. To date no study assess the impacts of flood on nitrogenous and phosphotous nutrients, zooplankton abundance and growth and condition of fish in the Kuantan river. Therefore, the present study was conducted to understand the impacts of moonson flood on nutrients (nitrogenous and phosphotous), fish foods (zooplanktons) abundance and growth and condition of fish in the Kuantan river

2.0 Methodology

For this study, fish samples were collected monthly from the Kuantan river for a period of 10 months (May 2015 - February 2016) and nutrients and zooplantkton sampling were conducted bi-monthly for one year and five months (September 2014 - January 2016). Data from another routine study has been included with this study to better understand the effects of flood on nutrients and micro-community (zooplantktons). Two fish species (*Barbonymus gonionutus* and *Barbonymus schanenfeldii)* caught by gill net were studied to understand their growth and condition factors. If fish samples were not sufficient, some fish specimens were also collected from fishermans who were engaged fishing in the Kuantan river. For nutrients and zooplankton studies, a total of three sampling sites were selected: the Kuantan river estuary (Zone A), 5 km upstream from the Kuantan river estuary (Zone B) and 10 km upstream from the Kuantan river estuary (Zone C). Each zone had a total of three sampling stations which were considered as replication. A series of water quality parameters (temperature, dissolved oxygen (DO), total alkalinity, nitrite-nitrogen (NO_2-N), nitrate nitrogen (NO_3-N), total ammonia nitrogen (TAN), phosphate phosphorus (PO_4-P) and silicate) were determined in three layers (surface, middle and bottom) of the water column at each sampling station. Temperature and dissolved oxygen were recorded directly in the field using a portable Hydrolab equiptment (Hydrolab Minisonde® water quality multiprobes). A Van Dorn water sampler was used to collect water for determining NO_2-N, NO_3-N, TAN, PO_4-P and silicate. All these water quality parameters were determined according to Persons et al. (1984).

For the qualitative and quantitative estimation of zooplankton, water samples was also collected by taking 1-L sample at 3 randomly selected locations in each sampling site with a Van Dorn water sampler. Each composite 3-L sample was then passed through a 40-µm mesh plankton net. Each concentrated zooplankton sample was then transferred to a polythene bottle and was diluted to 100 ml with formalin and distilled water to obtain a 7% buffered formalin solution. Zooplankton numbers was estimated in a Sedgewick–Rafter (S–R) counting chamber. A 1 ml sample was put in the S–R counting chamber and was left 10 minutes to allow zooplankton to settle. The zooplankton in 10 randomly selected fields in the S–R counting chamber was identified up to genus level and counted under a binocular microscope. Zooplankton density was calculated using the formula, $N = P \times C \times 100 / L$ (Rahman, 2015b), with N = the number of zooplankton per liter of river water, P = the number of zooplankton counted in ten fields, C = the volume of the plastic bottle holding the sample (100 ml) and L = the volume of the river water sample (3 L).

The growth coefficient will be calculated from the mathematical relationship between length and weight (regression analysis). It will be calculated using the following equation. W = aL^b with W = weight of fish (g), a = the intercept in the y-axis, b is an exponent (the regression coefficient) indicating growth pattern of fish and L = the total length of fish (cm). The value of b indicates isometric growth when close to 3, negative allometric growth when less than 3 and positive allometric growth when more than 3. The coefficient of determination (R^2) and the parameters a and b will be estimated by linear regression analysis after logarithmic transformed equation, Log W = Log a + b Log L. The Fulton's condition factor (K) for each fish will be calculated using the equation, $K=W/L^3 \times 100$, with Where, K = the condition factor, W = the weight of fish and L = the standard length of fish (cm). In order to confirm whether growth coefficient (b) obtained in the linear regressions were significantly different from isometric growth (b=3), we used a one-sample t-test expressed by the mathematical equation $t_s = (b\text{-}3)/s_b$ with t_s is the t-test value, b is the slope and s_b is the standard error of slope (b). The comparison between obtained t-test values and the respective tabled critical values allowed for the determination of the b values statistically significant, and their inclusion in the isometric range or allometric range.

Statistical equality of growth coefficient (b) and condition factors between male and female were analyzed through the analysis of covariance (ANCOVA), which was also used to test the statistical difference of growth coefficient (b) and condition factors among different sampling months. Water quality and zooplankton data were analyzed using a one-way repeated measure. If there was any significant effect ($P < 0.05$), the mean differences were analyzed through Tukey test. All statistical analysises were considered significant at $p \leq 0.05$. The statistical software SPSS (version 22.0) was used for all statistical analyses.

3.0 Results and Discussion

This is the first study that evaluates the effects of flood on water quality, zooplankton abundance, and growth and condition of fish in the Kuantan river. In this study, the impacts of flood on nitrogenous and phosphorous nutrients, and zooplankton abundance in various locations in the Kuantan river are clearly shown. Besides the effects of flood, this study shows concentrations of nitrogenous and phosphorous nutrients and zooplankton abundance in three different zones (Zone A: salinity ≈ 25 ppt, Zone B: salinity ≈ 15 ppt , and Zone C: salinity ≈ 1 ppt) in the Kuantan river. Temporal effects on all measured water quality parameters were significant ($P<0.05$) (Table 1). Similarly, sampling zone had significant effect on all measured water quality parameters. This indicated that means of each water quality parameter in various zones were not similar. However, temporal effects water quality parameters were not similar in all sampling zones as indicated by the interaction effects of sampling month and sampling zone on water quality parameters (Table 1).

Table 1: Effects of time (month), zone (sampling site) and their interaction on water quality and zooplankton abundance in the Kuantan river water based on one-way repeated measure ANOVA

Variable	Time	Zone	Time×Zone
Temperature	**	**	**
Dissolved Oxygen	**	*	**
Total Alkalinity	**	**	**

Nitrite Nitrogen	**	**	**
Nitrate Nitrogen	**	**	**
Total Ammonia Nitrogen	**	**	*
Phosphate Phosphorous	**	**	**
Silicate	**	**	*
Zooplankton Abundance	**	**	NS

* P< 0.05; ** P< 0.01; NS, not significant

The overall concentration of inorganic nitrogenous and phosphorous nutrients increased, and silicate concentration decreased in the Kuantan river water during the months of November 2014 to January 2015 ($P<0.05$) when the river experienced monsoon floods (data as Figs not shown due to space limitation). This effect was less during next monsoon (November 2015 to January 2016) when there was no flood. The concentration difference of nitrogenous and phosphorous nutrients and silicate between two monsoon might be the effects of flood. This finding concurs with Agostinho et al. (2004), who observed the changes of water quality parameters of the Parana River due to flood. In the present study, effects of flood was more pronounced on PO_4-P, TAN and silicate concentration than on other water quality parameters. Flooding increased the water PO_4-P concentration much in the upstream zones (Zone B and Zone C). The plausible reason might be due to terrestrial runoff, which might brought terrestrial phosphorus nutrients into the river (Rahman et al. 2016). The effects flooding on water PO_4-P concentrations was almost disappeared in the Kuantan river estuary (Zone A) ($P>0.05$). This might be occurred due to mixing of the PO_4-P rich water with large volume of seawater in the Kuantan river estuary. TAN concentration in the water was very high in Zone A and Zone B compare to Zone C. However, both temporal and spatial effects on water TAN concentration clearly indicated that the source of TAN in the water was very close to Zone B. The Zone B was located close to Kuantan city, which regularly discharges waste water containing TAN and organic matter into the Kuantan river water. Flood increased TAN concentrations in zone A and B by washing waste from Kuantan city. Flood significantly ($P<0.05$) reduced silicate concentration in the river. This might be due to mixing the large volume of terrestrial rain water into the Kuantan river water. This result is in agreement with Rajkumar et al. (2014), who observed lower silicate concentration in the Celeroon river (India) water during monsoon months compare to the other months of the year.

Flood reduced zooplankton abundance in the Kuantan river water as indicated by the lower zooplankton abundance in monsoon months (November 2014 and January 2015) compare to other sampling months (Fig. 1-A). The zooplankton abundance in the Kuantan river did not reduce during second monsoon period (November 2015 to January 2016) compare to non-monsoon months. The interaction effect of sampling month and sampling zone on zooplankton abundance was not significant (Table 1). This indicated that the flood reduced the zooplankton abundance in all sampling zones similarly although the mean abundance of zooplankton was higher in Zone A and zone B compare to Zone C (Table 1, Fig. 1-B). The observed negative effects of flood on zooplankton abundance concurs with Tawari et al. (2014), who observed lower zooplankton abundance in Amassoma Flood Plain of Niger Delta (Nigeria) after flood compare to before flood.

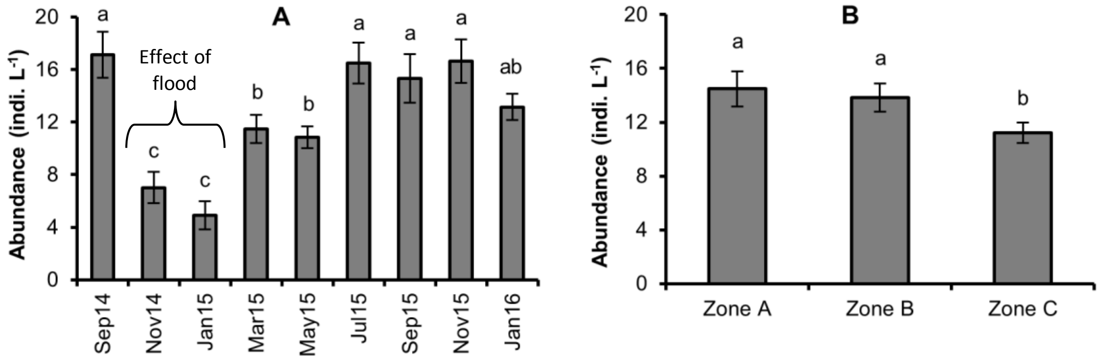

Fig.1. Effects of flood (temporal effect) (A) and sampling zone (B) on total zooplankton abundance in the Kuantan river water. Data are mean ± standard error. Mean (bar) with no latter in common are significantly different (P < 0.05) based on Tukey test, two-way repeated measure ANOVA

Temporal changes of growth co-efficient of male and female *B. gonionutus* and *B. schanenfeldii* in Kuantan river is shown in Table 2. Male and female showed similar growth in all months except August 2015 and February 2016 for *B. gonionutus* and december 2015 for *B. Schanenfeldii*. Both fishes showed negative allometric in almost all months. Overall both fishes showed positive allometric growth in December 2015 and January 2016. At that period there was some rainfall. However, reason of better growth of fish in December 2015 and January 2016 compare to other months is unknown. More investigation is still needed to understand the reason of better growth of fish in this period. The Kuantan river did not experience any flood during last monsoon and therefore, more study on fish growth during flooding time is needed to conclude about the effects of flood on fish growth in Kuantan river. Fish had similar condition factor throughout the study period except August 2015 (data as Figs not shown due to space limitation). The mean condition factor of *Barbonymus gonionutus* and *Barbonymus schanenfeldii* were 1.235 and 1.292, respectively. However, the condition factors of both represented a fair and acceptable condition (Charles and Alan, 2003). Overall female fish better condition than male fish.

Table 2: Changes of growth co-efficient of male and female *B. gonionutus* and *B. schanenfeldii* in Kuantan river.

Month	Sex	*Barbonymus gonionutus*			*Barbonymus schanenfeldii*		
		Growth co-efficient	R^2	Sig. (P value)	Growth co-efficient	R^2	Sig. (P value)
May15	F	2.659^{n}	0.987	NS	2.746^{n}	0.953	NS
	M	2.974^{n}	0.966		2.560^{n}	0.942	
Jun15	F	-	-	-	3.069^{I}	0.950	NS
	M	2.763^{n}	0.948		3.052^{I}	0.966	
Jul15	F	-	-	-	2.692^{n}	0.805	NS
	M	3.083^{I}	0.992		2.656^{n}	0.962	
Aug15	F	3.125^{p}	0.949	*	2.944^{I}	0.988	NS
	M	2.763^{n}	0.928		2.960^{I}	0.995	
Sep15	F	2.834^{n}	0.992	NS	2.769^{n}	0.993	*
	M	2.926^{n}	0.989		3.028^{I}	0.998	
Oct15	F	2.652	0.918	*	2.486^{n}	0.859	NS
	M	2.262	0.851		2.436^{n}	0.908	
Nov15	F	1.173^{n}	0.999	NS	-	-	-
	M	2.187^{n}	0.934		2.104	0.843	
Dec15	F	3.310^{p}	0.943	NS	3.084^{I}	0.993	*
	M	3.157^{p}	0.952		3.400^{p}	0.934	
Jan16	F	-	-	-	2.990^{I}	0.997	NS
	M	2.989^{I}	0.997		2.994^{I}	0.904	
Feb16	F	2.645^{n}	0.937	*	-	-	-
	M	2.934^{n}	0.994		2.661^{n}	0.989	

*, P<0.05; NS, not significant; F, female; M, male. Supercript I, n, p indicate isometric, negative allometric and positive allometric growth.

4.0 Conclusion

Following are the Summarized important findings of the project.

i. Flood influenced water quality in the Kuantan river. Flood increased nitrogenous and phosphorous nutrients and decreased silicate in the Kuantan river.
ii. The effects of flood on nitrogenous and phosphorous nutrients in the water was more pronounced in the downstream than upstream in the Kuantan river. Kuantan city is the important source of nitrogenous nutrients especially total ammonia nitrogen in the Kuantan river water.
iii. Flood decreased zooplankton abundance significantly in the Kuantan river.
iv. The mean abundance of zooplankton was higher in downstream water than upstream water.
v. Male and female showed similar growth in all months except August 2015 and February 2016 for *B. gonionutus* and December 2015 for *B. Schanenfeldii*. Both fishes showed negative allometric in almost all months. Both fishes had better growth (positive allometric growth) in December 2015 and January 2016 (monsoon).
vi. Similar study should be conducted for longer duration to confirm the effect of flood on nutrients, micro-communities and fish growth.
vii. The results of this study are useful for the proper management of Kuantan river. For example, Kuantan city is the important source of total ammonia nitrogen in the Kuantan river water. Water loaded with organic matter should not be discharged directly (or can be discharge after proper treatment) to the Kuantan river.

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ANALISIS LOGAM BERAT, UNSUR RADIOAKTIF TABII DAN BAKTERIA DALAM AIR PERIGI TIUB YANG BARU DIBINA DI KAWASAN BANJIR DI NEGERI KELANTAN DAN PAHANG

Maklumat Projek

Project Leader	: Sukiman Bin Sarmani
University	: Universiti Kebangsaan Malaysia
Address	: Pusat Pengajian Sains Kimia dan Teknologi Makanan
Contact number	: 0133357577
Email	: sukiman@ukm.edu.my
Project Members	: Ainon Binti Hamzah, Muhamad Samudi Bin Yasir Irman Bin Abdul Rahman, Faizal Bin K.P. Kunchi Mohamed Khoo Kok Siong, Wan Syaidatul Aqma Binti Wan Mohd Noor

1.0 Pengenalan

Kejadian banjir besar yang menimpa Semenanjung Malaysia pada Disember 2014 melibatkan negeri-negeri Kelantan, Perak dan Pahang. Antara kesan banjir adalah perpindahan sedimen terampai dan memendak di kawasan hilir. Logam berat terlarut dan bakteria pembawa penyakit yang berada dalam air banjir meresap ke dalam tanah dan boleh mencemar air tanah. Air bawah tanah merupakan sumber air penting di negeri Kelantan terutamanya di hilir Lembangan Kelantan kerana terdapat banyak akuifer dengan aras air yang rendah (Kamal, 2011). Kajian oleh Ismail and Anuar (2010) menunjukkan 75% penduduk di hilir Lembangan Kelantan bergantung kepada air bawah tanah untuk kegunaan domestik, pertanian dan perindustrian dengan anggaran penggunaan sekitar 150 juta liter sehari. Bagi menilai impak kepada kesihatan penduduk setempat akibat banjir besar maka kajian ini dilakukan untuk menentukan kandungan unsur beracun dalam air tanah di kawasan yang dilanda banjir. Sampel air di ambil dari perigi tiub baru yang dibina atas sumbangan Universiti Kebangsaan Malaysia (UKM) manakala perigi tiub lama dibina oleh Jabatan Mineral dan Geosains Malaysia (JMG). Parameter kualiti air yang dikaji ialah logam berat, bahan radioaktif tabii (NORM) dan bakteria pembawa penyakit. Perpindahan bahan pencemar dari air permukaan boleh mencemar air tanah ketika banjir. Bahan pencemar seperti bahan kimia organik, ion tak organik, pathogen dan bahan radioaktif boleh terlarut dalam air tanah dan membahayakan penggunaan air tanah (Sefie et al. 2015). Logam berat yang dikaji ialah Al. As, Cd, Cr, Cu, Fe, Hg, Mn, Pb, Th, U dan Zn. Kawasan hulu Kelantan dikenali mengandungi uranium dan torium yang lebih tinggi berbanding pantai maka analisis bahan radioaktif tabii seperti ^{40}K, ^{232}Th dan ^{238}U juga dilakukan bagi mengesan pemindahan bahan tersebut. Manakala mikrob pembawa penyakit seperti *E. coli* dan *Salmonella* yang berasal daripada bahan kumbahan manusia dan haiwan juga mencemari sumber air bawah tanah.

2.0 Metodologi

Bagi penentuan logam berat dan keradioaktifan dalam sampel air diambil dalam 2 botol plastik ukuran 5 liter. Sebanyak 100 ml sampel air dituras menggunakan penuras membren untuk dilakukan analisis logam berat menggunakan kaedah ICP-MS. Keradioaktifan alfa dan beta jumlah ditentukan di Agensi Nuklear Malaysia. Kandungan NORM dalam sampel tanah ditentukan menggunakan kaedah Spektroskopi Gama.

Kandungan bakteria ditentukan dengan kaedah turasan membran seperti yang disaran dalam standard Methods (APHA). Setiap koloni bakteria ditentusahkan dengan menggunakan kit komersial API 20E dan agar eosin metilina biru (EMB) untuk pengesahan *E. coli.*

3.0 Hasil dan Perbincangan

WHO dan Kementerian Kesihatan Malaysia menetapkan kandungan bahan radioaktif dalam air minuman tidak melebihi 0.1 Bq/L bagi keaktifan alfa jumlah dan 1 Bq/L bagi keaktifan beta jumlah. Had ini diasaskan pengambilan bahan radioaktif melalui air minuman mesti kurang daripada 0.1 mSv/th dalam Garis Panduan WHO itu dikira berdasarkan pengambilan air minum sebanyak 2 liter sehari. Hasil kajian menunjukkan kandungan bahan radioaktif tabii dalam air telaga tiub berada dalam keadaan selamat untuk diminum. Walau bagaimanapun sampel dari Menara Peninjau Penor, Kuantan menunjukkan aras tiga kali ganda lebih tinggi. Kawasan tersebut merupakan tanah gambut yang lazimnya tinggi kandungan bahan organic termasuk ^{40}K. Nilai yang diperoleh sepadan dengan sampel air Johor Bahru dengan keaktifan Gross alfa dan gross beta dalam air adalah masing-masing

0.012 ± 0.003 dan 0.234 ± 0.018 Bq L^{-1} (Saleh et al. 2015). Kandungan yang rendah mungkin kerana telaga tiub tersebut hanya pada kedalaman sekitar 30m.

Analisis sampel tanah dan sedimen sungai di kawasa kajian mendapati sampel sedimen dari Sungai Pahi menujukkan dos sinaran yang paling tinngi diikuti oleh Sg. Golok, Masjid Gual Ipoh, Sg. Pahang dan Kg. Acheh, Pekan manakala dos paling rendah pula adalah dari Sekolah Kebangsaan Manik Urai Baru, Kuala Krai. Bagi banyak kawasan di Malaysia radionuklid ^{232}Th adalah penyumbang utama kadar dos gama. Kajian di kawasan yang tinggi kandungan NORM seperti Daerah Segamat kadar dos dedahan adalah 276 nGy j^{-1} dan kadar dos setara tahunan 1.169 mSv (Salleh et al. 2013). Sanusi et al.(2014) dalam kajian penentuan dos sinaran bagi negeri Selangor, Kuala Lumpur dan Putrajaya mendapati kadar dos sinaran berada pada julat dari 17 $nGyj^{-1}$ hingga 500 $nGyj^{-1}$ dengan min pada 182±81 $nGyj^{-1}$. Bagi keseluruhan negeri Pahang kadar dos berada pada julat 26 - 750 $nGyj^{-1}$. Sebagai perbandingan nilai min dos sinaran global ialah 330±8 nGy/j manakala Malaysia ialah 92 nGy/j (UNSCEAR 2000). Kajian ini juga menunjukkan dos sinaran Sekolah Kebangsaan Manik Urai Baru Kuala Krai pada 37 nGy/jam adalah paling rendah dan berada di bawah kadar sinaran latar Malaysia. Bagi kawasan Sungai Pahang, Sungai Kuantan, Sungai Kelantan, Sungai Pahi dan Sungai Golok walaupun nilainya tinggi tetapi masih berada dalam julat min dos sinaran global 330 nGy/jam. Walaupun terdapat perindahan NORM daripada bahagian hulu namun aras dos sinaran masih di bawah aras selamat bagi orang awam.

Keselamatan air di Malaysia dipantau berasaskan Malaysian Raw Water Quality Criteria (RWQC) dan garis panduan Drinking Water Quality Standard (DWQS) yang ditetapkan oleh Kementerian Kesihatan Malaysia, antara parameter yang ditetapkan ialah amonia < 1.5 mg/L, Cu < 1.0 mg/L, Fe <0.3 mg/L, Mn < 0.1 mg/L, nitrat < 10.0 mg/L, sulfat < 250 mg/L, Cr < 0.05 mg/L, dan Zn < 3 mg/L of Zn. Sebanyak 10 jenis logam berat telah dianalisis dalam sampel air telaga tiub dan unsur As, Fe, Mn dan Pb berada pada kepekatan tinggi manakala unsur lain seperti Cd, Cu, Cr, Th dan U berada pada paras latar. Kebanyakan sampel dari negeri Pahang juga mengandungi Al yang tinggi akibat dari pemineralan boksit di kawasan tersebut. Pencemaran air bawah tanah disebabkan oleh pertumbuhan cepat industri di kawasan tersebut dan juga kegiatan agroindustri. Kajian terdahulu bagi sampel air bawat tanah daripada Sembilan telaga tiub Jabatan Mineral dan Galian (JMG), loji rawatan air Air Kelantan Sdn Bhd (AKSB) dan Natioal Hydraulics Research Institute of Malaysia (NAHRIM) menunjukkan sampel air bawah tanah Kelantan mengandungi Fe yang tinggi (Akbar et al. 2015). Kajian di Sungai Kerian Kelantan juga mendapati kepekatan As dan Fe melebihi piawai yang ditetapkan oleh Kementerian Kesihatan Malaysia. Kajian juga menunjukkan kandungan Fe dalam air telaga tiub lebih tinggi daripada air sungai (Ibrahim 2015).

Kebanyakan sampel air yang diambil di daerah Pekan mengandungi Fe dan Mn yang tinggi dan melebihi piawaian. Walaupun Fe dan Mn tidak membahayakan kesihatan pada kepekatan tinggi namun kualiti estetik air kerana warna dan rasa air telah berubah. Loji Rawatan Air PAIP Nenasi yang membekalkan air domestic di Nenasi dan sekitarnya merawat air tanah dan kualiti air terawat memenuhi piawaian DWQS Kementerian Kesihatan Malaysia. Bagi unsur As pula secara umumnya sampel negeri Kelantan mengandungi As jauh lebih rendah berbanding sampel negeri Pahang ini disebabkan telaga tiub Kelantan digunakan secara kerap manakala telaga tiub Pahang jarang digunakan dan bersifat sebagai telaga tiub pemantauan kemasukkan air masin. Belum terdapat kes keracunan arsenik di kalangan pengguna air bawah tanah di negeri Kelantan ataupun negeri Pahang. Unsur logam berat lain masih berada pada kepekatan latar namun pemantauan berkala masih perlu memandangkan pertumbuhan industry yang pesat di Daerah Pekan.

Bagi parameter mikrobiologi telah ditetapkan kandungan pathogen tinja penunjuk ialah 0 *Escherichia coli* per 100 mL sampel air manakala bakteria lain seoperti enterococci dan coliform jumlah juga 0 per 100 mL sampel air (WHO, 2006). Pemantauan bakteria coliform tinja menunjukkan bilangan bakteria bahaya yang mengakibatkan masalah kesihatan awam. Hasil kajian populasi mikrob diberikan dalan Jadual 8 dan Jadual 9. Sumber air telaga tiub dikelaskan mengikut kandungan jumlah bakteria seperti berikut; Kategori I (>3000 cfu/100ml) ialah Sekolah Kebangsaan Manek Urai Baru, Kuala Krai, Masjid Goal Ipoh, Tanah Merah, Balai Polis Lubuk Setol, Rantau Panjang, Menara Peninjau Kebakaran, Penur, Kuantan, Kg. Baruh, Cherok Paloh, Kuantan. Kategori II (500- 2000 cfu/100 mL) ialah Sekolah Kebangsaan Pasir Gajah, Kuala Krai, Masjid Pasir Ganda, Tanah Merah, Kg. Baharu, Pekan. Manakala bagi Kategori III (< 500 cfu/100 mL) ialah Taman KUB, Kota Bharu, Jalan Kadir Adabi, Kota Bharu, Loji Air PAIP, Nenasi, Pekan, Kg. Chenderawasih, Pekan, Masjid Kg. Ketapang Hilir, Pekan, Kg. Ubai, Ulu Penor, Pekan

Sebagai perbandingan sampel air Sungai Kelantan mengandungi bakteria yang jauh lebih tinggi. Sampel air Masjid Gual Ipoh mengandungi *Citrobacter freundii,* koloni yang berwarna hitam. Kesemua lokasi persampelan mengandungi bakteria enteropatogen. Kajian air tanah oleh Md. Issa et al. (2012) dari beberapa lokasi di negeri Perlis dengan formasi geologi berbeza iaitu formasi batu kapur Chuping, formasi batu kapur Setul, formasi Tertier Bukit Arang dan formasi Kubang Pasu-Singa menunjukkan adanya coliform jumlah (<20 cfu/100 mL) dan coliform tinja (<40 cfu/100 mL) yang melebihi had yang ditetapkan dalam Piawai kualiti Air Minuman (DWQS). Begitu juga halnya dengan keadaan air tanah Pulau Tiga Sabah yang melebih had selamat WHO iaitu coliform jumlah (<70 cfu/100 mL) dan coliform tinja (<40 cfu/100 mL) (Lin et al. (2010).

Dalam kajian ini antara faktor yang menyebabkan kontaminasi air tanah oleh bakteria akibat banjir kerana sistem sanitasi tidak baik, tiada sistem pelupusan sisa kumbahan, telaga tiub tidak cukup dalam, tiada kaedah perlindungan kualiti sumber air dan penyedutan air tanah pada kadar tinggi

4.0 Kesimpulan

Beberapara kesimpulan utama daripada kajian ini ialah:

4.1 Sumber air telaga tiub sesuai digunakan sebagai bekalan air kecemasan di waktu banjir. Bagi mengatasi kekurangan bekalan air bersih semasa banjir telaga tiub perlu dibina di kawasan penempatan mangsa banjir yang telah dikenalpasti dengan mengambil kira kuantiti bekalan air yang diperlukan. Pemantauan dari segi kualiti air perlu dilakukan secara berkala bagi mempastikan air selamat digunakan.

4.2 Bagi telaga tiub yang berada di kawasan perumahan atau perkampungan air perlu dimasak terlebih dahulu sebelum diminum bagi mengelakkan penyakit bawaaan air yang disebabkan oleh bakteria E. coli dan Salmonella.

4.3 Kandungan bahan radioaktif dan logam berat dalam sampel air telaga tiub masih mematuhi piawai DWQS Kementerian Kesihatan Malaysia kecuali kandungan Fe dan Mn yang tinggi. Walau bagaimanapun Fe dan Mn tidak memberi kesan penyakit dan hanya menurunkan kualiti aestetik air dari segi rasa dan bau.

4.4 Kajian kandungan aluminium dalam air sungai dan air telaga tiub juga dilakukan di Daerah Kuantan yang kaya dengan sumber mineral boksit mendapati tidak semua sumber air menunjukkan peningkatan logam aluminium tetapi hanya beberapa lokasi yang mengandungi aluminium tinggi dalam sampel air tanah. Ini sering berlaku di kawasan tanah gambut di mana pH air agak rendah sekitar pH 4.7 – pH 5.8 pada keadaan berasid aluminium lebih mudah terlaru membentuk ion.

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MICROBIAL ASSESMENT ON THE CONTAMINATION IN DRINKING WATER WELLS EXPOSED TO DIFFERENT DEGREES OF SUBMERGENCE DURING FLOOD

Project Information
Project Leader : Tengku Haziyamin Tengku Abdul Hamid
University : International Islamic University Malaysia
Address : Department of Biotechnology, Kulliyah of science, International Islamic University Malaysia, Jalan Istana 25200 Kuantan
Contact number : 09-5714000 ext 5041
Project Members : Dr. Azzmer Azzar Abdul Hamid (Kul. of Science, UIAM)
Dr. Noor Azlina Ibrahim (University Malaysia Kelantan. UMK)

1.0 Introduction

The frequency of flooding and the damage caused by urban flood events have increased over the past few decades. The recent unprecedented and extraordinary flooding in the several states in the East coast of Penisular Malaysia (Kelantan, Terengganu and Pahang) had caused overwhelming damage both to residential, commercial and other infrastructures. The combined flood water and sewage had resulted in potential exposure of pathogenic organisms, especially during post flood period. Following the report on faecal contamination on urban flood water after major disasters such as the severe flood in the New Orlean US, following Katrina and Rita hurricanes and other flood disasters; it is essential to develop strategy in assessing on the potential elevation in the level of fecal indicator bacteria or other pathogens in flood waters. During urban flooding, the combined sewer-flood waters is likely to be contaminated and may pose health risk. The contaminated floodwater may pose additional health risk from pathogen exposure to the victims in the affected region. In places where water supply was tremendously affected, the surface water or groundwater supplies would become an option. Municipal water supply is still low and inadequate in the most of regions in Kelantan. Due to this condition, an estimated 35% of population, especially the rural area are still rely on ground water for their daily activities (Idrus, 2014). In this study, sampling strategy based on different well submergences by flood were used in assessing the microbial contamination and physico-chemical quality during post flood period. The use of well as the source of analysis in this study is highly appropriate since; ii) wells in Kelantan are scattered throughout many regions and ii) well is considered the best ‘real time’ example available that was able to retain or preserve the characteristic of floodwater. Pre-esixting water quality and safety condition in Kelantan can be made worsen during monsoon and flooding. In addition, previous studies on water quality index along Sungai Kelantan was deteriorating due to sand mining and upstream lodging activities (Yen, 2013). Meanwhile, several series of waterborne disease outbreaks in Kelantan were correlated with poor water supply system (Isa, 1990, Ang, 2010, Malik, 2001). Therefore, information gained from this study could provide some important correlations between the extent of flood level, the well submergence and the health and safety risks exposed during post flood period. These information could be used to formulate some guidelines in developing better strategy of using well for drinking during post flood period. This could be part also of appropriate measure in implementing long term solution in alleviating post flood problem (Stephen, 2015).

2.0 Methodology

Main framework of this research work were carried out 2 main stages:

a. Sampling at designated well at effected sites within Sg. Kelantan river basin (see the map Sg. Kelantan river basin, as shown on Figure 1)
b. Physicochemical and Microbiological analysis of each of the the samples

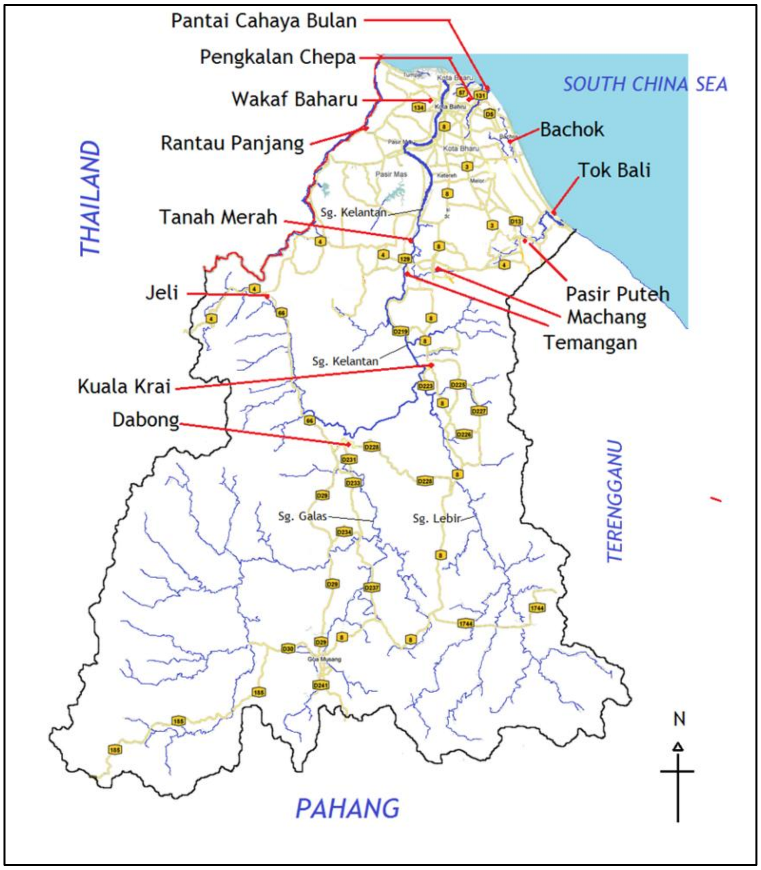

Figure 1

The domestic wells in selected populated area surrounding the Kelantan's Delta and the inner land of Sg. Kelantan basin including areas around the main tributaries (Sungai Galas and Sungai Lebir). In this study, sampling strategy based on different submerging conditions of well in Kelantan were used in assessing the degree of flood induced changes. A total of 65 wells selected from 13 station scattered around Sungai Kelantan basin and estuary regions were sampled for pH, Total Dissolved solid (TDS), Total Suspended solid (TSS) and microbial contamination (coliform count, CFU/100ml). For bacteriological analysis, the 500 ml samples were collected using sterile 1.0 L Scott bottles. For each station, the 4 to 5 samples from different but nearby wells were collected. Each well was categorized to be either submerged or unsubmerged during 2014 flood event. The bottles were tightly capped, labelled and kept on ice before being transported, as soon as possible, to laboratory at University Malaysia Kelantan (UMK) for further analysis. Microbiological analyses were conducted by measuring the total viable coliform (TVC) count (Edberg, 1988). Sample dilution and spread plate methods were used. The well water samples were serially diluted using sterile 0.85% NaCl and 100µL diluted samples were plated in triplicate on solidified MacConkey agar medium. The inoculated MacConkey agar media was incubated at 44.5ºC overnight to isolate faecal coliforms and to differentiate E. coli from other Gram-negative bacteria isolated. The average growth of coliforms in the form of colony forming units per 100 millilitre (CFU/100mL) were determined for each collected sample. Statistical non-parametric tests were carried out on independent groups to evaluate whether if the wells were significantly affected by its location in the Sg. Kelantan basin; or if it was submerged or not by the flood water.

3.0 Results and Discussion

A total of 65 wells selected from 13 station scattered around Sungai Kelantan basin and estuary regions were sampled for pH, Total Dissolved solid (TDS), Total Suspended solid (TSS) and microbial contamination (coliform count, CFU/100ml). All of the data collected from each station were averaged as shown in Table 1.

Table 1

	pH ±ΔSD	Turbidity ±ΔSD (NTU)	Conductivity± ΔSD (µS/cm)	TDS± ΔSD (mg/L)	Total Viable count ±ΔSD (x 10^4 CFU/100mL)
WAKAF BHARU	6.3±0.18	4.61±4.88	171.2±30.81	114.7±20.64	7.14±4.10
TANAH MERAH	5.5±0.65	0.34±0.09	157.4±34.24	105.5±22.94	0.45±0.63
PENGKALAN CHEPA	7.3±0.72	16.4±8.64	481±185.6	322.3±124.35	37.8±49.38
KUALA KRAI	6.8±0.12	2.1±0.22	127.2±21.43	85.2±14.36	1.7±0.88
PCB	7.3±0.15	6.8±3.94	295.8±83.43	198.2±55.9	6.6±13.1
DABONG	6.7±0.09	2.86±1.01	115.6±61.29	77.5±41.06	2.3±3.02
JELI	6.1±0.09	8.24±1.58	139±167.82	93.1±112.44	1.48±0.79
RANTAU PANJANG	6.5±0.2	3.94±0.55	84.4±10.64	56.5±7.13	10.82±16.64
TEMANGAN	7.1±0.06	2.35±0.25	126.4±10.81	84.7±7.24	4.46±0.61
PASIR PUTEH	7.4±0.06	2.39±0.37	303.2±24.93	203.1±16.71	1.23±0.32
BACHOK	6.6±0.62	3.06±1.67	279.6±114.23	187.3±76.53	0.64±0.86
TOK BALI	7.2±0.18	13.41±0.59	135.2±25.91	90.6±17.36	1.75±0. 72
MACHANG	7.4±0.11	2.04±1.22	125.4±4.88	84±3.27	7.5±2.47

Most of the samples (95%) from Kelantan's well showed positive on coliform test after flood. About 7 out of 65 samples (11.1%) showed TDS values >400µS/cm; meanwhile 19 samples (29.2%) recorded turbidity (TSS) beyond 7.0 NTU. Statistical non-parametric tests (Table 2) were carried out on independent groups to evaluate whether if the wells were significantly affected by its location in the Sg. Kelantan basin; or if it was submerged or not by the flood water. Both degree of submergence and well location have no influence on the degree of contamination. Since there were contaminations in non-submerged wells (eg. Machang, Temangan), existing pre-flood contamination could have contributed to variable trend of contamination being observed. In addition, wells exposed to different degree of submergences also showed no difference in the total dissolved solid (TDS) and total suspended solid (TSS). Interestingly, the physicochemical properties of the well water were shown to have effected by the geographical location; the TDS (at $P<0.05$) and TSS (at $P<0.01$), respectively. Well water from Sg. Kelantan estuary (Wakaf Baharu, Bachok, Pantai Cahaya Bulan, Rantau Panjang and Pengkalan Chepa) showed to have higher TDS (mean of 241.2 µS/cm ±159.5 SD) and TSS (8.04 NTU ± 6.53 SD) values compared to those from inner basin (Jeli, Tanah Merah, Kuala Krai, Pasir Puteh, Machang and Temangan) with lower mean for TDS (at 156.3 µS/cm ± 88.9 SD); and TSS (2.90 NTU ±2.46 SD).

Table 2 Summary of statistical analysis

Parameters	Analysis	N	Mean Rank	Sum of rank	Man Whitney	Z values	Asymptote (2 tails) (P-value)
Test on Estuary versus Far or Non-estuary							
TDS	Near estuary Non estuary Total	30 35 65	38.57 28.23	1157.0 988.0	358.0	-2.198	0.028
Turbidity	Near estuary Non estuary Total	30 35 65	42.53 24.83	1276.0 869.0	239.0	-3.764	0.000
CFU/100mL	Near estuary Non estuary	30 35	34.60 31.63	1038.0 1107.0	477.0	-0.632	0.527

	Total	65					
Test on Submergence versus Non Submergence							
TDS	Submerged Non submerged Total	40 25 65	31.40 35.56	1256.0 889.0	436.0	-0.863	0.388
Turbidity	Submerged Non submerged Total	40 25 65	33.49 32.22	1339.5 805.5	480.5	-0.263	0.793
CFU/100mL	Submerged Non submerged Total	40 25 65	32.03 34.56	1281.0 864.0	461.0	-0.526	0.599

Despite of the flood water was not directly resulted in changes to the well water, it could have enhanced the transmission of existing contamination that already present in the well. Even though the degree of submergence has no influence on the contamination in Kelantan's well during post flood period, the well location could still provide some information on the physicochemical quality of the well. Therefore, different well locations will be subjected to different changes and safety risk potential after flood.

4.0 Conclusions

From this work, the followings conclusions are deduced:

4.1 This is the first study using well water sample to evaluate the impact of flood in Kelantan.

4.2 In this study, the physico-chemical characteristic such as pH, turbidity, TDS and Total coliform count on the water 65 well water samples from 13 stations of locations in Kelantan wells were evaluated.

4.3 In terms of coliform CFU/100mL, most of the wells showed violation of microbiological safety limit for drinking purpose.

4.4 There was no significant correlation between microbiological contaminations with wells subjected to different degrees of flood water submergence; or well location along Sg. Kelantan. Other physico-chemical parameters such TDS and turbidity were also unaffected by flood submergence.

4.5 Even though, the extent of flood water submergence may not directly contribute to well contamination, pre-flood (existing) contamination seemed to have played essential roles in the distribution of contaminations observed during post flood period.

4.6 Flood may not directly the major causes of well water contamination since most of wel contamination were inherited before flood due to existing contamination.

4.7 Physico-chemical characteristic such as TDS and turbidity in the well were significantly affected as we moved from inner basin to the densely populated Kelantan delta. The well's TDS and turbidity values increased in the direction of flood flows and it could have exacerbated the transmission of existing contamination upon reaching the densely populated region.

4.8 Physical and geographical location of well could determine the physico-chemical properties of the well, and these inherently resulted in differential safety risk related to biological quality and safety of the well water following flood.

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MEMBANGUNKAN RANGKA KERJA TAKAFUL HARTA UNTUK KELESTARIAN PKS

Project Information

Project Leader	: Prof. Dr. Mohamed Dahlan Ibrahim
University	: Universiti Malaysia Kelantan
Address	: Karung Berkunci 36, Pengkalan Chepa 16100 Kota Bharu Kelantan
Contact number	: 019-9831519
Email	: cenordin@usm.my
Project Members	: Dr. Fauzilah Salleh (UNISZA) En. Razman Hafifi Haji Redzuan (UMK)

1.0 Pengenalan

Malaysia telah dilanda musibah banjir besar khususnya di negeri pantai timur semenanjung, Kelantan pada akhir tahun 2014. Dalam kejadian ini, hampir 70 peratus pelaburan PKS dalam bentuk peralatan, mesin, inventori dan stok barangan siap musnah sama sekali. Tidakkah ada satu skim perlindungan takaful yang komprehensif yang dapat melindungi harta PKS daripada bencana seperti banjir?. Perlindungan kepada risiko banjir menjadi satu isu nasional kerana skim takaful/insurans yang sedia ada hanya melindungi peril asas iaitu kebakaran dan peril banjir hanya dijadikan pilihan untuk dimasukan bersama polisi kebakaran. Oleh itu, pelan pengurusan risiko perlu dikaji semula untuk memberi gambaran yang jelas kepada pemilik PKS dan penggubal dasar pengurusan risiko korporat.

Musibah banjir yang menimpa PKS adalah salah satu faktor persekitaran yang di luar kawalan mereka di mana menyebabkan operasi kebanyakan daripada mereka terjejas teruk. Justeru, kajian ini mengambil inisiatif untuk merangka satu rangka kerja baru skim takaful harta yang komprehensif bagi tujuan melindungi aset PKS apabila berlakunya musibah banjir. Di samping itu, kajian ini juga penting melihat kesesuaian skim takaful tersebut ini dikenakan secara mandatori kepada PKS semasa mereka memperbaharui pendaftaran perniagaan masing-masing. Akhir sekali, kajian ini juga penting dalam mendapatkan maklumbalas daripada tiga pihak terlibat iaitu PKS, pengendali Takaful dan agensi yang mempunyai kaitan secara langsung dengan pembangunan PKS seperti SMECorp, SSM dan KPDNKK terhadap cadangan untuk membangunkan kerangka Skim Perlindungan Harta khusus kepada PKS (SME-ART©).

2.0 Metodologi

Kajian ini menggunakan Teori Prospek *(Prospect Theory)* dimana teori ini menerangkan kaedah individu memilih antara alternatif kebarangkalian yang melibatkan risiko, di mana kebarangkalian hasil diketahui (Kahneman & Tversky, 1979). Teori ini adalah model membuat keputusan di bawah risiko. Bidang kewangan dan insurans adalah antara yang ketara boleh dilihat mengaplikasikan teori ini di mana sikap terhadap risiko memainkan peranan utama (Barberis, 2013). Manakala rekabentuk kajian ini menggunakan kaedah penyelidikan bercampur (mixed mode) iaitu kaedah kualitatif dan kuantitatif. Dalam kaedah kualitatif pihak penyelidik memberi tumpuan kepada kajian kes dan perbincangan kumpulan fokus. Sebanyak lapan kes yang terdiri daripada usahawan-usahawan PKS yang terlibat dengan banjir besar di Kelantan telah digunakan dalam kajian ini. Kajian ini menggunakan kajian kes penerokaan yang bertujuan untuk menentukan persoalan kajian dan untuk menentukan kebolehlaksanaan kajian. Merujuk kepada Yin (2003), reka bentuk kajian yang sesuai bagi kajian ini adalah mengunakan kaedah pengajian berbilang (*Multiple case design*) dengan unit holistik, di mana lapan (8) orang responden daripada jumlah mangsa banjir adalah lapan unit holistik analisis dan setiap kes menyumbang kepada keseluruhan skop kajian. Dalam kajian kes berbilang, di mana beberapa keadaan individu disiasat, mungkin sangat kuat dan berhasil kerana kemampuan untuk membanding dan penemuan.

Populasi kajian terdiri daripada mangsa banjir PKS di Kelantan pada tahun 2014. Saiz sampel kajian kualitatif adalah kecil, tetapi ia memberikan maklumat yang banyak daripada komen-komen daripada responden. Kajian ini menggunakan reka bentuk pensampelan berkebarangkalian untuk menjalankan keseluruhan penyelidikan. Dalam kajian ini, pensampelan penghakiman telah dipilih sebagai jenis persampelan bertujuan. Terdapat seramai 8 orang daripda 10 responden yang terdiri daripada pemilik syarikat PKS di Wakaf Che Yeh dan Kota Bharu yang menjadi mangsa banjir 2014 di Kelantan telah memberi kerjasama untuk mengambil bahagian dalam kajian ini. Di samping itu, kajian ini melibatkan lawatan tapak kerana ia menyediakan pemahaman yang lebih baik mengenai operasi syarikat dan penyelidik perlu membuat beberapa pemerhatian mengenai perkara-perkara berikut (i) bagaimana teratur dan lancar operasi berjalan, (ii) apakah suasana sebagainya - terutamanya jika penyelidik boleh mendapat peluang untuk bercakap dengan orang yang mereka ini pergi sekitar dan (iii) keadaan benda (sifat iaitu rosak, tahap kerugian) (Yin, 2009).

Kajian ini juga telah menggunakan kaedah perbincangan kumpulan fokus atau lebih dikenali sebagai FGD (focused group discussion) untuk mendapatkan input serta pandangan setiap peserta kepada beberapa persoalan yang berkaitan dengan kerangka skim takaful yang dicadangkan oleh penyelidik serta kaedah pelaksanaan yang berkesan. Sebanyak dua pusingan FGD telah dilaksanakan iaitu pada 4hb Ogos 2015 bertempat di ibu pejabat MTA dan 12hb November 2015 bertempat di Hotel Seri Pacific, PWTC. Sesi FRG melibatkan peserta yang mewakili Malaysia Takaful Association (MTA), SSM, Persatuan PKS, KPDNKK, PIAM, Bank SME dan BNM. Sesi FGD dirakam dan teknik digunakan untuk sesi kumpulan fokus kajian ini mengikuti garis panduan oleh Kruger dan Casey (2000).

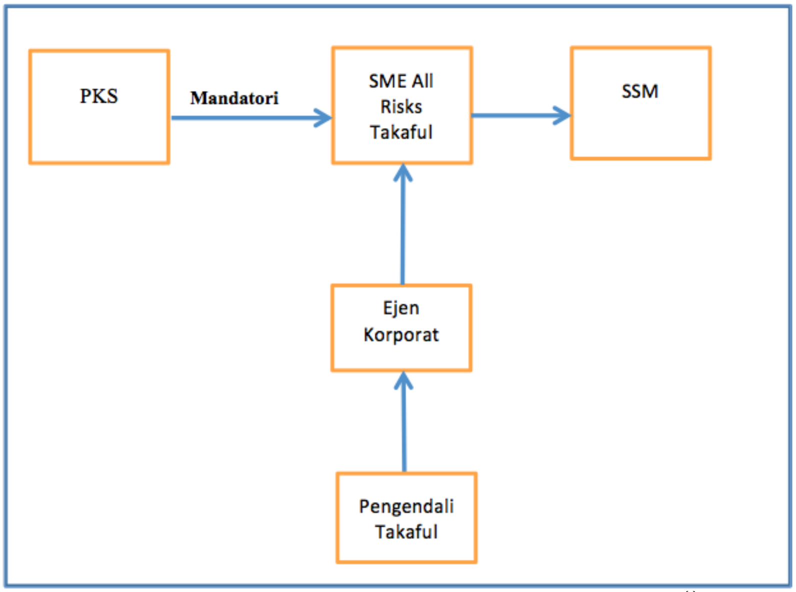
Kajian ini menggunakan satu proses temu bual separa berstruktur dalam Bahasa Melayu, pemerhatian bukan-penyertaan dan analisis dokumen, di mana penyelidik adalah instrumen utama bagi pengumpulan data (Merriam, 1998). Dalam kajian ini, analisis dokumen yang digunakan seperti data penduduk dari SME Corp, SSM, polisi insurans hartanah semasa dari pengendali Takaful dan peta bahaya dari JPS serta maklumat banjir daripada MKN. Dalam kajian ini, analisis kandungan akan dipilih sebagai analisis data bagai membolehkan penyelidik mengkaji artifak komunikasi sosial. Data daripada perbincangan kumpulan fokus telah dianalisis menggunakan ATLAS.ti 7.

Kajian ini juga menggunakan kaedah kuantitatif bagi mengukuhkan dapatan kajian, di mana kerja lapangan telah dilaksanakan dengan mengedarkan borang soalselidik kepada responden yang telah dikenalpasti. Sampel kajian dipilih dengan menggunakan persampelan mudah. Wawancara dijalankan oleh tiga penyelidik untuk memastikan seramai 251 PKS responden menjawab soalan-soalan dengan tepat. Untuk mengenal pasti jumlah kerugian yang dialami oleh PKS di seluruh negeri Kelantan, kajian ini dijalankan di tujuh (7) jajahan termasuk jajahan Kota Bharu, Pasir Mas, Tumpat, Tanah Merah, Gua Musang, Rantau Panjang dan Kuala Krai. Instrumen kajian yang digunakan dalam kajian ini ialah soal selidik yang bertanyakan jumlah kerosakan atau kehilangan harta perniagaan yang dihadapi semasa banjir berlaku. Kaedah ini adalah sesuai dan mudah untuk disoal siasat, mengurangkan wawancara berat sebelah, menjadikannya lebih cepat untuk ditadbir, dan mudah untuk dijawab oleh responden.

3.0 Dapatan Kajian

Konsep perlindungan sedia ada ini sangat membebankan PKS dengan nilai premium yang lebih tinggi, mengakibatkan skim ini menjadi kurang menarik ditambah pula dengan bukti kadar penembusan yang rendah. Kajian ini juga mendapati PKS menghadapi risiko kerugian yang besar apabila banjir melanda kawasan perniagaan mereka. Dari hasil kajian kuantitatif yang dijalankan, dari jumlah 251 PKS di seluruh negeri Kelantan, penyelidik mendapati 88.5% mengalami kerugian kurang daripada RM30,000 dan hanya 2.4% mengalami kerugian melebihi RM100,000. Kajian ini juga telah mendapati kerugian yang ditanggung oleh PKS ialah dari segi kerosakan bangunan, perkakasan, stok bahan mentah, dan stok barangan. Kerosakan kepada premis perniagaan tidak ditanggung secara langsung oleh PKS memandangkan premis yang digunakan bagi operasi perniagaan adalah premis yang kebanyakannya disewa.

Sehubungan dengan itu, kajian ini juga telah berjaya membentuk satu produk perlindungan asas kepada PKS hasil daripada perbincangan bersama 5 orang ahli Persatuan Takaful Malaysia (MTA) yang dihadiri oleh Ketua Pegawai Eksekutif MTA, eksekutif MTA, wakil STMB serta ahli-ahli penyelidik, produk baru tersebut diberi nama tentatif ‘SME All Risk Takaful (SME-ART©). (Rujuk rajah 3.1). Berhubung dengan kaedah perlaksanaan SME-ART©, satu lagi perjumpaan dengan pihak Focus Group Discussion (FGD) yang terdiri daripada wakil Kementerian Perdagangan Dalam Negeri, Koperasi dan Kepenggunaan (KPDNKK), Suruhanjaya Syarikat Malaysia (SSM), Bank Negara Malaysia, Persatuan Insurans Am Malaysia, SME Corporation, SME Bank, Malaysian Takaful Association, Pengendali Takaful di Malaysia telah diadakan dalam membangunkan prosedur operasi perlaksanaan skim ini. Pihak yang berkenaan yang hadir secara dasarnya bersetuju dengan pelan skim ini, dan memohon kajian lanjutan dapat dijalankan dalam menentukan kadar minimum premium takaful. Perlaksanaan di pihak kabinet juga amat perlu kerana ia melibatkan akta serta polisi pendaftaran.



Rajah 1: Cadangan Kerangka Perlaksanaan SME-ART©

4.0 Kesimpulan

Konsep perlindungan sedia ada ini sangat membebankan PKS dengan nilai premium yang lebih tinggi, mengakibatkan skim ini menjadi kurang menarik ditambah pula dengan bukti kadar penembusan yang rendah. Dalam kajian ini, seramai 251 responden PKS menunjukkan 88.5 peratus PKS mengalami kerugian kurang daripada RM30,000 manakala 2.4 peratus mengalami kerugian melebihi RM100,000. Untuk mengurangkan kesan musibah banjir kepada pihak PKS, para penyelidik telah merangka Skim Takaful Harta (SME-ART©) untuk memberi perlindungan kepada aset PKS sekiranya berlaku bencana alam seperti banjir. Secara dasarnya pihak takaful bersetuju dengan rangka kerja skim yang dicadangkan untuk diangkat ke peringkat yang lebih tinggi bagi membantu pihak PKS dimasa hadapan jika menghadapi bencana banjir.

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DEVELOPMENT OF A DISASTER ACTION PLAN FOR HOSPITALS IN MALAYSIA PERTAINING TO CRITICAL ENGINEERING INFRASTRUCTURE RISK ANALYSIS

Project Information

Project Leader	: Rimfiel Janius
University	: Universiti Putra Malaysia
Address	: Fakulti Kejuruteraan, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor
Contact number	: 03-89466418
Email	: janius@upm.edu.my
Project Members	: Khalina Abdan Zairul Ain Zulkaflli

1.0 Introduction

During a disaster event, hospitals are expected to operate efficiently and continuously in order to provide medical treatment to injured patients. Medical care can be affected if hospitals face insufficient support of critical engineering infrastructures (CEI) such as electricity, water supply, medical gas and access to road transportation networks. However, electricity and water supply are more vulnerable as, when affected, they will escalate other potential threats. Therefore, this study focuses on the importance of electricity and water supply only as CEI in hospitals.

According to the Ministry of Health (MOH), Malaysia (2015), as of 31 December 2014, there are 142 numbers of government hospitals in Malaysia with 40,260 official beds and 184 numbers of private hospitals with 13,038 official beds. In striving to provide better services to the community, the MOH faces the challenges of rapid increment of patient admissions to hospitals as well as changing trends in disease patterns. A total 2.4 million patient were admitted in government hospitals while another 20 million were outpatient attendees in the year of 2014 (Ministry of Health Malaysia, 2015). This large numbers has resulted in hospitals having to be better equipped and always ready to provide continual services especially during disasters.

Therefore, the development of a comprehensive hospital disaster action plan (DAP) specifically for CEI is proposed in this study. This is in line with the campaign of making hospitals safe during emergencies or disasters, which was initiated by the World Health Organization (WHO) on World Health Day 2009, by highlighting how health facilities and their services are crucial to the community in times of disasters. Hospitals are critical assets of communities both routinely and during emergencies, disasters and other crises. Destruction or damage to a hospital may result in a loss of trust in the local authorities, especially government agencies, as well as exposing patients and health workers to further vulnerabilities.

This study focuses on the importance of electricity and water supply as critical engineering infrastructures in hospitals. These two elements are vulnerable during disasters and when affected, will escalate other potential threats. The area of study comprises the states of Kelantan and Selangor which, respectively, are prone to floods and socio-technical disasters, and have high numbers of water and electricity supply interruptions. The outcome of this study is a comprehensive hospital disaster action plan for water and electricity supply. It is hoped that this action plan will be able to assist the Ministry of Health in developing the National Guideline on Sustainable Hospital during Disaster whose objective is the ensuring of the continuous functioning and availability of CEI during disaster periods. The main aim of this study is to evaluate the extent of planning and preparedness of disaster management teams in terms of hospital DAPs. The specific objectives are: i) to identify and analyse threats to water and electricity supplies, the threats being of high tendency to be realised during floods and socio-technical disasters; and ii) to review existing disaster action plans and subsequently develop a comprehensive one for water and electricity supplies and to be referred together with existing hospital DAPs.

2.0 Methodology

This is an explorative study involving five (5) government hospitals which mainly represent state and major specialist hospitals. The selection of these 5 out of 142 government hospitals in Malaysia is based on the criteria that the hospital must have had experienced flooding in any condition and frequency. The approach of the study consists of four steps, further described in subsequent sections: (i) identification of potential threats in electricity and water supply during a disaster event; (ii) collection of data through a standard questionnaire survey; (iii) evaluation of risk for identified threats; (iv) review existing disaster action plan of various hospitals.

2.1 Identification of potential threats to electricity and water supply during disaster event

The method used in identifying the potential threats of CEI can be demonstrated from the bow-tie diagram of Figure , which illustrates the causes and consequences of unwanted (extraordinary) events as a basis for the risk analysis (Kjølle et al., 2012). The left side of the diagram represents causes to the hazardous event, and the right side represents the consequences of the event. Based on the consequences, risk can be revealed and disaster action can be planned. In this paper, the consequences of cascading failures were investigated and listed, with a focus on power outages and disruption of water supply system. Besides that, fieldwork observation and interview sessions with related hospital and concession company personnel were conducted to identify the possible threats and hazards on electricity and water supply during a disaster event.

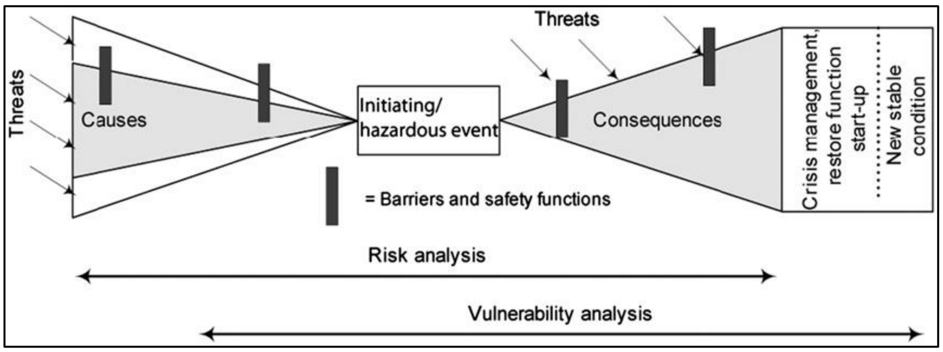

Figure 1: Risk and vulnerability analysis in a bow-tie diagram. Source: (Kjølle et al., 2012)

2.2 Collection of data through a standard questionnaire survey

Following the identification of threats described in section 2.1, a questionnaire was designed to obtain detailed information regarding flood disaster and risk assessment on electricity and water supply. There was a total of 58 questions in five sections: Part A - respondent background (four questions); Part B – flood situation in hospital (ten questions); Part C – impact to hospital during flood disaster (six questions); Part D – risk assessment on critical engineering infrastructure (eight questions) and Part E – detailed risk assessment on CEI specifically for technical personnel who was involved in engineering system (thirty questions). Multiple-choice item was used in questions for Part A, B and C based on the respondent's observation and experience in the hospital. In Part D and E, respondents evaluated the risk of CEI by using a Likert Scale, ranked from 1 to 5, for the consequences and the frequency of threats identified in each question as per Table 2.

Sampling method used in conducting the questionnaires was cluster sampling. This is due to the wide area of the studied population such that simple random sampling would be difficult to implement. Five hospitals were chosen randomly out of the 142 hospitals in Malaysia, and for each hospital selected, eighty respondents were chosen through simple random sampling. Since the simple random sampling was done twice, this sampling method is known as a two tier cluster sampling (Chua, 2011). The sampling size of eighty respondents from each hospital was determined based on Krejcie and Morgan (1970) table, where the total numbers of hospital staff in five hospitals involved were 12,846. With that, a total of 400 respondents were involved in the survey, consisting of hospital director, hospital engineers, charge man, doctors, nurses, administration personnel and technical personnel from engineering field. All data were analysed based on 400 respondents in five hospitals, namely, Raja Perempuan Zainab II, Kota Bharu Hospital (HKB), Kuala Krai Hospital (HKK), Kajang Hospital (HKJ), Serdang Hospital (HSG) and Tengku Ampuan Rahimah, Klang Hospital (HAR). The respondents consist of 79% from government servants and 20% from concession companies. From these figures, 17% were involved in engineering field, 28% from administration department, 7% from various fieldwork and 46% were from medical background. Of the total respondents, 58% have working experiences in their respective hospitals of more than 5 years.

Table 2: Likert Scale used in questionnaires survey for risk evaluation

Likert Scale	1	2	3	4	5
Consequences	Minor: No interruption	Moderate: Medical services was temporarily interrupted, all departments are still operating	Serious: Only a few departments operate	Critical: Patient evacuated & transferred to other hospitals, only outpatient department still operating	Catastrophic: Hospital shutdown, unable to operate and delivered services
Frequency	No case happen	1 case happen in 5 to 10 years	1 case happen in 1 to 5 years	1 case happen in 6 months to 1 year	1 case happen in 0 to 6 months

2.3 Evaluation of risk for identified threats

Risk assessment is a process in which judgements are made, after an undesirable event occurs, on the frequency of the identified threats and their consequences on the operability of the hospital in delivering medical services. An example calculation of risk is shown in Table 3 below.

Table 3: Risk analysis and evaluation of the identified threats

Threats on hospital critical engineering infrastructure (T)	Frequency (F)	Severity (S)	Calculation of Risk $R_h = F \times S$	Risk (R)
T1	2 (1 case happen in 5 to 10 years)	3 (Serious)	$R_h = 2 \times 3 = 6$	6
T2	2 (1 case happen in 5 to 10 years)	2 (Moderate)	$R_h = 2 \times 2 = 4$	4

T represents the identified threats and h is the name of the hospital. Risk is calculated as $R_h = F \times S$, where R is risk, F the frequency of the identified threat after an unwanted event occurs, S the severity of the consequence of the threat to the operability of the hospital in delivering medical services. Frequency, severity and risk are tabulated in a risk matrix as shown in Table 4.

Table 4: Risk matrix

		Severity				
		1	**2**	**3**	**4**	**5**
Frequency	**5**	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

Four categories of risk were adopted: low risk (risk values of 1 to 2), medium risk (risk values of 3 to 4), high risk (risk values of 5 to 10) and very high risk (risk values of 11 to 25). A risk identified as low may be considered as acceptable but further reduction is necessary to ensure the resilience of healthcare facilities. A medium risk requires a planned approach to controlling the threats and an application of a temporary measure if required. High and very high risks are unacceptable and immediate actions to control the threats are required.

2.4 Review of existing DAPs of various hospitals

The hospital disaster action plans of a few hospitals involved in the study have been reviewed thoroughly. From the readings, the current DAPs do not explain the procedure on how to respond to power outage and water supply disruption. Therefore, to develop a comprehensive DAP for CEI, a summary of the highest risk level for a particular threats and how to respond to it during a disaster was drawn. The control of each threat was compiled in a procedure format of networking framework.

3.0 Results and Discussion

3.1 Threats to water and electricity supply caused by flood disaster

There are seven (7) potential threats related to electricity supply and four (4) to water supply that made the electricity and water supply systems vulnerable during flood events. The water supply system consists of water sources (generally from dams or reservoirs), water treatment plants and water reticulation facilities, before entering the internal water system of a hospital. Along this supply line, there are points with potential flooding and some components of the system could be submerged. In Kelantan, 38% of the respondents have experienced floods with a maximum coverage of more than three quarters of the hospital area under water. Apart from being submerged, subsequent threats can develop from the flood event whereby the internal electricity system is highly short circuited and causes intermittent power supply.

A major threat to electricity supply is the malfunction of generators. Although all hospitals in Malaysia have been equipped with alternative electricity supply system which increases their resilience and secures the continuity of medical services, they could still be flooded due to location factor. Most of the CEI in these five hospitals have been designed and built at the lowest ground floor. Generators can also stop functioning during a flood event if diesel fuel is inadequate and flooded road network surrounding the hospital area prevents the delivery of fuel supply. The summary of potential threats to hospital CEI during flood disaster is shown in Table 5.

Table 5: Potential threats to hospital critical engineering infrastructure during flood disaster

Threats category	Threats to hospital critical engineering infrastructure
Submergence	Power outage due to TNB substation (outside hospital compound) being submerged
	Power outage due to TNB substation (inside hospital compound) being submerged
	Power outage due to hospital's main switch board being submerged
	Generator malfunction due to being submerged
	Water shortage due to water treatment plant being submerged
	Water shortage due to hospital's water pump room being submerged
Technical failure	Power supply disruption due to short circuit
	Generator malfunction due to mechanical failure but not submerged
	Water shortage due to damage to hospital's main water tank
Unpreparedness	Generator malfunction due to inadequate diesel supply
Unexpected event	Water shortage due to power outage

3.2 Threats to water and electricity supply caused by socio-technical disaster

There are eight (8) potential threats to electricity supply and five (5) to water supply system that made these systems vulnerable during a socio-technical disaster. Wide area blackout or outage is possible if any point in the electricity supply system malfunctions. Major blackout incidents are rare, and no two incidents are the same. The events leading to the incident vary, among others are human actions or inactions, system topology, load or generation balances, power system characteristics and status and capability of protective devices. Most of the threats identified were caused by maintenance-related issues such as component breakdown and aging of asset which can inflict subsequent major damage such as substation failure, transformer explosion or service cable damage. Internal electricity supply system in hospital can lead catastrophic impact too. Although the backup system is designed to be automatically triggered whenever power supply fails, it can have possibilities of inoperability due to mechanical failures or diesel shortage.

Water crisis and shortage resulting in the interruption of treated water supply were due to a few reasons such as prolonged drought causing a decrease in river flows accompanied by a decrease in the reservoir level. The end result is a shortfall in supply and water has to be rationed, affecting also the hospital existing supply. Another factor than can cause shortage is low river flows as to be insufficient to dilute pollution loads leading to increased incidents of river pollution to levels that exceed the threshold of treatment. This results in closure of water treatment plants that obtain raw water from the river intake. Water loss due to leakages and blockages in the distribution systems and pilferages are also factors. A summary of potential threats to hospital CEI caused by socio-technical disaster is shown in Table 6.

Table 6: Potential threats to hospital critical engineering infrastructure caused by socio-technical disaster

Threats category	Threats to hospital critical engineering infrastructure
Technical failure	Power outage due to TNB substation (outside hospital compound) breakdown
	Power outage due to TNB substation (inside hospital compound) breakdown
	Power outage due to hospital's main switch board breakdown
	Power supply disruption due to short circuit
	Power supply disruption due to wiring wear and tear
	Generator malfunction due to mechanical failure
	Intermittent water shortage due to piping leakage
Unpreparedness	Generator malfunction due to inadequate diesel supply
	Intermittent water shortage due to piping blockage
	Water shortage due to maintenance work
Unexpected event	Power supply disruption due to lightning strike
	Water shortage due to drought season
	Water shortage due to closing of water treatment plant as a result of water source contamination

3.3 Risk analysis on critical engineering infrastructure

All risks of identified threats in the five hospitals were analysed as discussed in Section 2.3 above. Table 7 shows that in HKB and HKK, electricity and water supply face high risk during flood disaster due to yearly frequent event. However, HSG, HKJ and HAR face low risk due to the rare occurrence of flood disaster, but the impact to healthcare services is high. Table 8 summarizes the risk analysis on water and electricity supply caused by socio-technical disasters. Again, HKK and HKB demonstrate high risk and while HKJ falls in medium risk. Threats on power disturbance due to short circuit and intermittent water supply due to maintenance work were in medium risk for HAR, HKJ and HSG. Both HKJ and HSG were in medium risk for the drought season threats.

Table 7: Risk analysis on water and electricity supply during flood disaster

Threats	Risk Analysis and category				
	HKB	HKK	HAR	HKJ	HSG
Power outage due to TNB substation (outside hospital compound) being submerged	High	High	Medium	Low	Low
Power outage due to TNB substation (inside hospital compound) being submerged	High	High	Low	Low	Low
Power outage due to hospital's main switch board being submerged	High	High	Low	Low	Low
Power supply disruption due to short circuit	High	High	Medium	Medium	Low
Generator malfunction due to being submerged	High	High	Low	Low	Low
Generator malfunction due to mechanical failure but not submerged	High	High	Low	Medium	Low
Generator malfunction due to inadequate diesel supply	High	High	Medium	Low	Low
Water shortage due to power outage	High	High	Low	Medium	Low
Water shortage due to water treatment plant being submerged	High	High	Low	Low	Low
Water shortage due to hospital's water pump room being submerged	High	High	Low	Medium	Low
Water shortage due to damages to hospital's main water tank	High	High	Low	Low	Low

Table 8: Risk analysis on water and electricity supply caused by socio-technical event

Threats	Risk Analysis and category				
	HKB	**HKK**	**HAR**	**HKJ**	**HSG**
Power outage due to TNB substation (outside hospital compound) breakdown	High	High	Medium	Medium	Low
Power outage due to TNB substation (inside hospital compound) breakdown	High	High	Medium	Medium	Low
Power outage due to hospital's main switch board breakdown	High	High	Medium	Medium	Low
Power supply disruption due to short circuit	High	High	Medium	Medium	Medium
Power supply disruption due to lightning strike	High	High	Medium	Medium	Low
Power supply disruption due to wiring wear and tear	High	High	Medium	Medium	Low
Generator malfunction due to mechanical failure	High	High	Low	Medium	Low
Generator malfunction due to inadequate diesel supply	High	High	Low	Medium	Low
Intermittent water shortage due to piping leakage	High	High	Low	Medium	Low
Intermittent water shortage due to piping blockage	High	High	Low	Medium	Low
Water shortage due to drought season	High	High	Low	Medium	Medium
Water shortage due to closing of water treatment plant as a result of water source contamination	High	High	Low	Medium	Low
Water shortage due to maintenance work	High	High	Medium	Medium	Medium

3.4 Observation from DAP reviewed

There is a lack of integration and coordination between the CEI management team (i.e. the concession authorities) and the hospital management team in current hospital DAP documents. It is therefore suggested that communication and information between them be interactive in regular disaster management meetings conducted on monthly basis. Water and electricity supply need the full support of the utility provider in order to function continuously.

4.0 Conclusion

Important findings of the study are summarized as follows:

4.1 Hospital water and electricity supply are threatened during a disaster and faces high risk of failure. Enhancement of existing DAP to include CEI management will provide better respond, control and coordination in any cases of disaster.

4.2 Networking between state health department, hospital management and utility providers should be embedded in a new DAP design to enhance coordination and response during and after disaster.

4.3 A comprehensive DAP is much needed for hospitals, must be published and is crucial to be utilized in order to save lives, reduce losses and establish hospital resilience. This document will be produced in another article and distributed to all hospitals involved.

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A MODEL TO DETERMINE THE DEGREE OF HOUSING DAMAGE FOR A FLOOD AFFECTED AREA IN KUALA KRAI, KELANTAN

Project Information

Project Leader	: Thuraiya Mohd (PhD)
University	: Universiti Teknologi MARA, Kampus Seri Iskandar (Perak)
Address	: Hal Ehwal Akademik, UiTM Perak, 32610, Bandar Seri Iskanda, Perak
Contact number	: 05 3742811, 0135331535
Project Members	: Tajul Edrus Nordin, Dzulkarnaen Ismail Siti Fairuz Che Pin, Mohd Nasurudin Hasbullah

1.0 Introduction

Flood is the most frequent disaster in Malaysia that causes damage to properties, possessions and infrastructures (Chan, 1996). December 2014 was the worst flood ever happened in Kelantan. After a flood disaster, there is often a tally of preliminary damage assessment to assess the damage sustained at the flood affected areas. There are many guidelines for assessing the degree of building damage prepared by different countries like United Kingdom, United State of America, Pakistan, Japan, Indonesia and et cetera. However, different countries are likely to have different construction methods, materials used and the nature of the disaster. Thus, a general assessment from other countries that determines the extent of flood hit houses seems irrelevant for Malaysia context. Moreover, in Malaysia, there is no standardized damage assessment used by the authorities or relevant agencies in assessing the degree of housing damage after disasters. As a result, errors in assessing the degree of housing damage and providing inaccurate type of assistance may occur. Thus, this research emphasis on the understanding the degree of houses damage and recommends significant input in developing the damage assessment framework in Malaysia. The objectives to achieve the research aims are to develop a housing damage assessment model, to design a damage housing assessment form and to identify the degree of housing damage according to the model.

2.0 Methodology

This research encompasses both descriptive and exploratory methods. To achieve objective 1, a self-developed model that is derived from literature review, case study observation (Kuala Krai), survey by using questionnaires instrument and focus group. From the review on eight (8) models of house damage assessment from different countries, the attributes of degree of damage and the description of damage were sorted in a matrix table form and the frequencies were recorded. The model was later formed after the observation of the affected houses at the case study area. The purpose of the observation are to see the actual conditions of the affected houses and to suit the building types, nature of flood and building structures in Malaysia, especially in Kuala Krai. After that, questionnaires were distributed to 50 respondents consist of engineers (n=10), architects (n=10), quantity surveyors (n=10), real estate valuers (n=10) and building surveyor (n=10) by using purposive sampling to gauge their perceptions on attributes of degree of housing damage and eventually conducting a focus group consist of ten (10) technical experts involved in MERCY Malaysia in assessing the housing damage for model validation. Confirmatory Factor Analysis (CFA) was used to analyse the relationship between the degree of housing damage and the descriptions of the damage developed in the model. Initially, the factorability of the eight (8) attributes of degrees' of housing damage was examined using Kaiser-Meyer-Olkin (KMO) and Bartlett's test.

To achieve objective 2, a structured observation instrument form to assess the degree of damage for post flood residential areas was designed from review of ten (10) expertise views involved in MERCY Malaysia for form validation purpose.

For objective 3, survey observation and informal interviews were conducted at case study area that is the worst flood disaster area along the Sungai Krai that includes Jalan Geale B, Geale C, Geale C2, Geale C3, Geale C4 and Geale D, which is located in the District of Tualang territories. The affected area involved 23 units of the affected houses. While the informal interviews were conducted with the owners or households of the affected house and the respondents were selected based on the convenience sampling technique. The data collected was tabulated into percentages and frequency distribution for univariate analysis.

3.0 Results and Discussion

Based on the eight (8) reviews of the attributes model, and with a comprehensive summary based on the feedback from experts, the frequency of the degree of housing damage attributes and building structure in the Malaysian context, the model of degree of housing damage for flood affected area is as follows:

Table1: The degree of housing damage for flood affected areas after model validation.

Degree of Damage	Description of Damage	Attributes of Damage
Minor	Slight damage to building structure, can be occupied within a short period of time after minor repairs.	Minor damage in partitions, infills and ceilings
		Minor damage to doors and windows
Major	The building has sustained structural or significant damages, inhabitable after extensive repairs.	Substantial failure of walls, floors, foundation or roof.
		Utilities damaged (Electrical, Surface water drainage, Sewerage reticulation system, Water reticulation)
Destroyed	The building structure is permanently uninhabitable and requires demolition.	The building structure is a total loss.

[Source: Researchers' Study, 2015]

Based on the review of literature and significant feedback from the technical experts, the design and construction of this form, the suggested Housing Damage Assessment Form after form validation is provided in Figure 1.

HOUSING DAMAGE ASSESSMENT FORM

Please tick (√) in the appropriate box or state where necessary.

Inspection date:		Form Serial No:
Surveyed by:	☐ Individual ☐ Team	
Name:		
Local guide:		

1. INCIDENT DETAILS

Disaster Type:			
State:		Longitude:	
District:		Latitude:	
Village:		Elevation:	

2. RESPONDENT DETAILS

Name:		National I.D:	
Gender:	☐ Male ☐ Female	Age:	
Status:	☐ Single ☐ Married	Occupation:	
Contact no.		No. of Household:	

Household Details:

No.	Name	Relationship	Gender	Age
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

3. LAND DETAILS

House Status:	☐ Owned	☐ Rented	Copy of land title:	☐ Obtained	☐ Not Obtained
Ownership:	☐ Single	☐ Multiple	☐ Rental	☐ Corporate	☐ Government

Space availability for temporary shelter:	☐ Yes	☐ No	
Damage category:	☐ Destroyed ☐ Major	☐ Minor	☐ No damage
Contact person name and no. (Owner / Head Village):			

4. DAMAGE ASSESSMENT

Degree of Damage	Description of Damage	Attributes of Damage		Recommendation	
Minor	Slight damage to building structure, can be occupied within a short period after minor reparation.	☐	Minor damage in partitions, infills and ceilings	☐	Immediate action for assistance
		☐	Minor damage to door and windows	☐	Habitable after minor repairs less
Major	The building has sustained structural or significant damages, inhabitable and requires extensive repairs.	☐	Substantial failure of walls, floors, foundation or roof.	☐	Urgent for assistance
		☐	Utilities damaged (Electrical, Surface water drainage,	☐	Habitable after extensive repairs
Destroyed	The building experiences total loss or has completely destroyed.	☐	Unsafe for occupancy	☐	Very urgent for assistance
				☐	Require new house

5. SKETCH OF DAMAGE AND LOCATION

6. PHOTO

7. FOR OFFICE USE ONLY

Surveyed by:		Verified by Head of Village:	
Name:		Name:	
Checked by:		Approved by:	

Figure 1: Housing Damage Assessment Form

The assessment form was used to identify the degree of housing damage at the selected area and the result is tabulated as below.

Table 2: Summary of Housing Damage Degree

Affected Area	Number of houses/ Damage Scale				
	No Damage	**Minor**	**Major**	**Destroyed**	**Total of houses**
Jalan Geale B	17	10	10	14	**51**
Jalan Geale C	0	5	7	15	**27**
Jalan Geale C2	3	10	9	9	**31**
Jalan Geale C3	6	8	1	5	**20**
Jalan Geale C4	15	18	18	3	**54**
Jalan Geale D	26	10	1	3	**40**
Total	**67(30%)**	**61(27%)**	**46(21%)**	**49(22%)**	**223**

4.0 Conclusion

This research presents a model to determine the degree of housing damage for flood affected area and the housing damage assessment form. The model helps for estimation of degree of damages due to flood event in Malaysia. The framework assures that no type of damage is counted more than once. In addition, individual property surveys must be undertaken to provide details information for record or administrative purposes (tenure of property and damage category) and for technical purposes (type of construction and materials, details of damage, reinstatement steps). This information is best recorded on a standardized survey form to ensure consistency and completeness of the information collected. The Housing Damage Assessment Form will be give an edge to the government, local authorities, NGOs, MERCY, insurers or other appropriate bodies involved in assessing or evaluating the condition of houses affected by floods. By using this form, the process of assessing the degree of housing damages after floods can be more accurate, transparent, and efficient.

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KERANGKA KONSEP PENGURUSAN SISA PASCA BANJIR DALAM KALANGAN PENDUDUK DI TUMPAT DAN PASIR MAS

Project Information
Project Leader : Nur Zakiah Mohd Saat
University : Universiti Kebangsaan Malaysia
Address : Program Sains Bioperubatan,Pusat Pengajian Sains Diagnostik dan Kesihatan Gunaan
Email : m_nurza@yahoo.com
Project Members : Hjh Zawaha Hj Idris, Dr Muhammad Ikram Abdul Wahab
Dr Nor Malia Abdul Warif, Pn Siti Aishah Hanawi
Dr Nur Ashikin Mohd Saat

1.0 Pengenalan

Di Malaysia, banjir dianggap antara satu bencana yang buruk yang boleh membawa kerosakan kepada kehidupan. Kelantan menghadapi bencana banjir pada tahun 2014. Banjir besar yang terdahulu adalah sekitar tahun 1927 dan 1967, dianggap penting dalam sejarah Kelantan. Banjir 1967 mempunyai kesan yang teruk kepada separuh daripada penduduk Kelantan yang dianggarkan meliputi 70% daripada seluruh negeri (Chan, 1995).

Kesan daripada bencana banjir akan menghasilkan sisa yang banyak. Pengurusan sisa adalah cabaran kepada pihak berkuasa di dalam memajukan negara disebabkan oleh peningkatan sisa, kos pengurusan yang tinggi, kurang kesedaran dalam kalangan penduduk dan sebagainya (Guerrero, et al. 2012; Brown 2011). Pelbagai badan kerajaan dan pertubuhan bukan kerajaan (NGO) terlibat dalam proses pembersihan di seluruh Kelantan. Antaranya adalah Majlis Daerah Tumpat (MDT), Alam Flora Sdn. Bhd. dan SWCorp telah dipertanggungjawabkan dalam menyelesaikan isu pengurusan sisa. Ditambah dengan peranan NGO yang dianggap begitu penting untuk membantu pihak kerajaan menyelesaikan isu sisa banjir.

Kesan bencana menyebabkan terdapat banyak longgokan sampah di kawasan yang dilanda bencana dan perlu dilupuskan dengan segera bagi mengelakkan penyebaran wabak penyakit berjangkit selepas bencana. Ini kerana kelewatan dalam menangani pelupusan sampah akan menggalakkan lagi peningkatan haiwan perosak seperti lipas, lalat dan tikus yang boleh menyebabkan penyakit bawaan air (Douglas et al. 2008; Berita Harian, 2015). Antara contoh penyakit bawaan air dan debu lumpur banjir adalah demam, sakit tekak, cirit-birit, penyakit kulit, malaria, demam denggi dan leptospirosis. Oleh itu, adalah penting menjalankan penyelidikan mengenai pengurusan sisa untuk mengelakkan semua kesan-kesan akibat daripada sisa banjir.

2.0 Metodologi

Kumpulan Sasaran

Seramai 94 orang responden dari 3 buah daerah iaitu Pasir Mas, Tumpat dan Kuala Krai dipilih secara rawak. 39 responden (Pasir Mas), 31 responden (Tumpat) dan 25 responden (Kuala Krai). Responden telah dibahagikan kepada kumpulan kecil dan 7-10 orang responden bagi setiap kumpulan.

Kriteria Pemilihan Responden

Responden dipilih minimum umur 25 tahun dan ke atas, penduduk tempatan yang bermastautin sekurang-kurangnya dua tahun, dan terlibat secara langsung dalam banjir pada 2014. Orang dewasa yang mempunyai masalah mental atau kemurungan tidak diambil sebagai responden.

Perbincangan Kumpulan Berfokus (FGD)

Sesi perbincangan dilakukan berdasarkan format Perbincangan Kumpulan Berfokus (FGD) dan dilaksanakan oleh moderator berpengalaman dari Kementerian Kesihatan Malaysia. Semua responden telah diberi taklimat mengenai kajian dan tujuan kajian. Responden dimaklumkan bahawa semua maklumat dari perbincangan akan direkodkan bagi tujuan kajian, dan tidak akan didedahkan. Satu borang kebenaran bertulis diisi oleh responden.

3.0 Hasil Kajian dan Perbincangan

Responden mengakui di antara sisa banjir yang diurus adalah sisa makanan, daun kering, najis, bangkai haiwan, plastik, tin, lumpur, kayu, botol, perabot, barangan elektrik, besi, buluh, pakaian dan barang perhiasan rumah. Antara faktor kegagalan dalam pengurusan sisa adalah disebabkan oleh kelemahan sistem sedia ada. Tiada garis panduan (SOP) secara khusus bagi pengurusan banjir. Kemudian, responden juga tidak mendapat maklumat dengan jelas atau pendedahan yang berkaitan dengan aktiviti-aktiviti banjir atau kesihatan oleh kerajaan bagi sebelum, semasa atau selepas banjir.

Ketidakberkesanan pengurusan sisa membawa kepada penyebaran penyakit. Penyakit ini berpunca daripada kekotoran air dan debu banjir menyebabkan penyakit demam, sakit tekak, penyakit kulit, cirit-birit demam denggi, dan sebagainya. Terdapat kerjasama di antara penduduk dan ia menyumbang kepada keberkesanan pengurusan sisa pasca banjir. Agensi kerajaan dan NGO turut menyumbang kepada keberkesanan dalam pengurusan sisa. Agensi kerajaan telah meminta penduduk mengumpulkan sisa di kawasan tertentu untuk memudahkan pungutan sisa. Bantuan turut diberikan dari segi bekerjasama dengan penduduk, menyediakan makanan dan minuman serta menyediakan rawatan selepas banjir.

Berdasarkan kajian Roper (2008), sisa yang banyak dihasilkan kesan daripada kejadian bencana taufan Katrina di New Orleans, dan sisa perlu diurus dan dilupuskan dengan segera. Agensi persekutuan bekerjasama dengan bandar New Orleans dan kerajaan tempatan untuk menangani isu sisa selepas bencana. Di Kelantan, kerosakan harta benda penduduk turut menghasilkan sisa yang banyak. Contoh sisa adalah runtuhan rumah, barangan elektrik, perabot, pakaian, najis, bangkai, daun-daun kering, plastik, botol dan lumpur. Longgokan sisa yang terbiar lama mengakibatkan pelbagai kesan kepada penduduk terutamanya penularan penyakit seperti jangkitan kuman, demam denggi, leptospirosis, batuk, cirit-birit, selesama dan alahan kulit. Jadi, pengurusan sisa yang cepat dan betul perlu dilakukan untuk menyelesaikan masalah sisa di Kelantan.

Berdasarkan kajian Rathi (2006) di dalam isu pengurusan sisa di Mumbai, India mendapati bahawa pelbagai NGO yang terlibat dalam pengurusan sisa. Oleh itu, penyertaan pelbagai NGO serta masyarakat adalah amat penting dalam membantu menyelesaikan masalah sisa, di samping mengurangkan kos pengurusan sisa dengan penglibatan masyarakat itu sendiri. Hasil kajian menunjukkan terdapat beberapa cara pengurusan sisa yang dilakukan iaitu pengurusan secara individu, kerjasama dan bantuan NGO. Sesetengah sampah diurus oleh penduduk dengan cara cuci, bakar, tanam, kumpul dan jemur sehingga kering sebelum dibuang ke dalam tong sampah. Penduduk mengakui cara tersebut berkesan bagi mereka untuk mengurangkan masalah sisa di rumah mereka. Terdapat juga sikap kerjasama antara penduduk, iaitu melakukan gotong-royong di bangunan awam seperti masjid dan sekolah, serta rumah ahli keluarga dan jiran-jiran terdekat. Selain itu, bantuan dari persatuan-persatuan NGO yang dianggap berperanan penting dalam pengurusan sisa banjir. NGO dari dalam negara dan luar negara yang memberi bantuan dalam banyak aspek semasa dan selepas banjir terutamanya membersihkan sisa-sisa di kawasan penduduk.

4.0 Kesimpulan

4.1 Hasil kajian mendapati bahawa punca utama masalah dalam pengurusan sisa adalah lumpur tebal akibat banjir dan kelemahan pihak pemegang taruh dalam menangani situasi banjir.

4.2 Didapati juga tiada pendekatan pendidikan kesihatan yang dianjurkan untuk penduduk di kawasan berisiko banjir, dan kelemahan penguatkuasaan undang-undang yang diambil dalam pengurusan sisa. Bagi menyelesaikan masalah ini, semua pihak termasuk penduduk, NGO dan pemegang taruh disarankan untuk mengambil tindakan segera apabila berlakunya banjir dan melaksanakan langkah-langkah yang betul dalam pengurusan sisa.

4.3 Pemegang taruh perlu memperbaiki dasar sedia ada yang sesuai dalam menangani banjir. Cadangan atau perancangan juga telah disuarakan oleh pihak-pihak terlibat seperti MDT, Alam Flora dan SWCorp bagi panduan Majlis Keselamatan Negara (MKN) untuk mengambil strategi yang sesuai dalam menangani situasi banjir akan datang. Contoh cadangan adalah dari segi SOP peruntukan dana yang cukup dan penambahan bilangan aset dalam pengurusan sisa. Pemegang taruh mencadangkan untuk mewujudkan masyarakat kitar semula dalam menangani masalah pengurusan sisa.

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GOVERNANCE & CAPACITY BUILDING (GCB)

SUSTAINABLE RECONSTRUCTION: TOWARDS GUIDELINES OF POST-DISASTER VULNERABILITY REDUCTION FOR PERMANENT INFORMAL HOUSING IN KELANTAN DUE TO FLOODING

Project Information

Project Leader : Dr. Ruhizal Roosli
Email : ruhizal@usm.my
Project Members : Professor Dr. Julaihi Wahid
Professor Dr. Abu Hassan Abu Bakar
Dr. Faizal Baharum

1.0 Introduction

Malaysia still does not have specific guidelines for building housing after a disaster especially in disaster-prone areas (Roosli et al. 2011). Currently, the only related reference is the Policy and Mechanism on National Disaster and Relief Management to determine the kind of actions to be taken to minimize the effects of major disruptive events. In this policy, there are no specific requirements for permanent post-disaster housing provision. In general, allocation for physical post disaster recovery is categorized under infrastructure development, which is the responsibility of the Public Works Department and the post-flood recovery work led by the Department of Drainage and Irrigation (NSC, 2011). However, the legislation on urban planning, such as the Planning Act and Building By-Law states that the local authorities have the authority to approve plans for public and private buildings.

In Kelantan, flood victims who have actually experienced flood almost every year are reluctant to leave their homes due to their ownership of land. It is no guarantee that they will be able to secure their homes from flooding in the future. It was reported that the houses should be built on stilts, which can withstand certain levels of impact during flooding. Unfortunately, until today no guidelines are available to assist homeowners to rebuild their homes. In addition, there is also no clear operational procedure to monitor the progress of this construction work. This research is a review of recent national disaster mechanism experiences in the housing sector. This research is also an effort to promote resilient housing; safety and security; and secure tenure in a flood prone area. At the end of this study, key lessons emerged from the review process and data analysis that illustrate key lessons and influence the emergence of broader guidelines. These key lessons point to the need for best operational and technical guidelines and can be compared to other International cases that are adapted to national situations. The guidelines are prepared in accordance with aspirations within the prevention phase of a disaster. The overall objective is to support humanitarian responses to environmental disaster and conflicts through this example of resilience house construction in a flood prone area.

1.1 Post-disaster housing provision after the 2014 Kelantan flood in Malaysia

Kelantan has been repeatedly affected by environmental disasters such as storms and flooding. Although prone to flooding every year, many authorities in Malaysia have not yet addressed the risk of floods to housing. Many houses were damaged and destroyed. Families already stricken by poverty were unable to reconstruct their houses and left it to the authorities to look after the matter. The authorities also encountered a number of obstacles in providing this housing (State Secretary's Office, 2015). The reasons included a lack of relevant national and state policies and action plans; existence of regulations on urban planning and environment which have not been adjusted to manage flood; slow response to flood disasters due to lack of capacity and resources; and a lack of public awareness of flood variability and flood-induced hazard mitigation (Soti et al, 2012).

Even where the country has an abundance of rules and regulations in providing housing, these are only applicable to the formal type of development or housing (Kennedy, 2008). Many housing units in Kelantan were identified as informal housing especially in villages that were constructed free from obligation to these rules and regulations. As a result, it is not surprising that many houses hit by the floods were washed away. In addition, some of the projects initiated and monitored by responsible agencies also fail to protect disaster victims' rights. Figure 1 shows examples of the ineffectiveness of post-disaster housing provision by the appointed agencies. These images show that even though the design has been approved and budgeted for by the agencies, the allocated building collapsed and contributed to the delays of appropriate housing provision for targeted residential areas.

a

b

Figure 1 (a & b) Building collapsed. They were designed by and awarded for construction through the contractor by JKR in July 2015

Post-disaster housing is put up after disasters by governmental and/or private institutions. There are two types of housing built after a disaster: one is principally a shelter put up for immediate relief purposes, and the other is more permanent housing for long term settlement purposes (Jha, 2010). For the purpose of this study, only permanent housing provision was analysed though it is recognised that the process of housing needs to also be understood across the spectrum of temporary to permanent constructions in order to study the full extent of successes of housing programs. Permanent housing, which is the last stage of housing recovery, aims to be a final solution post-disaster to provide housing individually, which would fulfil the needs of the inhabitants in relatively much longer period of time. They aim not only to serve as housing units or or for basic protection but also to satisfy all necessary living requirements.

The cabinet of Malaysia had agreed to build permanent houses worth RM48,000 each for victims whose homes were destroyed. Meanwhile, the government also agreed to provide aid of between RM5,000 and RM10,000 for houses which sustained partial damage. Victims who previously lived in squatter homes would be provided a new settlement and permanent houses from the state government. However, the question inevitably arises regards the control over the buildings that are considered as dwellings on private land owned by the victims of the disaster event. It also not clear as to the design and technology of housing that should be provided. For Malaysia, the existence of guidelines for the construction of houses in flood-prone areas is necessary for at least to mitigate the effects of housing that is destroyed by flooding and to make preparations to face both the small-scale and larger scale flooding impacts.

1.2 The problem with post-disaster housing

Many of the difficulties encountered by agencies' shelter and housing work are frequent across the sector. Shelter and housing work is the "least successful form of aid when compared to other humanitarian intervention sectors" (ALNAP, 2003). While some of the problems noted by ALNAP are generic to all humanitarian projects, others are more specific to the shelter and housing sector.

Housing provision is as part of relief efforts typically leads to a rehabilitation divide and confusion as to its objectives and responsibility (ALNAP, 2003). Other than some specific authorities, few donors and NGOs are willing to fund housing work outside of an emergency context. As such post disaster emergency presents one of the few opportunities available for upgrading the quality of vulnerable housing. The Government is responsible for ensuring safe housing for their citizens, but this otherwise often becomes in reality an unorganized action by NGOs and local agencies as international funding mounts within a disaster affected area. In many cases, the role of government in rebuilding houses becomes muddled.

2.1 Methodology

This research was first based on an analysis of evaluation reports and existing guidelines from recent post-disaster housing work. This desk research involved the summary, collation and synthesis of existing information rather than primary research. A cross-referencing exercise of the secondary data was carried out to identify key aspects of these texts that could form the basis for a reinvigorated post–disaster housing literature applicable to the study region. Extracting key advice from the text was a process used to deciper the main focus of guidelines to date (Roosli, 2015). This enabled a better definition of the research problem through gaining information about post-disaster housing procurement (institutional influences), flood disasters (environmental influences), effects of disaster related concepts (socio-economic influences) and post-disaster housing types (technical influences).

The second phase consisted of interviews with field based staff including those of the Works Department (JKR), *Syarikat Perumahan Negara Berhad* (SPNB), state authorities/ agencies (*Majlis Agama Islam Kelantan*), State Economy Development Corporation (SEDC) and representatives from the aid agencies responsible for constructing the houses. The respondents were selected based on their experiences in disaster response particularly relating to housing provision. This complimented the findings from the first stage assisting in understanding how international and national practices impacted in this area. Both quantitative and qualitative methods were used in this stage based around the basic framework presented in Figure 2.

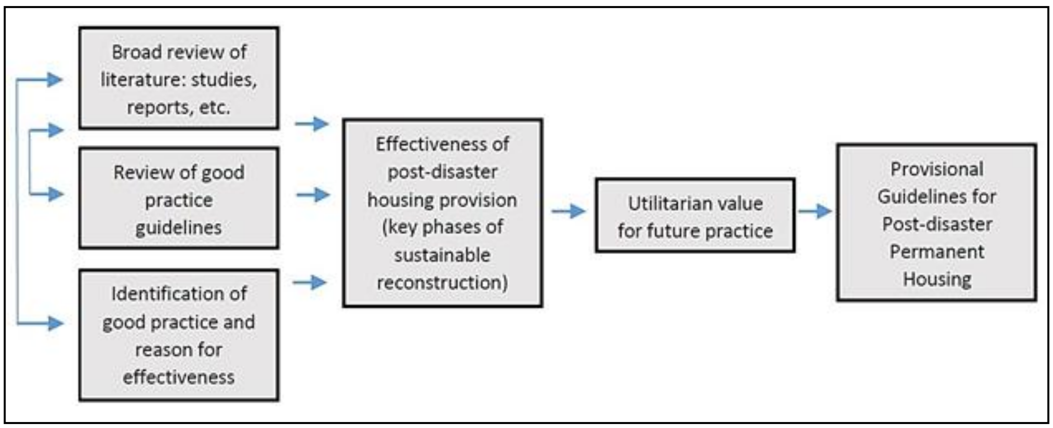


Figure 2: Methodological framework

Sampling was based on a the rationale of no restrictions to who could be included the Disaster Management systems of Malaysia. In total, 67 respondents participated in this interview. These were the implementers of disaster management across each of the departments of the Disaster Management institutions in Malaysia. They included managers, clerical staff members, technical staff members and officers involved in disaster management, especially in the role of providing emergency housing.

3.0 Results and Discussion

The reconstruction process, which has the following organizational set up of partners (Figure 3), depends on whether the project will be located in a new area or not and whether the beneficiaries want to implement an official design or custom made designs. It was found that the process was initiated and controlled by 1) the Prime Minister's Department (*The Unit Pemulihan Pasca Banjir* with National Security Council as moderator), and 2) the Public Work Department at the federal level working hand in hand with the state committee (the state secretary and state director of economic planning unit and the-land office representative, district officers and other related officers). Later, private firms, builders, other designers and beneficiaries all participated in the project. At the state level, the private firms appointed, who designed the houses, communicated only with the state committee. The various partners in the house building process each have a specific role to play. Current practices of the Post Disaster Housing Provision in Kelantan can be summarized as in Figure 4.

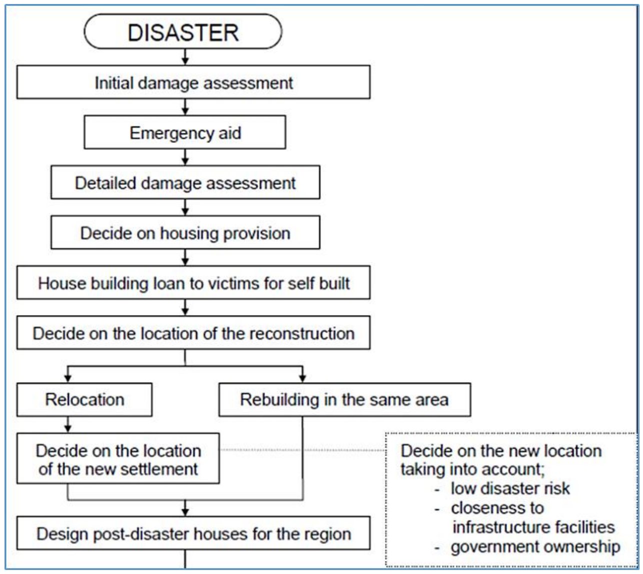


Figure 3: The process of reconstruction project

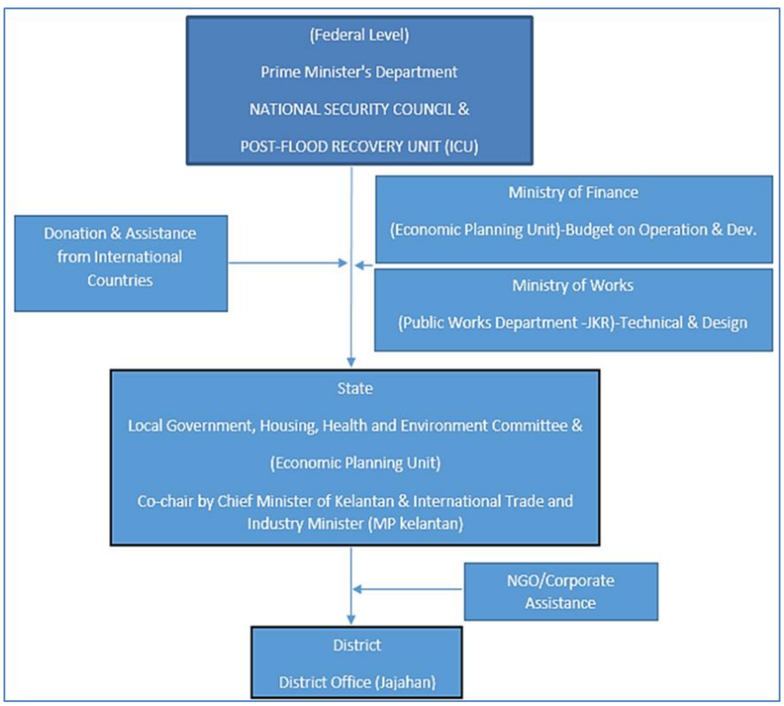


Figure 4: Current practices of the post disaster housing provision in Kelantan, Malaysia

The findings from the questionnaires showed that these respondents in representing their institutions had broadly little knowledge of implementing any guidelines or Standard Operating Procedure (SOP) available. There appeared to be a negative perception reflecting a negative awareness of current practices. They were unsure about their reactions towards the implementation of permanent housing provision. They knew very little about implementation and suggested they needed to know more about any future project initiative.

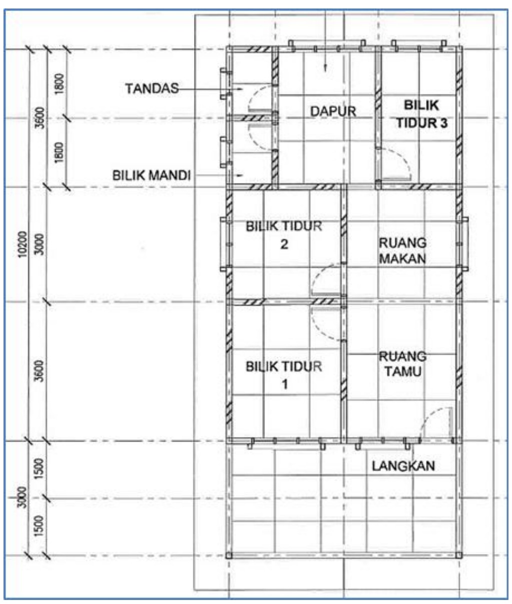
Only a few actors (11.1%) agreed with the idea of implementing such a scheme. These cited that the Malaysian National Security Council (MNSC) Directive and 20 and other guidelines of post-disaster reconstruction are formulated for good reasons such as to help in the realization of a 'caring society'; this would promote and develop self-esteem in actors and disaster victims; and is in line with the national philosophy of equal opportunities. However, most of actors (82 per cent) still wanted to see changes at the department level before the implementation would go ahead, even though some of them were against the implementation happening at all. The most cited suggestion was that these actors should be given in-service training, the department should be articulate on the rationale of implementation and all departments involved in any programme should be provided with appropriate physical resources and working equipment.

At the present stage in the MNSC Directive 20 and other related guidelines' implementation, the main issues were: actors not receiving enough information about the programme; the introduction of implementation increasing their workload due to misunderstanding; not enough resources; disaster victim involvement; and actors themselves not being ready due to lack of training. Respondents suggested that the key actors should be given in-service training and engage more with the rationale of the MNSC Directive 20/SOP implementation. This would include survivors of environmental disasters forming groups towards promoting a mutually 'caring feeling'. It was also asserted that information about the programme should be more specific and not simply as a general approach.

3.1 Technical

Currently, designs are controlled by the Public Work Department of Malaysia. However, there were some designs chosen by other agencies including NGOs and state agencies to be constructed during the emergency period. However, at the federal level only one design of building has been acceptable for post disaster housing in Kelantan and other states (Figure 5). Detailed drawings provided by JKR (of only one typical design) of the *Cawangan Arkitek, Ibu Pejabat Jabatan Kerja Raya Malaysia* on 28 February 2015 for all federal government post-disaster housing reconstruction are is as follows:

a



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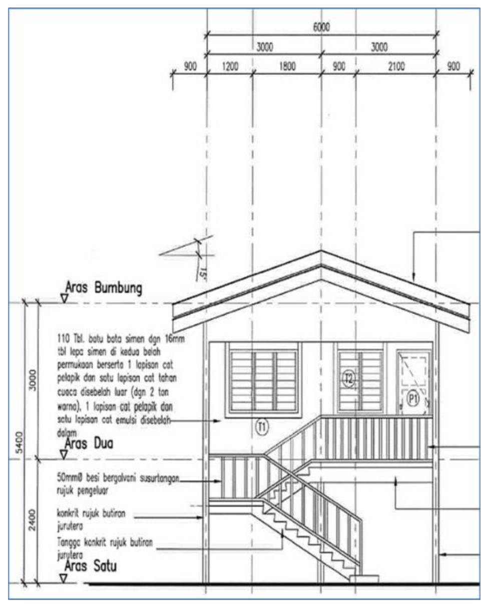

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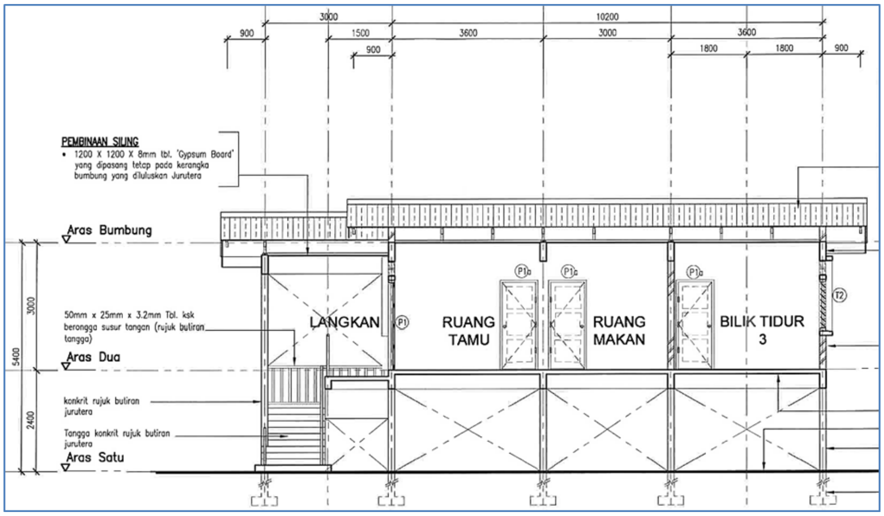

Figure 5: (a) Floor plan; (b) Front elevation; (c) Side elevation

3.2 Socio-economic and environmental

Results showed that land, employment, infrastructure, and access to the means of reconstruction were the key priorities in this area. Therefore the needs identified by the affected groups point to more long-term strategies of rebuilding, and of the creation of capacity for their involvement in the post-disaster rehabilitation. Results also show that the involvement of local organizations and government, and the empowering of the affected communities, is much more effective than the transplanting of outside organizations to deal with the problems. This is also closely connected to the concern over the creation of dependency on the donors in the affected society. The building of capacity, through the involvement of the affected groups in their long-term rehabilitation must be a guiding principle in any post-disaster reconstruction programme. Past experience indicates several needs:

First, an institution must be established to collect, organize, and analyze the necessary sector by sector information, from profiling existing baseline data to superimposing damage and losses assessment with a unified and comparable approach. The team should be multidisciplinary and inter-institutional, with clearly designated focal points to compile and present the data in a comparable manner, so that they can be summarized and factored into a macroeconomic scenario exercise. Each focal point should have common terms of reference. The global analysts (e.g. macroeconomists, environmental economists, gender experts) can then proceed to use the emerging data of damage and losses to: contrast the disaster scenarios with the non-disaster trend; make environmentally related damage and losses visible; and differentiate men and women's circumstances and impacts with the post-disaster process. Second, a deadline would be established to submit the final report deadlines for submission of sector data (quantification in standardized format with agreed common criteria) with accompanying descriptive text depending on the final deadline. Third, a deadline must be set for completion of other relevant institutional procedures that form a part of the housing provision, and this deadline would be discussed and made compatible with a strategic reconstruction proposal.

Further suggested guidelines are that each sector team should consult and exchange information with each other to avoid duplication, share data of common interest or of interest in more than one sector, and identify information gaps or lack of information. The sector specialist would not only gather information on baselines and the disaster impacts on them (i.e. damage and losses), but on reconstruction needs in the form of sectoral strategic responses. These can be used as input to develop an overall reconstruction strategy and possibly project proposals.

The strategic proposal would include a framework for action, based on pre-existing policies or development strategies, focusing on adaptation of the latter to the needs of reconstruction, to prioritize and sequence the process, with defined resource gaps to be filled from government, private and external sources, together with profile execution processes in which affected populations and other stakeholders can play key roles in reconstruction.

3.3 Provisional guidelines of post-disaster permanent housing

Achievements of immediate objectives in planning for the post-disaster programme are the inputs that have reached the target group and the client and beneficiaries satisfaction with the outputs. However, the success of any new settlement project/programme is based on a well-functioning management process. The guidelines are organized according to the typical main steps of a reconstruction project as adapted from Sphere standards (Sphere Project, 2011) and the outcome of this research. They focus is on permanent housing. The main steps are outlined in Table 1.

Table 1 Provisional guidelines for post-disaster permanent housing

Steps
Preparation
1. Assessment
2. Set-up
3. Community
4. Partners
5. Approach
6. Project definition
7. Site selection
Planning phase
8. Disaster preparedness
9. Site plan
10. Building design
11. Infrastructure
Implementation
12. Project management
13. Quality control
14. Environmentally friendly site management
15. Material banks
16. Controlled demolition
17. Reuse of debris
18. Maintenance

4.0 Conclusion

Experience shows that pre-disaster planning is usually inadequate and needs to be up-dated after the disaster in the light of actual vulnerabilities identified. No conventional procurement process is possible because there is no clear contracting client, the survivors have few resources and probably no "voice" in decision-making and resources have to be shared among several options. The case of Malaysia is rather unique because the three tier administration (level of administration) from federal, state to district requires higher level of commitment due to different political understanding. The tendency in Kelantan was for government, donors and the media to focus on the number of houses constructed as a measure of achievement. However the delay in housing provision shows ineffectiveness with a lot of room for necessary improvement. This research proposes that other organizations such as NGOs, universities, uniform based bodies and/or private firms can be involved in the earlier stage of reconstruction projects as the organizers and/or they can participate in the operations. Long term and permanent housing provision is more appropriately handled by governing authorities. In terms of implementations, it was observed that the main problem was the lack of satisfactory actions and policy frameworks in the pre-disaster phase. Therefore, although the actions in the post-disaster phases seem to be more satisfactory, implementations taking place following the floods can hardly be called a success where more permanent solutions might have been possible.

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IMPROVEMENT OF THE ADAPTIVE CAPACITY OF PRIMARY HEALTH CARE CLINIC AND PATIENTS WITH CHRONIC DISEASE TOWARDS FLOOD PREPAREDNESS THROUGH COMMUNITY PARTICIPATION APPROACH

Project Information

Project Leader	: Dr Ching Siew Mooi
University	: Universiti Putra Malaysia
Address	: Faculty of Medicine and Health Sciences University Putra Malaysia, 43400 Serdang, Selangor
Contact number	: 0193806652
Email	: sm_ching@upm.edu.my

1.0 Introduction

Disaster has emerged as an important issue in Malaysia in the last decade. Floods are among the most frequent and costly natural disasters in terms of human and economic loss. As much as 90% of the damage related to natural disasters in Malaysia is caused by floods. The Kelantan River is located in the north-eastern part of Peninsular Malaysia and presents a great challenge in terms of recurring floods. The rainfall over the area varies between 0 mm in the dry season (March–May) to 1750 mm in the monsoon season (November–January). The average runoff from the area is about 500 m^3/s. Together with natural factors such as heavy monsoon, rainfall, intense convection rain storms, poor drainage and other local factors, floods have become a common feature in the lives of a significant number of Malaysians. People living in surrounding flood-prone areas are becoming ever more susceptible to this disaster as climate change continues worsens the situation throughout the year. The flood incident in Malaysia involves extensive use of finance and human resources as well as needing effective coordination and complex interventions actions from various agencies over a long period of time.

Flood preparedness is a planned inventiveness that is projected to increase readiness and awareness among the various stakeholders regarding the dangers of flood and thus improve the preventive measures, response and recovery strategy related to flood. It seeks to improve the overall preparedness towards a disaster or at least the type of disasters that is likely to happen at a particular locality. The capacity of patient in preparing themselves for their own health needs during this critical period also important to minimise morbidity and mortality. Correct information and practices are important in order to make the right decision during next event of flood to reduce mortality and morbidity to the lowest level. To our best knowledge, there is one local study that looked into disaster preparedness in Malaysia so far. There is still a gap in the beliefs, perceptions, expectations and feelings of the residents around the flood area as there only 10 subjects were recruited from the east coast region in the previous study. Thus, this study aims to determine attitude and practice related to flood preparedness in Kelantan, a flood prone area in the east coast of peninsular , Malaysia. We believe the information gathered from this study is very important to assist the ministry of health in future planning an effective model for sustained public preparedness programs directed at local communities in disaster prone areas.

2.0 Methodology

2.1 Setting

This is a cross-sectional study of patients registered with outpatient clinic of the University Sains Malaysia branch campus at Kubang Kerian, in Kota Bahru district, Kelantan Malaysia. This clinic is located in a tertiary hospital in northeastern part of Malaysia. This tertiary hospital including its primary care clinic serves a majority Malay population of 48,714 in the surrounding area. Kubang Kerian, Malaysia. Kubang Kerian is famous with the Kelantan River and Sultan Ismail Petra Airport, located in Pengkalan Chepa[8]. The primary care clinic is run by 10 family medicine specialists and 20 vocational trainees in family medicine.

2.2 Inclusion criteria

All patients above 18 years of age were eligible for the study. The sample size was calculated using Epi Info 7 based on a local study of 346 patients in assessing the preparedness towards disaster in Malaysia. A convenient sampling method was applied in recruiting the study subjects between June to August 2015.

2.3 Questionnaire

A pre-tested and pre-designed, structured questionnaire modified from Centre for Disease Control and Prevention was administered to the study subjects for assessing the current level of knowledge, attitude and practice about flood preparedness.[9] There are 42 questions to evaluate the measure of precautionary actions for each participant during the previous flood and the future flood.First section contain 11 items and the sum of these 11 items were assumed as the response or practice of the subjects in the previous flood situation (Cronbach's α=0.75). The median for this score which considered as cut-off point was 5, thus any participant with practice score lower than 5 considered as participant with low practice. During second section, there were 25 items for their future practice if they are under a flood warning. The sum of these 11 items were assumed as the preparedness score for the future flood (Cronbach's α=0.80). The median for this score which considered as cut-off point was 6, thus any participant with practice score lower than 6 considered as participant with low practice.

2.4 Statistical analysis

Continuous data are described as mean and standard deviation if the distribution is normal. When the data was a skewed distribution, median, minimum and maximum value were used to describe the data. Categorical data are reported as proportions (percentage). Chi-square test or Fisher exact tests were used for the categorical or dichotomous variables. All variables with the p-value of less than 0.25 in the univariate analyses as well as clinically significant variables were entered into the multivariate logistic regression. The dependent variable was good practice (yes or no). The independent variables were age, gender, ethnicity, education level, marital status and household income. All analyses were done with 95% confidence intervals (CI), and the level of significance was set at $p < 0.05$. All the statistical analysis was done using the Statistical Package for Social Sciences (SPSS version 21). Ethical approval was obtained from the Human Research Ethics Committees of Universiti Putra Malaysia (FPSK (EXP15) P084). Informed consent was obtained from all the study subjects.

3.0 Results and Discussion

A total of 328 subjects were recruited into this study. Table 1 shows the sociodemography profile of the study population. The study involved mostly (92.7%) Malay patients with mean age of 39 years. More than half (56.1%) of the subjects were female and almost half of them received tertiary education (46.3%). A fifth of the respondents were working in blue collar field. More than half of the respondents have household income of RM1000– RM4999 (USD 253-USD 1013). Table 2 shows the responses of the subjects towards flood preparedness during their previous flood experience. Less than half of them (38.7%) aware of the designated local community emergency center. Less than one fifth of the subjects fill containers, plastic and bottle with clean water (11.6%), preparing personal hygiene supplies (6.4%), and gathering the emergency supplies (17.7%) and turn off all utilities at the main power switch (15.9%) during the flood warning. Less than quarter of the respondents have a good practice in food and water related safety issues.

Table 3 compares the sociodemography factor among respondents who have good and poor practice in the future flood. During univariate analysis those older population and from a blue collar background practiced a good preparation towards flood.Table 4 demonstrates the predictors of good practice in the previous flood experience. Those subjects who are older and housewife were associated with good practice in previous flood preparation compared to those younger population and students. Table 5 demonstrates the predictors of good practice toward future flood preparedness. Those subjects who are older and with a blue collar background were associated with good practice in future flood preparation compared to those younger population and students.

The aim of this study was to determine the attitude and practice in preparedness towards previous and future flood to reduce morbidity and mortality among patient in flood prone area.It was observed that there is inadequacy of the subjects' awareness towards flood preparedness during their previous flood experience. Less than half of them (38.7%) aware of the designated local community emergency center. A similar finding was reported in another study from Japan where only 33% of therespondents identify the designated evacuation center.

Flooding has been shown to be linked with epidemics of water and vector borne diseases. The main reason is due to the poor standards of hygiene in camps set up for individuals in the flood area. Thus, practicing a good personal hygiene is critical to reduce the spread of the disease. Unfortunately, awareness of these practice are still lacking in this population as less than quarter of them have good practice in food and water related safety issues. Therefore, this issue needs to be tackle immediately as in planning the national disaster preparedness program.

During the previous flood, our study show that those subjects who are older and housewives were associated with good practice compared to those younger population and students. This is consistent with that reported in another study, a population household study, where older age, female were found to have a better household preparedness towards disaster. However for preparedness towards future flood, those subjects who were older and with a blue collar background were associated with good practice compared to those younger population and students. Similarly in the Japan study, they reported that in the presence of an elderly household member, and farming occupations were associated with better community preparedness. The reason could be due to the fact that Kelantan has a chiefly agrarian economy dominated by rice, rubber, tobacco and fishing activity. Thus the subjects belong to the blue collar category will be more prepare towards flood as they are the more affected during the disaster. Some of the most important impacts of global climate change will be felt among the populations, predominantly in developing countries, referred to as "subsistence" or "smallholder" farmers.

Studies reported that people with a lower educational level are at higher risk of unpreparedness than people with a higher education but our study didn't show that. The possible reason could be due to that the proportion of subjects who received tertiary education and non-tertiary was in the equal in our study population.The strength of the study was we are able to run a multiple logistic regression to look at the predictors of flood preparedness. The limitation was the sample size is small and a future study with a bigger scale is needed.

4.0 Conclusion

In conclusion, our study shows most of the respondents were lacking preparedness towards flood despite stay in a flood prone area. Every effort needs to be taken to improve the knowledge and practice toward flood preparedness.

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CONSTITUTIONAL AND LEGAL ASPECTS OF DISASTER RESPONSE AND MANAGEMENT

Project Information

Project Leader	: Muhammad Fathi Yusof
University	: Universiti Teknologi Malaysia
Address	: UTM Razak School, Tingkat 7 Menara Razak, UTM Kampus KL,Jalan Sultan Yahya Petra, 54100 Kuala Lumpur
Contact number	: 013-6669669
Email	: fathi@utm.my
Project Members	: Dr Arieff Salleh Bin Rosman, Dr Abdul Latiff Bin A Mohd Ibrahim Dr Farahwahida Binti Mohd Yusof, Dr Tamar Jaya Bin Nizar Dr Siti Norlina Bt Muhamad, Dr Mohd Al'ikhsan Bin Ghazali Dr Mazlan Bin Ali

1.0 Pengenalan

Kajian ini bertujuan untuk menilai pengurusan bencana dari sudut keperlembagaan dan perundangan. Aspek ini berkait rapat dengan soal urus tadbir kerajaan yang memainkan peranan terpenting dalam menguruskan soal bencana (Comfort, 1988). Kerajaan bukan sahaja perlu menjadi teraju dalam menghulurkan bantuan kepada mangsa, bahkan perlu menjadi pemudah cara kepada semua sumber bantuan. Lebih besar lagi, kerajaan berperanan untuk merangka dasar yang terbaik untuk mengurangkan risiko bencana serta untuk mengendalikan pengurusan bencana dengan cekap Drabek, 1987). Apabila menyentuh soal ini maka aspek yang kritikal dan kerap kali dipandang enteng ialah aspek keperlembagaan dan perundangan (Nicholson, 2007).Pada dasarnya terdapat tiga isu keperlembagaan yang kritikal yang wajar diperhalusi melalui kajian ilmiah. Pertamanya adalah isu berkaitan bidang kuasa gerakan tindak balas dan pengurusan banjir; kedua, pengisytiharan darurat banjir dan ketiga, amalan federalisme.

2.0 Metodologi Kajian

Secara umumnya penyelidikan ini termasuk dalam kategori penyelidikan perundangan, dengan penggabungan antara kaedah penyelidikan perundangan konvensional dan kaedah penyelidikan perundangan sosial. Kaedah yang pertama juga disebut ‘doctrinal legal research’ atau kajian undang-undang secara doktrinal. Kaedah ini dilaksanakan dengan menganalisa sesuatu isu, situasi atau amalan dari sudut perundangan dengan mengambil kira undang-undang sedia ada yang terpakai, undang-undang yang berkaitan, kes-kes mahkamah yang berkaitan, serta perbandingan dengan undang-undang setara di tempat lain (McConville and Wing, 2007). Kajian ini secara tidak langsung melihat kesan undang-undang dari sudut sejarah, falsafah, ekonomi, sosial dan politik (Hutchinson &Ducan, 2012). Penyelidik menggunakan kaedah ini dengan nilai tambah melalui temu bual dengan pakar-pakar perlembagaan bagi memperoleh dapatan yang jitu. Kaedah yang kedua iaitu ‘social-legalresearch’ atau penyelidikan perundangan sosial akan menggunakan kaedah penyelidikan dalam sains sosial dengan menggunakan pendekatan kajian diskriptif dalam menilai pemakaian dan keberkesanan peraturan terutamanya ketika berlaku banjir besar 2014 yang lepas. Kaedah ini juga dibuat untuk menilai keperluan, skop dan model Akta Pengurusan Bencana yang dicadangkan. Data dikumpulkan dan dianalisis menggunakan kaedah kualitatif melalui pengendalian temu ramah serta perbincangan dalam kumpulan fokus. Temu ramah dibuat melibatkan pihak-pihak yang terlibat secara langsung dengan pengurusan bencana. Gabungan hasil tinjauan dan dapatan kajian perpustakaan akan dimanfaatkan untuk menilai penyelesaian yang sesuai bagi mewujudkan satu garis panduan yang diperlukan..

3.0 Dapatan dan Ulasan

3.1 Arahan MKN No.20 menurut Perlembagaan Persekutuan

Dari sudut kesahihan, Arahan MKN No. 20 boleh berdiri secara sah melalui Akta 216, satu akta yang dibuat khusus untuk melindungi kesahihan peraturan yang dibuat melalui kuasa darurat. Namun dari sudut moral, kewujudan peraturan yang bertujuan untuk menguruskan tindak balas dan operasi bencana di bawah kuasa darurat merupakan suatu yang tidak wajar. Undang-undang berkaitan darurat sepatutnya hanya terhad kepada peraturan yang benar-benar memerlukan kuasa darurat. Badan eksekutif tidak wajar menggunakan kuasa darurat untuk sesatu urusan yang boleh dijadikan melalui proses legislatif biasa. Prinsip ini bertujuan untuk mengelakkan kuasa darurat digunakan untuk salah guna kuasa oleh badan eksekutif (Das, 1994). Dalam hal ini, kajian mencadangkan agar diwujudkan satu Majlis Pengurusan Bencana Negara yang menjadi teraju kepada pengurusan, tindak balas, kajian, latihan, pembangunan teknologi dan penerangan berkaitan bencana. Majlis ini tidak menumpukan aspek keselamatan semata-mata, bahkan juga aspek-aspek lain yang meliputi enam urusan teras iaitu pencegahan, pengurangan risiko, kesiapsiagaan, tindak balas, pemulihan dan pembangunan (Carter, 2008).

3.2 Konsep Darurat Bencana menurut Perlembagaan Persekutuan

Kaedah mengkategorikan tahap-tahap bencana kepada tiga tahap seperti yang terkandung dalam Arahan No. 20 sudah memadai untuk menjadi panduan tentang tahap penggemblengan tenaga dan penggunaan aset-aset agensi peneraju. Tahap kecekapan kerajaan juga tidak berbeza jika darurat diisytiharkan atau tidak. Dalam situasi bencana, agensi-agensi yang terlibat biasanya melonggarkan tahap ikatan birokrasi dan memudahkan proses penggunaan aset dan penggemblengan tenaga. Ia boleh dilakukan tanpa pengisytiharan Darurat.Soal pelepasan para pekerja awam dan swasta serta pelajar-pelajar sekolah atau institusi pendidikan tinggi daripada menghadiri kelas dalam tempoh bencana juga bukan satu masalah. Setiap institusi dengan sendirinya akan memberikan kelonggaran bila berlakunya situasi yang mendesak seperti bencana.

Oleh yang demikian, kewujudan kuasa pengisytiharan darurat bencana di bawah Arahan No. 20, merupakan sesuatu yang sukar untuk dilaksanakan. Pertamanya kerana kuasa untuk mengisytiharkan darurat hanya dimiliki oleh Yang Di-Pertuan Agung.Pihak-pihak lain seperti Perdana Menteri atau Jawatan kuasa Pengurusan Bencana tiada sebarang kuasa untuk mengisytiharkan Darurat di bawah Perkara 150, atau sebarang darurat yang mempunyai kesan perundangan. Jika terdapat keperluan yang jelas untuk mewujudkan mekanisme Darurat Bencana, maka asas perundangan yang paling sesuai ialah melalui Akta khusus berkaitan pengurusan bencana. Perlu diingat bahawa undang-undang itu perlu secara jelas memisahkan Darurat Bencana daripada Darurat yang terdapat dalam Perkara 150. Walau bagaimana pun, jika tiada undang-undang khusus sekali pun, dan jika dirasakan perlu untuk menangani bencana yang amat besar dan mempunyai kesan menyeluruh, maka Darurat boleh diisytiharkan oleh Yang Di-pertuan Agung melalui Perkara 150.

3.3 Pengurusan dan Tindak balas Bencana dari Sudut Amalan Hubungan Persekutuan-Negeri

Jadual Kesembilan Perlembagaan Persekutuan tidak meletakkan secara khusus bidang kuasa berkaitan dengan bencana. Perkara yang disenaraikan di bawah butiran 3 dalam Senarai Persekutuan iaitu “keselamatan dalam negeri” juga tidak memasukkan soal pengurusan bencana. Walau bagaimana pun, menurut prinsip yang diguna pakai di peringkat antarabangsa, tanggungjawab pengurusan bencana terletak di bawah Kerajaan Persekutuan (Baas, 2008).

Prinsip ini digunakan kerana Kerajaan Persekutuan lazimnya mempunyai sumber kewangan yang lebih besar. Hal ini bertepatan dengan situasi di Malaysia yang memberikan hak kerajaan Persekutuan untuk mendapatkan hasil dari pelbagai sumber berbanding kerajaan negeri yang sangat bergantung kepada pendapatan berkaitan guna tanah dan kerajaan tempatan. Tambahan pula Perkara 103 Perlembagaan Persekutuan menyediakan satu peruntukan perlembagaan yang khusus berkaitan dengan Kumpulan Wang Luar Jangka. Kumpulan wang ini perlu diwujudkan secara khusus dan boleh digunakan apabila timbul ‘keperluan perbelanjaan yang mendesak dan di luar jangkaan’ termasuklah dalam situasi bencana.

3.4 Keberkesanan Pengurusan Bencana Berasaskan Arahan No.20 dan Peraturan Tetap Operasi Semasa

Secara umumnya Arahan No. 20 dapat menjadi panduan yang amat bermanfaat untuk menjadi rujukan jentera kerajaan serta agensi-agensi peneraju yang terlibat. Agensi-agensi yang terlibat biasanya mendedahkan anggota-anggotanya dengan kandungan Arahan No. 20 ini melalui surat pekeliling, latihan, dan taklimat semasa (Azmi, 2015). Arahan ini juga banyak membantu dalam menyelaraskan gerak kerja antara agensi-agensi terlibat (Anas, 2015). Dari sudut perlaksanaan agensi-agensi yang terlibat sedaya upaya mematuhi garis panduan berkenaan. Walau bagaimana pun, terdapat juga beberapa inisiatif untuk melicinkan perlaksanaan tugas, umpamanya dengan mengagihkan tugas agensi-agensi berasaskan zon, penyediaan garis panduan tambahan melalui surat-surat pekeliling, dan seumpamanya (Rasiddi, 2015).

Dalam keadaan tertentu seperti kecemasan dan keperluan untuk bertindak segera wujud mekanisme untuk menyerahkan budi bicara kepada agensi yang melaksanakan operasi. Proses membuat keputusan yang cepat dan tepat amat kritikal dalam suasana genting terutamanya untuk menyelamatkan nyawa. Dalam situasi ini alat komunikasi yang cekap dan berkesan amat diperlukan bagi memudahkan keputusan yang cepat dapat dibuat pada saat-saat yang getir. Arahan No. 20 dan peraturan yang relevan seperti Peraturan Tetap Operasi pada umumnya sudah berjaya mengelakkan berlakunya kecelaruan dalam operasi tindak balas bencana. Namun demikian, terdapat beberapa saranan untuk meningkatkan keberkesanannya. Di antaranya ialah keperluan untuk menyediakan keperluan yang tertutup dan selesa kepada para anggota penyelamat. Kajian mendapati bahawa wujud keperluan untuk menstrukturkan semula Arahan No. 20 dan institusi yang diwujudkan melalui arahan ini. Selain itu beberapa penambahbaikan perlu dibuat untuk memantapkan lagi undang-undang pengurusan bencana di Malaysia.

3.5 Keperluan dan Skop Akta Pengurusan Bencana

Undang-undang yang ada iaitu Arahan No. 20 serta Peraturan Tetap Operasi wajar digantikan dengan satu akta khusus berkaitan dengan pengurusan bencana serta beberapa undang-undang kecil yang boleh diletakkan di bawah Akta berkenaan.Keperluan kepada kewujudan akta ini timbul bagi memantapkan undang-undang berkaitan dengan pengurusan bencana. Selain itu kewujudan undang-undang sedia ada iaitu Arahan No. 20 yang berdiri atas Pengisytiharan Darurat yang sudah berlalu juga menjadi sebab penting kepada kewujudan akta yang baru. Pembaharuan undang-undang ini perlu berjalan seiring dengan perubahan dari sudut pentadbiran iaitu dengan mewujudkan Majlis Pengurusan Bencana menggantikan peranan MKN dalam pengurusan bencana. Perubahan ini perlu bagi meluaskan skop pengurusan bencana kepada aspek yang lebih luas meliputi enam urusan teras iaitu pencegahan, pengurangan risiko, kesiapsiagaan, tindak balas, pemulihan dan pembangunan. Skop pengurusan bencana juga dibesarkan kepada aspek-aspek lain selain keselamatan iaitu alam sekitar, pendidikan, pembangunan, teknologi dan lain-lain.

4.0 Kesimpulan

Secara keseluruhannya terdapat keperluan untuk menambahbaik pengurusan bencana di Malaysia dari perspektif perlembagaan dan perundangan. Perkembangan dunia termasuklah kesedaran baru dan perubahan iklim dunia menuntut kesedaran awam dan kerajaan untuk lebih bersedia menghadapi sebarang kemungkinan bencana. Kerajaan sebagai teraju utama mempunyai peranan besar untuk menggerakkan perubahan ini. Aspek perubahan yang kritikal adalah dari sudut penstrukturan semua pengurusan bencana—satu inisiatif yang tidak wajar dipisahkan dari keperluan untuk mewujudkan undang-undang komprehensif berkaitan pengurusan bencana. Kajian ini mendapati terdapat sekurang-kurangnya lima aspek yang perlu diberikan perhatian dalam konteks perlembagaan dan perundangan.

Rujukan

Perlembagaan PersekutuanMalaysia

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A LIVELIHOODS APPROACH TO FOOD-SECURITY ASSESSMENTS IN SUNGAI PAHANG BASINS AREA

Project Information

Project Leader	: Norazmir Md Nor
University	: Universiti Teknologi MARA
Address	: Fakulti Sains Kesihatan
Contact number	: 03-32584510
Email	: azmir2790@puncakalam.uitm.edu.my
Project Members	: Khairil Anuar Md Isa Mohamad Ghazali Masuri Mohd SuleimanMurad

1.0 Introduction

Floods that occur from the erratic rainfall are one of the natural disasters that affect the whole world. As the same as other countries, Malaysia was also facing the same problems. Even in Malaysia, the flood was included as one of a normal phenomenon that destroys belongings and even can cause death to the life. The frequency of flood in Pahang that being reported in a study done at Lubuk Paku station revealed that 20% of river exceed its the maximum river discharge that river bank can pass safely (Tekolla, 2010). When it comes to the monsoon changes, it will cause floods to happen at different states in Malaysia. These situations give high and immediate impact to the life of the people, and one of it because of the destroyed food supply for their survival. Moreover, it also affects their home, crops, and households. Also, social, economic and environment also impacted by the flood (Ramakrishna et al., 2014).

2.0 Methodology

2.1 Study area

The present study was carried out on August 2015 in East Coast of the Peninsular Malaysia which was in Bera district, Pahang. The specific location of the area (3o19'45.3"N latitude, 102o30'29.7" E longitude). There were 13 villages of Bera district was chosen as it located along the Pahang basin area. The villages that were included in this study were Kampung Lubuk Ayam, Kampung Seberang Guai, Kampung Tok Langit, Kampung Paya Panjang, Kampung Kuala Bera, Kampung Batu Papan, Kampung Batu Papan Tengah, Kampung Batu Balai, Kampung Kuala Triang, Kampung Mengkarak, Kampung Paya Serai, Kampung Bukit Keledang and Kampung Bohor Baru. All of the villages were located along the Jalan Kuala Bera, which besides the Pahang River.

2.2 Study population

Bera, Pahang is considered as a rural area with a population of 92,200 inhabitants (Department of City and Town Planning, 2006). Most of the residents at the Jalan Kuala Bera are primarily involved in rubber tapping, fishing, farming and gardening. There are also many individuals who engaged with the professional professions such as government service, private service and teaching. Besides that, there were also individuals that do commercial activities. The prevalence for the flood victims in Bera was 1.2%, 2.5% of error (95% confidence) with Z=1.96, thus, the sample size of the flood victims was 73 person. The respondents that agree to participate in this study were 100 people which more than the actual sample size. The criteria for the respondents were they must stay in the area that affected with the floods.

2.3 Structured questionnaire

A structured questionnaire from a previous study that relates to this study was taken and used. The questionnaire was named as District and Community Questionnaire (Mwape, 2009). The questionnaire was developed in English and then translated to the Malay language. Trained research assistants interviewed the participants in person, asking questions on demographic data (i.e., gender, age and education level), socioeconomic background (i.e., household income, occupation, income sources during flood), behavioural risks (i.e., general hygiene such as cooking the drinking water), living condition (i.e., types of water sources, housing, electricity, water access, livestock, crops, communication and sanitation) and to assist them in answering the questionnaire. For children, their parents or guardian were interviewed to complete the survey.

2.4 Data collection

Before data collection, the period for the data collection done in 3 weeks in August 2015. At least 2 participants were interviewed for their feedback for each day. The data were collected at the affected by flood area only and the area that mostly get the highest of the relocation. The first step of the collection was surveyed from one village to other villages. Two days were used only for surveying the place and collect information from the villagers. Surveying was useful to know the conditions of the area and also to marks the roads that were going to be used. Next step for the data collection was approaching the participants. The session was done when the participants were agreed to answer the questionnaire and done the anthropometric data. Instead of getting information from the questionnaire, observation and verbal communication were also handled to get more information from them.

2.5 Data analyses

The data were entered into the Microsoft Excel and cross-checked to avoid repetition. After no repetition, the data were key-in into the calculation software. The statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 21.

3.0 Results and Discussion

3.1 Risk factors of food security identification

The frequency of the risk factors of food security during floods is shown in Table 1. It was evident that food and beverages; living place and clothing; transportation; electricity; water access were the most risk factor of food security during the flood. The highest was from food and beverages when it shows the percentage of 96%. 77% of the population chooses living place and clothing as one of the risk factors. Besides that, transportation also gives almost half of the number. There was balanced respond from the factors of water access that 50% of it agree and not agree. Whereas the rest of 3 factors that were reported as not as important risk factors that will impact them during flood disaster.

Table 1: The frequency of the risk factors of food security during floods.

Risk factors	n (%)
Foods and beverages	
No	4 (4)
Yes	96 (96)
Living place and clothing	
No	23 (23)
Yes	77 (77)
Transportation	
No	57 (57)
Yes	43 (43)
Electricity	
No	50 (50)
Yes	50 (50)
Water access	
No	26 (26)
Yes	74 (74)
Communication	
No	97 (97)
Yes	3 (3)
Internet access	
No	94 (94)
Yes	6 (6)
Mobile phone	
No	99 (99)
Yes	1 (1)

3.2 Relationship of live impacts with nutritional status

There is an association of risk factors with the number of the sick people and also the meals intake during the flood. The relationship of the impact of the live causing by the risk factors of food security with nutritional status was shown in Table 2. 6% of the overall impact has the relationship with underweight BMI. While normal BMI shows 32% of relationship with an impact of live. The overweight and obese both show 33% and 29% respectively relationship to the impact.

Table 2: Relationship of the impact of the live causing by the risk factors of food security with the nutritional status

Class BMI	Impact to live		
	Not affected (%)	Partially affected (%)	Most affected (%)
Underweight	9.1	5.6	-
Normal	31.8	33.8	14.3
Overweight	45.5	29.6	28.6
Obese	13.6	31.0	57.1

4.0 Conclusion

4.1 Food and beverages; living place and clothing; transportation; electricity; water access were the most risk factor of food security during the flood.

4.2 There is an association of risk factors with the number of the sick people and also the meals intake during the flood.

4.3 Overweight category was the most impacted by life by the risk factors of food security during the flood disaster.

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POST DISASTER WASTE MANAGEMENT ADAPTION DISASTER MANAGEMENT GUIDELINES

Project Information

Project Leader	: Dr Zulhabri bin Ismail
University	: Universiti Teknologi Mara (Uitm Shah Alam)
Address	: Centre of Studies For Construction, Faculty of Architecture, Planning and Surveying, 40450 UiTM Shah Alam, Selangor
Contact number	: 019-2172309
Email	: zulhabri@salam.uitm.edu.my
Project Members	: Roshana Binti Takim (Dr) Emma Marinie Binti Ahmad Zawawi (Dr) Nor Syazwani Binti Yusof

1.0 Introduction

Malaysia is considered a middle-income country and has emerged as a multi-sector economy. In the past, Malaysia has faced a variety of magnitudes of disasters consisting of structural collapse, earthquakes, biological, landslides and meteorological incidents (Malek, 2005). Additionally, the effects of climate change have resulted in an increasing amount of climate related disasters, resulting in a newfound threat to Malaysia's health and development. But now, the disaster either natural disaster; or man-made disaster, are still happen and became worst from year to other year. Every single days, we're produced a lot of waste and it is one of the 'common phenomena' in Malaysia. As we know, every year our country, Malaysia suffers natural disasters such as flooding and landslides caused by torrential rain ending of the year, 2014. Meanwhile, disaster often create a large of volumes of debris and waste especially in the flooding events and it's exceeding from existing issues of solid waste management capacity. Waste management plan was related on the current planning of post disaster waste management that conducted by the several of agencies and relevant stakeholders which are who are involved directly or indirectly in disaster waste management. Lack of management on a clean-up effort can exacerbate these problems, and can result in a slow and costly recovery which is potentially risky to public and environmental health in both the short and long term (Brown & Milke, 2009). So, disaster waste management is very important to curb this issue. The aim of this research to highlights possible points for waste management adaption into Disaster Management Guidelines in Malaysia that have been adapted in four countries namely, Malaysia, Japan, North Carolina, and Indonesia and how to effectively plan for managing the disaster waste in Malaysia regarding on the existing guidelines (MKN- Policy of Directive 20), act of Solid Waste and Public Cleansing Management Act 2007 (Act 672), and other policies related on post-disaster waste management especially on flooding. The extent of disaster waste affecting to the environment; the needs of the waste management to be adopted into disaster management guidelines; and to propose post disaster waste management adaption into disaster management guidelines in Malaysia has been developed by researcher as a guide in future. Regarding the existing act, guidelines and policies, there are only focus on solid waste management nor on the disaster waste management. In case of that, our country can follow the policies from the other countries as guidelines such as from Japan and Indonesia; and at the same time can adopt from it.

2.0 Methodology

This research employed extensive literature review, documentary review and semi-interview session among the selected organization involved in disaster waste at the end of the December, 2014.Extensive literature review on the chronology of disaster in Malaysia, comparative studies on the existing policies implemented in other selected countries. Observation parameters on disaster waste at the affected area in Malaysia which is Temerloh, Pahang and Kuala Krai, Kelantan. The overview done by this research follow by documentary and reporting had done by government sector based on previous operational system in managing disaster waste. Additionally, the current policies and technologies used in waste management. Hence, this qualitative research method has been design by way of semi-structured interview. The results shows the opinions from industry players regarding the ways of how they manage wastes on disaster waste at affected area of disaster, the systems used and also the major improvement that may hinders them from adopting sustainable waste management from the other countries.

TABLE 1: Respondents' Detail

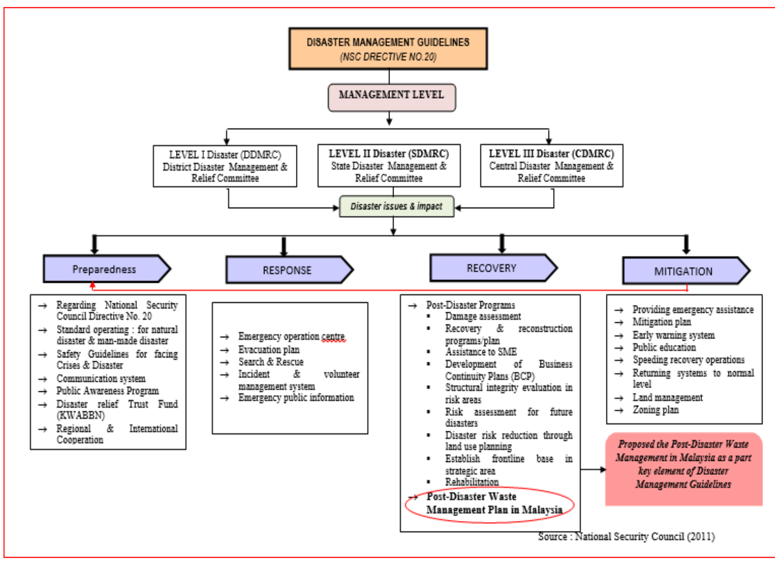
	Organisation	Department / Unit	Respondents	No. of Respondent
G1	National Security Council (NSC)	State Disaster Management and Relief Committee	Senior Assistant Engineer	1
G2	National Solid Waste Management Department	Technical Department of Ministry of Urban Wellbeing, Housing and Local Goverment	Senior Assistant Director	1
G3	Temerloh Municipal Council	Public Health & Licensing Unit	Senior Assistant Public Health	1
G4	Kota Bharu Municipal Council	Human resources Department, MPKB	Senior Assistant Offer	1
G5	Kuala Krai District Council	Public Health & Licensing Unit	Assistant Director	1
G6	Department of Environment (DOE)	Flood Management Unit	Environmental Officer	2
G7	Solid Waste and Public Cleansing Management Corporation (SWCorp)	Research Centre for River Management	Engineer and Assistant Engineer	4
P1	Alam Flora Sdn. Bhd.	Disaster Waste Management and Operational Division	Assistant Manager I and Supervisor Landfill	3
P2	SWM Environment Sdn Bhd	Management of Solid Waste and Operational Unit	Senior Assistant Operational Management	1
P3	Kualiti Alam Sdn. Bhd	Operational and Waste Management Department	Landfill Operation Assitant Manager	1
P4	Standards and Industrial Research Institute of Malaysia (SIRIM)	Enforcement & Legislation Unit	Executives Enforcement, Marketing & Business Development Development Section	1

*G-Representing government sector/ organisations
*P-Representing private sector/ organisations

Semi -Structured interviews was conducted in between on October 2015 until February 2016. Table 1 provides information on the respondents that were involved in the disaster waste management in Kelantan and Pahang. Thirty (30) respondents have been identified by researcher and seventeen respondents (17 of respondents) were agreed to participate. The selection criteria were involvement in post disaster waste management and minimum of 5 years working experience. The respondents are categorized into two; government and private sector/organizations. Eleven (11) respondents from government sectors involved in disaster waste management in Temerloh, Pahang and Kuala Krai, Kelantan which are National Security Council, National Solid Waste Management, Temerloh Municipal Council, Kota Bharu Municipal Council, Kuala Krai District Council, Department of Environment & Solid Waste and Public Cleansing Management Corporation (Swcorp Pahang & Swcorp Kelantan). In addition, six (6) respondents from private sectors/organizations involved in flood management and experience handling disaster waste management in their affected area including Alam Flora Sdn. Bhd (Pahang & Kelantan), SWM Environment Sdn. Bhd (Pahang), Kualiti Alam Sdn. Bhd (Pahang) & SIRIM Sdn. Bhd.(existing guidelines on landfill safe closure). For government sector, the organisations selected were based on their roles in flood management and roles of managing disaster waste in Malaysia. Meanwhile, the private sectors were selected based on their experience on handling flood in their operational system project of disaster waste based on their past experiences. Finally, conclusions are drawn in order to achieve the aim of this research. Recommendations are made for further research.

3.0 Results and Discussion

The establishment of the improved of disaster waste management plan in Malaysia was drawn from the analyses of the data collection comprising of the document reviews and the exploratory semi-structured interviews. The results from the data analyses have formed a basis and needs for establishing post-waste management to improve disaster management guidelines pertaining to waste management in Malaysia. Figure 1 shown the Proposed key Element in Post-disaster Waste Management into Plan Disaster Management guidelines in Malaysia. Valuable lessons were learned from past disasters and they had greatly influenced the evolution of safety and disaster management in the country. Some of these were land-marked disasters where various regulations, acts, and laws were amended or introduced, and formation of specialized functional bodies. Hence, it appears that the current policy and system are more resulting from reacting to the problem at its root. Setting clear guidelines about the objectives of waste management and adopting certain principles would allow for such a proactive stand. The case of Japan, Indonesia and North Carolina showed that this may lead to steady improvement in Malaysia as an 'Options' in proper guidelines in disaster management.



Post-Disaster Waste Management Plan in Malaysia

PHASE 1: Set Up the Structural of Coordination

- Combination with the disaster management government sector + private sector + volunteer
- **who will be handle: local authorities (Department of food and health quality control division cooperate & Department of vector and cleanliness monitoring division)**

PHASE 2: Waste Classification & Waste Assessment

- Estimating the amount of waste & classification of waste

PHASE 3: Collection & transportation of waste

- Process of colleting waste, estimation of time, transportation factor and quantity of manpower

PHASE 4: Handling of waste

- Encourage separation waste
- Recycling, reused, incineration Disposal/Landfill

FIGURE 1: Proposed key Element in Post-disaster Waste Management into Plan Disaster Management guidelines in Malaysia

The results of the presented above to provide some insights into the best practices in terms the managing the waste and effective improvement in disaster management guidelines pertaining to waste management in Malaysia in terms of flood preparedness plan either in short terms or in the long-term. In relation to this, there is an opportunity of development to be continued by other researcher in order to give contribution in sharing ideas and solutions towards these issues. In fact, it was not mentioned in the form of post-disaster solid waste management. Thus, in that case, the researcher suggested had best practices on post-disaster waste management in Malaysia as a platform and guide when disaster happens again. So, regarding on the planning above, there are five (5) phases to go through in the cycle of post-disaster waste management plan in Malaysia. Firstly, setting up the structural of coordination. This phase will see a combination of government sector cooperation with the private sectors, and also from the volunteers. The government sector that have to in-charges in local authorities which are (Department Of Food And Health Quality Control Division Cooperate and Department Of Vector And Cleanliness Monitoring Division + Solid Waste & Public Cleansing Management Corporation) and private sector which are Alam Flora Sdn Bhd. Alam Flora's proven track record as an excellent service provider in waste management with close collaboration with the local municipalities or local authorities (LA). This combination will find a wise and quick solution to overcome the issues of the disaster waste especially post-disaster waste problems after flood disaster happens. Secondly, waste classification and assessment. This phase is essential and compulsory whereby to know the classification of the post-disaster waste such as plastics, clothes, woods and others. Consequently, it will make it easy to the sectors that involved on estimating the amount of the waste. But the most of the waste from flood disaster are mixed waste. Collection and transportation of waste is the next phases involved. Systematic process of collecting the waste results to the less time used. During collecting the waste, the communities should cooperate with the organization that involved in managing the waste which they have to collect all the disaster waste/bulky waste neatly in front of the shoulder of the road on the day of collection. Thus, transportation facilities need to be suitable with the types of waste such as lorries, backhoe and others so it can save a lot of time in terms of time management of handling the disaster wastes. An independent and high skilled worker or manpower play the crucial roles in this phase so it make the process run smoothly and accordingly. Recycling, reused, incineration and disposal/landfill method which are one of the important phases which are involved in handling the waste. The waste that still can be use, will be recycled especially paper. Disposal/landfill method, are the next advanced process if the waste cannot be recycled anymore in order to protect our nature. Lastly, the final phase which is the most important process is reporting and documentations. The preparation and submission of completed reports on the current issues will be used as references on the lesson learnt in developed countries. From the process above, they need to have at least a general idea and standardized of guidelines on handling extreme cases or disaster to avoid randomness and improve the efficiency. Hence, this is one of contribution and significance in promoting the disaster waste management for Malaysia.

4.0 Conclusion

From the research above, the researcher can conclude that:

4.1 Thirty (30) respondents have been identified by researcher and seventeen respondents (17 of respondents) were agreed to participate. The selection criteria were involvement in post disaster waste management and minimum of 5 years working experience and they were had an experienced on managing the disaster waste in flood disaster at the end of December. The respondents are categorized into two; government and private sector/organizations. The organization that eperts in managing disaster waste were National Solid Waste Management, Temerloh Municipal Council, Kota Bharu Municipal Council, Kuala Krai District Council, Department of Environment & Solid Waste and Public Cleansing Management Corporation (Swcorp Pahang & Swcorp Kelantan) and also Alam Flora Sdn. Bhd (Pahang & Kelantan). Regarding on the respondents, there are not had a proper plan on managing disaster waste and when it is happen, immediately, they were decided and organized all the events ‘ad-hoc’ to solve all the issue and problem at the affected area in Kelantan and Pahang.

4.2 Since in Malaysia have implemented an act for solid waste management; Solid Waste and Public Cleansing Management Act 2007 (Act 672), there are still lack of regulations and the government policies are still not effectively taken action by industry practitioners. The policies are not enough to encompass whole concept of sustainability. Hence, the government sector required to enforce initiatives by providing a legislative and regulations to manage disaster waste in Malaysia. In the same time, the government sector should provide a proper or initial plan in the peaceful time regarding the current initiatives of disaster waste management. Private sector was able to support the waste management system in case of disasters by providing the needed tools to the authority, and by conducting the work as contractors or subcontractors. However, the processes on managing disaster management in Malaysia are gathered all the debris and waste in the temporary storages, then classified them and sent them to the proper ending point.

4.3 The time to recover from the disaster effects relied on the work seriousness of the responsible authorities or organisations. Thus, the related organisations and stakeholders will get a lot of advantages in proper managing disaster wastes and their responsible to ensure sustainable development is successful at least a general idea about handling extreme cases to avoid randomness and improve the efficiency of managing disaster waste in developed country. There was related with estimated time for the area to return to the normal situation. Therefore, in Malaysia, there was no time estimation for the recovery phase to end, and in many cases the problems remained unsolved for long time.

4.4 In fact, Malaysia tends to schedule all the work process and assess their achievements. The role among the Malaysian government and private sector in managing disaster waste also needs to be restructured and improved by their skills on managing the waste. Recommendations to improve the suggestions on the post- disaster waste management in Malaysia were highlighted which involves the current environmental issues and the adoption of effective disaster waste management will offer environmental protections for Malaysia. Thus, in long term it had offer an economic advantage to the Malaysia and at the same time it had improved disaster management guidelines pertaining to waste management.

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KNOWLEDGE BASE FRAMEWORK TO SUPPORT DECISION MAKING FOR FLOOD DISASTER RELIEF

Project Information

Project Leader : Dr. Nor Balkish Zakaria
University : University Teknologi MARA, UiTM Cawangan Johor, Segamat
Address : KM 12, Jalan Muar, 85200 Segamat, Johor
Contact number : 014-6332362
Email : balkish@johor.uitm.edu.my
Project Members : PM Dr. Jamaliah Said
Ida Suriya Ismail
Mas Ervina Samsuddin

1.0 Introduction

Malaysia has experienced several extreme weather and climatic events, which have caused flood disaster in several places in the country. Only one main guideline for disaster management appeared. It is a policy that is administered from the Prime minister's department to manage all types of disasters including flood. This policy did not specifically enacted to cater flood management; it is merely an act to transform disaster planning policy into government machinery action together with several other legislations. This policy also fails to highlight the detail framework that could be used to support any prompt decision making during the flood disaster. Furthermore, inaccurate decisions could bring negative impact in terms of monetary and other limited resources.

In reality, flood risk management requires more than just responding to the emergency that has risen. The biggest challenge appears whenever only a single guideline policy available without a clear knowledge–base framework for the disaster relief organisatios or bodies to depend on during disaster. This would lead to several difficulties to identify, control and manage the most useful information out of available information options in order to support any urgent decision making process during the flood crisis.

The above points shows that Malaysian Government needs to have an effective flood governing instrument. Thus, this study hence aims to develop a knowledge-base decision making framework that help to provide disaster relief information to support any urgent decision making. During disaster, normally there are several alternatives emerge, however any improper decision would severely affect monetary implication and resources wastage which are so crucial during the disaster period.

2.0 Methodology

This knowledge-based framework for decision makers is establish based on the sets of guidance and key policies set by the standard flood disaster practise of four development countries, which are the United Kingdom, the United States of America, Japan and New Zealand. Besides that, series of interviews were held with Kuala Krai 2014 flood victims, Jabatan Pertahanan Awam Kota Bharu, Pertubuhan Kebajikan Ikstisas Negeri Kelantan, Bomba Kuala Krai, District Officer Kemaman and Kluang.

Despite of the guidance that this knowledge-based framework could serves, this framework only provides information and planning assumptions to inform and encourage contingency flood planning. It is not intended to provide detailed operational guidance for individual emergency planners or responders. With the target to protect human life and alleviate suffering; and, as far as possible, property and the environment while supporting the continuity of routine activity and the restoration of disrupted services at the earliest opportunity, this framework first discusses the 'concept of emergency level during flood crisis operation' (CELFO) to cater the specific arrangements for the response to flood emergency. The flow of this knowlwedge-based framework continues with the discussion of the roles and timing of flood crisis reports. It is vital that the rescuing teams that's involve during flood rescue operation to gather information on the impact of flooding incidents as soon as possible after it has happened. Early intelligence is important for flooding as weather systems track across the country and different impacts can be seen in different areas.

Early reporting of flood impacts means that scarce resources can be prioritized and the need for any government support can be determined. It can be used to provide local responders and those who work across wider areas, with a broader picture of what is happening.

This knowledge-based framework also provides a list of several flood rescue agencies and government bodies. A table of decision support overview of services is served by this famework. This knowledge-based framework also prepares a table of vulnerability identification to aid the identification of potential vulnerable people or group that need the help in priority.

An important guidance for flood rescue arrangements is discussed and presented in the framework. This discussion is in the form of process flow arrangement beginning with the identification of risk of a flood event requiring additional specialist flood rescue assets by the authorities.

This framework finally draw the concept of information flow that should be obtained and prompt delivered during the flood incidents. Risk management factors are also part of the issues highlighted in the overall concept.

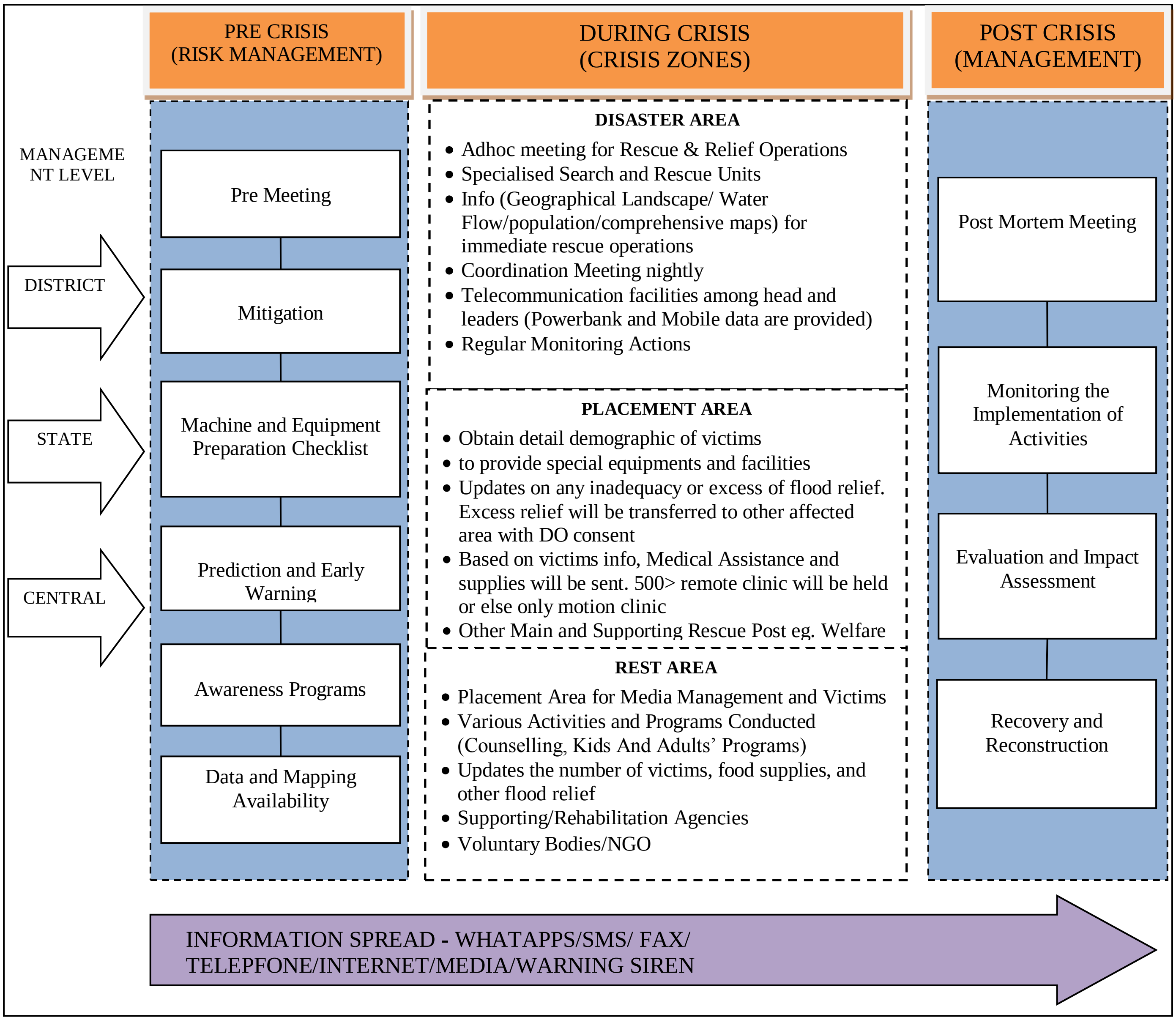

FIGURE 1. Knowledge-base decision making framework for disaster relief during flood crisis

4.0 Conclusion

4.1 Management level: The Core Decision Maker among District, State and Central levels.

In the case of flood disaster that affect specific place such as village to a large area like a state will definitely involve many parties that responsible to mitigate, monitors and makes appropriate recommendations for recovery process. This paper recommends three management levels that have power to make a decision through the entire phases, which are district levels, state levels and central levels.

4.2 Pre Crisis: Risk management

In this phase six key activities have been identified to ease the process of decision making when the real disaster happened. The activities are as follows: Pre-meeting among the district, state and central levels, Mitigation activities based on the previous flood disasters, Prepare checklist for appropriate machine and equipment needed, Prediction and early warning need to be spread to public, Create awareness programs for public awareness, Prepare data and mapping availability.

4.3 During Crisis: Crisis Zones

The preparation during pre-crisis will determine the smoothness of the relief during crisis zones. It is not much can be done especially in the worst area. The three areas are as follows:

Disaster Area

- Adhoc meeting for Rescue & Relief Operations
- Specialized Search and Rescue Units - At the flood area only selected body can enter and help the victims. The government due to the safety reasons has regulated this policy.
- Info (Geographical Landscape/ Water Flow/ Population/ Comprehensive Maps) for immediate rescue operation – It will be valuable for the rescuer if they are familiar with the geographical landscape of disaster area.
- Coordination Meeting Nightly –The meeting will focus more on rescue efforts instead of delivery of food supplies.
- Telecommunication items among head and leaders (Powerbank and mobile data are provided – This is to make sure the leaders are updated each other with the current situation, Whats application (WhatsApp) group also been created.
- Obtain details demographic of victims to provide special equipment and facilities

Placement Area

- Regular Monitoring Actions – Regular monitoring activities need to be performed for the purpose of safety reasons.
- Updates on any inadequacy or excess of flood relief – Excess relief will be transferred to other affected area with District Officer consent.
- Based on victims information, medical assistance and supplies will be sent around 500 or more remote clinic will be held or else only motion clinic will be provided.
- Other Main and Supporting Rescue Post – In the placement area other supporting rescue post such as welfare department and district officer can also help the victims to ensure their comfort.

Rest Area

- Placement Area for Media Management and Victims – Media play important roles to deliver the correct and current information to public for the purpose of assistance and supplies.
- Various Activities and Programs Conducted – A lot of programs can be done in the rest area such as counselling, kids and adult’s programs to reduce trauma and anxiety among victims.
- Updates the number of victims, food supplies and other flood relief
- Supporting / Rehabilitation Agencies
- Voluntary Bodies/NGO

4.4 Post Crisis: Crisis Management

This is to ensure the continuity of effectiveness and efficiency of flood knowledge management to support decision making in flood disaster relief. It can help to make sure that all actions taken are monitored, assessed for improvement and help the recovery process after the flood disaster. There are four key activities have been identified:

- Post mortem meeting to discuss on before and during the crisis.
- Monitoring the implementation of activities.
- Evaluation and impact assessment.
- Recovery and reconstruction is a process after the flood disaster.

4.5 Information Spread

Accurate information regarding flooding should be spread in all the three phases. One of the most important is the early warning system (warning siren) used to inform people or villagers about the possibility of flood in order for them to make early preparations to saves important documents and things.

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CONSOLIDATING POLICY AND LEGAL FRAMEWORK FOR NATIONAL DISASTER RESPONSE

Project Information
Project Leader : Lt Kol Jamal Rodzi bin Dahari
University : National Defence University Malaysia
Address : Sungai Besi Camp, Kuala Lumpur
Contact number : 012-3990860
Email : rodzi@upnm.edu.my
Project Members : Lt Kol Dr Mohd Zaini bin Salleh
Dr Salma binti Yusof
Lt Kdr Mazura binti Md Saman
Dr Lokhman Hakim bin Osman

1.0 Introduction

An effective coordination of assistance effort is a key success in managing disaster relief. Thus, policies, regulations and laws should provide ample patronage to disaster victims and those involve in relief operation. Two important aspects of disaster relief are evacuation of disaster victim's process and volunteers involve in relief operation. Hence, this research is aimed at identifying the cavity in current policies and regulations with regards to an evacuation order by the authorities. Consolidation of the rules pertaining to evacuation order then is proposed, to minimize legal barriers that hinder disaster response. The other aspect which become the concern of this research is the management of Non-Governmental Organizations (NGOs) involved in relief effort. Throughout our study, it is ascertained that there was no framework obliging the unaffiliated NGOs to register with the authorities afore the commencement of relief operations. In addition, there is neither Volunteer Protection Act being implemented in Malaysia nor there is a standard insurance available for volunteers. Hence, the prevailing rules are insufficient to response to the above lacuna and there is a necessity to promulgate additional regulation to accommodate the gap and disparity in volunteer's protection.

2.0 Methodology

This study employed qualitative approach combining interviews, focus group discussions and document analysis. Legal research is done by examining legal documents. The study is significant endeavor in promoting formulation of a national legislation for disaster management legislation which covers various players in relief operation and minimize legal barriers which hinder relief operation.

3.0 Results and Discussion

3.1 Evacuation Process

The prevailing statutes and directives displays that there is no explicit provision spelling out the authorities to authorize evacuation order. However, practices show that evacuation order is a matter of decision and discretionary power of the commander on scene at district level or state level depending on the severity of the disaster. In general, DN 20 defers to the District Disaster Management and Relief Committee (Level 1 Disaster) and State Disaster Management and Relief Committee (Level II Disaster) to promulgate their own standard operating procedure to be adopted during disaster. Thus, as a matter of practice, committees headed by District Officer with the advice of police and other agencies at district level are to decide who, when and how to order for evacuation.

In accordance with the operating procedures under the flood relief mechanism, the Department of Irrigation (DID) is the agency responsible to observe closely the flood situation when the river level of the flood warning station reaches the 'alert' level. The DID will recommend the appropriate flood control centers that the flood relief machinery shall be activated. The respective state DID office will carry out the flood forecast operation using the real time telemetric data and river forecasting computer models during the flood season. When the river water level at any forecasting point exceeds the critical level, the forecast will be transmitted to the flood operation centers and other relevant agencies such as the National Security Division of the Prime Minister's Department and the national and state control center for flood relief operation (Mohd Shukri,2015).

Flood relief operation during the disaster requires close cooperation and understanding among various parties involved at the flood plain including coordination district level to be efficient and successful in rescuing victims and reduction of property losses. Ineffective response will create chaos and additional dangers in the flood rescue operations, especially when both road transport and telecommunications are disrupted and electricity supply is short-circuited at the start of the flood and rescue operations must continue throughout the night. Obviously, the flood emergency response to rescue the victims is led by Army and Public Defense Services. Because of that, an advanced and accurate flood warning information system provided in a timely manner before and throughout the flood duration, will also help to reduce the number of flood victim deaths, trauma and property damages. Flood hazard maps should be produced early and disseminated to the public beforehand to help and guide the flood victims to safety in the fastest possible routes when flooding occurs (Mohd Shukri, 2015).

3.2 Volunteers' Protection

In general, the involvement of volunteers in relief efforts are mentioned in Directive No. 20. The organized volunteers group such as RELA and Red Crescent Society has special section mentioning their functions and roles. Enclosure M, items I and J (Directive no. 20) are applicable to statutory bodies, the private sector, voluntary bodies and individuals. Their roles are, inter alia, to help channeling the aid in the form of goods needs during disaster through welfare department, assist in humanitarian tasks including the maintenance of shelters and relief Centre, cooking and serving food, distributing essential items such as clothing, blankets, carry out registration and recovery to disaster victims, evacuation of victims and assisting the health department in providing emergency aid and other emergency assistance and health at the relief centre. According to Enclosure I, these volunteers group will be placed in the green zone, which is the less risky zone, as determined by the commander of operation. The green zones include media management center, relief centre, counselling centre, welfare centre, and logistics distribution centre and aid agency.

DN 20 provides general enabling provision with regards to the involvement of the unaffiliated volunteers group in the relief operations. None mention of registration and management of these group, the legal protection in any case of mishap and negligence, criminal liability, accountability in handling unsolicited donations and raised public funding and general liability. It can be said that, as it is now, the policy allows volunteers to operate in relief operations. However, there is no guidance or guidelines to regulate their existence in the disaster area.

It is observed that there are differences between an affiliated group of volunteers and non-affiliated group of volunteer. The term affiliated are being defined as volunteers who are attached to a recognized voluntary or nonprofit organization and are trained for specific disaster response activities. Their relationship with the organization precedes the immediate disaster, and they are invited by that organization to become involved in a particular aspect of emergency management (FEMA, 2004). On the other hand, unaffiliated volunteers are not part of a recognized voluntary agency and often have no formal training in emergency response. They are not officially invited to become involved but are motivated by a sudden desire to help others in times of trouble. They come with a variety of skills. They may come from within the affected area or from outside the area.

4.0 Conclusion

4.1 By scrutinizing the prevailing laws, it can be concluded that government relief agencies discharging their duties in disaster relief operation based on different footing of law, although the ultimate objectives are for protection of life. These law need to be consolidated under one roof of national legislation in the form of National Disaster Act. It is high time for Malaysia to legislate a comprehensive National Disaster Act to cater legal issues of authorization of evacuation, the capacity to make this decision compromised (for example, competing tasks, personal conflicts, time or external pressures, knowledge and experience), legal constraints on the authority to evacuate and legal protection to government, rescuers and victims in any case of negligence by any party.

4.2 In formulating evacuation policies and guidelines related to evacuation order, the authorities should consider to develop the rules to nurture compliance with mandatory evacuation orders by eliminating those factors that impede full voluntary compliance, for example, by developing warning systems that are reachable and able to be understood by all victims in the affected area.

4.3 The authorities should spell out their legislative intent regarding implementation of mandatory evacuation orders. Law enforcement agencies should include in their SOP procedures on forcible evacuations and use of force related to evacuation enforcement. It is not recommended that police departments adopt a unilateral policy of evacuation by force, but they should be ready to recognize those circumstances where forced evacuations may be sanctioned.

4.4 SOP should be drafted in a way to give fair and non-discriminatory treatment to all affected disaster victims regardless of their status in community, their education level, their political alliances and any other differences which may result them to be treated unfairly by the relief agencies and volunteers.

4.5 It is proposed that the National Security Council should draft the Standard Operating Manual for unaffiliated volunteer to be adopted at district level. The manual shall serve as guidance in planning and managing unaffiliated volunteer during all phases of emergency management. It may regulate the registrations of volunteer, reporting of duties to the commander on scene, the legal authorization of managing relief centre, reporting of fund raising, auditing, and insurance and takaful protection for volunteers in the course of action.

4.6 During the response phase, Volunteer and Donation Coordination Team (VDCT) and Volunteer Reception Center (VRC) should be activated.

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DETERMINATION SAFETY INTEGRITY LEVEL (SIL) BY USING LAYEROF PROTECTION ANALYSIS (LOPA) FOR FLOOD EMERGENCY RISK MANAGEMENT

Project Information
Project Leader : PM Dr Sa'ari bin Mustapha
University : Universiti Putra Malaysia (UPM)
Address : Jabatan Kejuruteraan Kimia dan Alam Sekitar, Fakulti Kejuruteraan, UPM
Contact number : 03-89466303/1
Email : saarimust@gmail.com

1.0 Introduction

Floods in Malaysia occur almost every year especially during Northeast Monsoon whereby potentially to be transformed into severe floods, especially along the east coast states of Peninsular Malaysia namely Kelantan, Trengganu and east coast of Johor and in states of Sabah and Sarawak. Heavy rain in short period of time typically in few days is main factor to cause major flood, besides supported by others factors such as land clearing for agricultural purposes also due to rapid residential and industial development. In 1971, Permanent Flood Control Commission was established (Suruhanjaya Tetap Kawalan Banjir) where a master irrigation plan for major towns was introduced in which at first time flood warning system was implemented (Nizam Yatim, 2007). The flood warning system involves monitoring of water at flood warning station, when river the Department of Irrigation and Drainage (DID) begins to monitor closely the flood situation. As it reaches the warning level, the DID informs the relevant flood control centers to activate flood relief mechanism by whom the community as well as responders teams are alerted for evacuating and releif.

After eight decades of the enforcement, a major flood occurred in 2014. The flood involved six states which were Kelantan, Trengganu, Pahang, Perak, Perlis and Johor. There were 500,000 people were evacuated, 25 people dead and lost in billions of Malaysia Ringgit. The disaster was alarming and studies are required to clarify the burning issues likes global warming and inappropriate development at the vulnerable areas were believed to be the main sources of the calamity.

Generally flood prevention involves two approaches *viz* structures and non-structured measures. The structural measures include constructing flood retention dam, widening sections of river channel, building of flood protection bunds (levee and concrete wall), by-passing flood ways (diversion), converting used mining ponds for flood attenuation and directing water run-off to retention dan detention ponds. The non-structured measures comprise of restriction development on vulnerable flood areas, land zoning, resettlement of population, flood proofing, flood forecasting and warning system and flood mitigation.

Factors cause flood disaster include direct and indirect causes; a direct cause is unusual heavy downpour which more than capacity of drainage system and rivers can take, which prone to transform to flood, while indirect cause is solely due man made problem such as improper logging and clean up land. An integrated and continuous approach must be sustainable to solve the recurrent flooding. Assessing of major flood which prone to esclates to wide areas requires a risk assessment method. Risk determination is obtained either by referring to risk matrix or LOPA (Mohanad, 2010). Application of LOPA method is originally in the context of defining safety Integrity Levels (SILs) for electronic/programmable related system. However, it is found extensively being applied in process industry and has intoduced in disaster management. Incorporating safety safety integrity levels (SILs) to safeguards natural disaster events demands a risk based solution. Selection of specific protective layers (IPLs) is subjected to flood control measures, commonly deduce from opinions of expertises and experience of responders. Application of LOPA in flood emergency risk management for is newly approach. Evaluating the risk scenario and comparing it with risk tolerance criteria and after all it indicates either the proposed safeguards are adequate or not. Establishment of risk levels or later on refer to SILs might be based on national and international standards, regulations and goverment policies supported by good engineering practices/technology option and input from stakeholders. All the prevention and control measures demand a huge capital and operation costs, involvement of organisations or agencies, use of manpower and thier performances appraisal. Thus, evaluation of the best technology option for risk reduction evaluation is essential when the safeguards are vulnerable extreme conditions during the monsoon. Reliable information on the proposed prevent and control measures reflect the integrity of relevant authorities. After all, residue hazards to be be screened further and the consequences will be determined by calculation/simulation.

Major floods in Malaysia were recorded happened in 1931, 1947, 1957, 1967, 1971, 2007, 2010, 2012 and 2014 during North East Monsoon from October to March every year. For period 1961-2006 the frequency flood in Kelantan has indicated that the water level reached the dangerous level 23 times (Tuan Pah Rokiah, 2013). By constructing of proposed Kemubu Dam and proposed Lebir Dam might reduce forty percent of the impact and further flood reduction could be expected by constructing the proposed levee at bothsides of riverbanks of Sungai Kelantan from Tanah Merah through Pasir Mas to Kota Bharu(UPEN, 1989). As said, risk of flood can not be totally disappered although the structure and non-structure flood prevention in place. Thus, the IPLs (the structure and non-structure flood prevention) must be continuously revised and updated by consulting with expertise and authorities.

Consequence will be defined in term of losses of life and property and it size and tolerance limits, which to be referred to related organizations. Losses such as injuries and fatalities of people, damage to the environment, or financial losses are terms used to express the target risk levels.

SILs to be defined from which it would be useful to the related agencies whose dealing with flood emergency risk management. The outcomes of analysis will be used to assess the risk levels and for identifying suitable safeguards (IPLs) to enhance the existing of flood control and risk management.

A friendly tool/devise/code (LOPA) was developed where users can key in the data of a intiating event into a software and configure a number of Independent Protective Layer (IPLs) (in option) for risk assessment. Furthermore, it aims to help flood emergency risk management decision makers to compliance with the regulatory requirements and standards.

2.0 Methodology

LOPA includes the method that falls between qualitative and quantitative methods. There several steps involve in developing this analysis. Below is the summarization of the steps or methodologies that to be used in the whole project:

Step 1 : Identification of the consequences to screen the scenarios
Step 2 : Selection an accident scenarios
Step 3 : Identification the initiating event of the scenario (flood) and determine the initiating event frequency (events per year)
Step 4 : Identification of the IPLs and estimate the probability of failure on demand of each IPL.
Step 5 : Estimation of the risk of the scenarios by mathematically combining the consequences, initiating event, and IPL data

The overall activities using LOPA method is depicted in Figure 1;

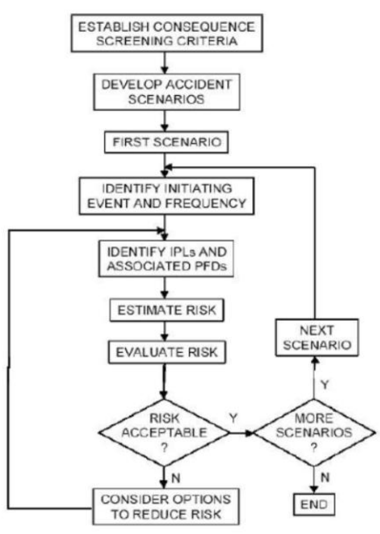

Figure 1: Flowchart of Activities in LOPA Method

Step 1: Identifion the consequences to screen the scenarios

In LOPA, consequences are estimated to an order of magnitude of severity. The consequences are the undesirable outcomes of accident scenarios There are various types of consequence analysis used in LOPA such on effect the hazardous event to lifes, property, environment and community. The organization with its resources estimate the consequences might be onto the receptor e.g. people or community and its be done with attentive evaluation.

Step 2: Select an accident scenarios

A scenario is an unplanned event or sequence of events that results in an undesirable consequence. Each scenario consists of at least two elements:

i. An initiating event that starts the chain of events ;
ii. A consequence that results if the chain of events continues without interruption;
iii. Enabling events or conditions that have to occur or be present before the initiating event which yield consequence;
iv. The failure of safeguards (which may be IPLs).

Once a scenario has been identified, it must be developed and documented to the level where a basic understanding of the events and safeguards is achieved. The scenario may not be initially understood completely and may undergo revisions. Once the initiating event is identified for a specific scenario, the analyst must determine whether any enabling events or conditions are required for the initiating event to lead to the consequence. The next step is to confirm that the consequence is stated using the same criteria as the LOPA method.

Step 3: Identify the initiating event of the scenario and determine the initiating event frequency (events per year)

For LOPA, each scenario has a single initiating event. The frequency of the initiating event is normally expressed quantitavely of events per year. The initiating events, should be reviewed, verified as validated initiating events of the following consequences. Any causes that are incorrect or inappropriate should be either discarded or developed into valid initiating events. This step covers searching of source of frequency data, selection of failure rates, derivation of initiating event frequency from failure data, time at risk, adjustment of frequency rates and high demand mode.

Step 4: Identify the IPLs and estimate the probability of failure on demand of each IPL.

An IPL is a device, system, or action that is capable of preventing a scenario from proceeding to its undesired consequence independent of the initiating event or the action of any other layer of protection associated with the scenario. In order to be considered an IPL, a device, system, or action must be:

i. Effective in preventing the consequence when it functions as designed,
ii. Independent of the initiating event and the components of any other IPL already claimed for the same scenario
iii. Auditable; the assumed effectiveness in terms of consequence prevention and PFD must be capable of validation in some manner.

The basic requirements of effectiveness, independence and audit ability for an IPL are determined by several methods. The simplest is to use a written design basis, or IPL summary sheet, which must be available for review by the LOPA team or analyst.

Step 5: Estimation the risk of the scenarios by mathematically combining the consequences, initiating event, and IPL data

The following is the general procedure for calculating the frequency for a release scenario with a specific consequence by following equation,

$$f_i^C = f_i^I \times \prod_{j=1}^{j} PFD_{ij} = f_i^I \times PFD_{i1} \times PFD_{i2} \times \ldots\ldots\ldots\ldots PFD_{ij}$$

.

Where:

f_i^C is the frequency for consequence *C* for initiating event *i* f_i^I is the initiating event frequency for initiating event *i*

PFD_{ij} is the probability of failure on demand of the *j*th IPL that protects against consequence *C* for initiating event *i*.

The Equation is applicable for low demand situations that is, f_i^I is less than twice the test frequency for the first IPL.

Step 6: Making Risk Decisions
Three basic types of risk judgment are used in conjunction with LOPA:

i. The predominant method is to compare the calculated risk with predetermined risk tolerance criteria through use of various methods;
ii. The second type is expert judgment by a qualified risk analyst;
iii. The third type is relative comparison among competing alternatives for risk reduction, using either of the methods described above.

Result of risk determination from predetermine scenario will be judged based on risk tolerence criteria. The result are presented in three categories which are acceptable, not acceptable or fall in between the regions (intermediate) as depicted in Table 1.

Table 1: Risk Tolerence Criteria (J Ramseh Babu)

Frequency of consequence (/yr)	**Consequence Category**				
	Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**
$10^{0} – 10^{-1}$			Not acceptable		
$10^{-1} – 10^{-2}$					
$10^{-2} – 10^{-3}$			Intermediate range		
$10^{-3} – 10^{-4}$					
$10^{-4} – 10^{-5}$					
$10^{-5} – 10^{-6}$		Acceptable			
$10^{-6} – 10^{-7}$					

The consequence category is defined in Table 2 a slight adjusment on the levels (US Army Corp, 2012)

Table 2: Consequence Category of Flood Impacts

Level of Category	Definition
Category 1	No significant impacts to downstream population other than temporary minor flooding of roads or land.
Category 2	Limited property/environmental damage. Although life-threatening flows are released and people are at risk, life loss is unlikely.
Category 3	Moderate property/environmental damage. Some life loss is expected (1 to 10).
Category 4	Significant property/environmental damage. Large life loss is expected (10 to 100).
Category 5	Extensive property/environmental damage. Extensive life loss is expected (> 100).

In making risk decision, all scenario optons are considered in the operation in order to determine that the incidents are properly analysed by the LOPA approach.

Lopa4Flood Software
The Lopa4Flood was developed a software for analyzing and assessing risk through semi-quantitative methods. The software is provided with facility whereby users can add pseudo protection layers (IPLs) for flood protection to evaluate the proposed protection layers. With provision predetermined risk criteria

then the users can make comparison with a sets of pseudo protection layers (IPLs). Accuracy of IPLs frequencies are critical in the calculation because it later determine the outcome or risk by simulation. The frequencies data can be obtained from historical data, related agencies itself and expertise. Result will obtained spontaneously from completing key in a set of IPLs data. Firstly develop of scenarios of flood with a set of safeguards or protection layers (IPLs), then insert frequency data of initiating and enabling events and then providing frequencies of the IPLs .
Below are the recommended criteria for a scenario :

- If risk 'Acceptable' , no need to add other IPLs.
- If risk 'Unacceptable' or 'Intermediate', it has to add other IPLs, until the result reaches 'Acceptable'

Lopa4Flood Web Application

Lopa4Flood is a web application to evaluate and analyze the risk tolerance for Layers of Protections for flood situation. The web application helps to estimate the consequences cost of possible damages caused by flood in a fast and reliable way. The application supports all devices such as desktop, tablet or smartphones running on any modern web browsers on any operating systems such as Google Chrome and Mozilla Firefox. The codes are built using HTML5 and JavaScript language.

Designing the application

HTML5 is a markup language used for structuring and presenting content on the World Wide Web. It is the fifth and current version of the HTML standard. JavaScript (JS) is a lightweight, interpreted, programming language with first-class functions. JavaScript is most well known as the scripting language for Web pages. HTML5 and JavaScript were chosen because they are supported on all kind of operating systems running on any devices. The codes, which were uploaded to a web server, are accessible to users by accessing the URL www.lopa4flood.com

Building the Graphical User Interface (GUI)

The design of the GUI is based on the markup language (HTML). For this application, a few HTML forms element are used such as input field (text box), and button. For the results view, HTML tables are used. HTML is also used to develop LOPA4Flood as front-end (GUI) and simulate the Consequence Estimation based on the Layers of Protections in the back-end. The computation of the Consequence Estimation based on the Independent Layers of Protections (IPL) data has been written in JavaScript. GUI is very to use and the users can perform the Layers of Protection analysis by filling in a few input fields such as PFD of Initiating Event, PFD of Enabling Event and Independent Protection Layer(s). User can proceed to compute the Consequence Estimation by clicking the "Next" button.

Input Interface

This interface contains various input fields for user to fill in. The user will be required to enter at least three mandatory fields:

i. Probability of Failure (PFD) on Demand of Initiating Event
ii. Probability of Failure (PFD) on Demand of Enabling Event
iii. At least one Probability of Failure (PFD) of Independent Protection Layer (IPL)

The users can fill in up to 6 PFD of IPLs. Figure 2 shows the input fields mentioned above and examples of the value to be keyed in.

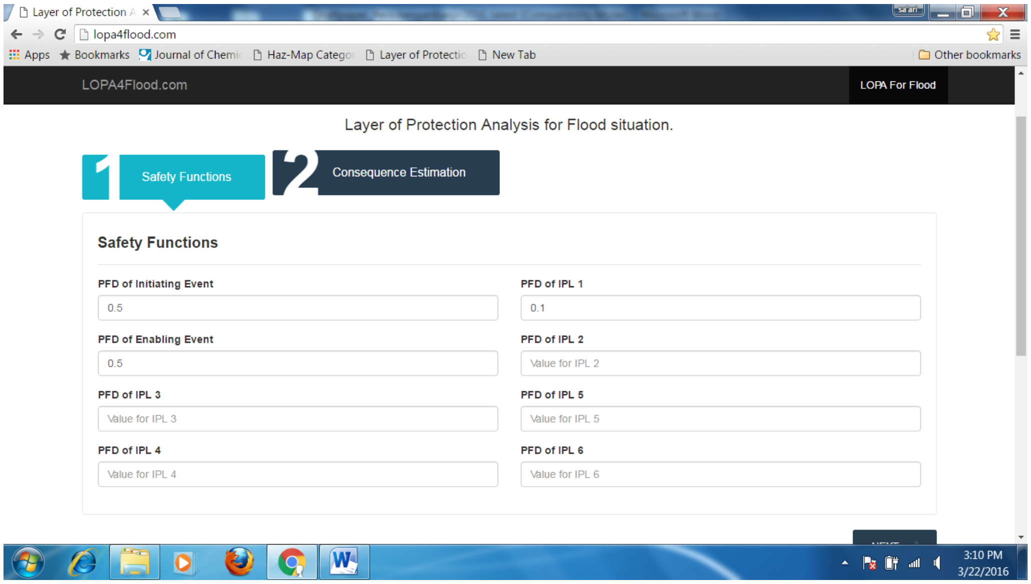

Figure 1: Main Front Page Lopa4flood

<u>Output Interface</u>

After the application performed the computation to estimate the consequence cost, the results for the consequence estimation will be displayed in tabular format. The application will display the frequency of consequence per year and the consequence Impact / consequence characteristic as listed below:

i. No significant impacts to downstream population other than temporary minor flooding of roads or land
ii. Limited property/environmental damage. Although life-threatening flows are released and people are at risk, life loss is unlikely
iii. Moderate property/environmental damage. Some life loss is expected (1 to 10).
iv. Significant property/ environmental damage. Large life loss is expected (10 to 100).
v. Extensive property/environmental damage. Extensive life loss is expected (> 100).

Based on the Consequence Impact/ Consequence Characteristic, the application will show whether they are Acceptable (Green color), Intermediate Range (Yellow color) or Not Acceptable (Red Color). Figure 2 shows the example of the results for Frequency of Consequence / Year of 10^-0.

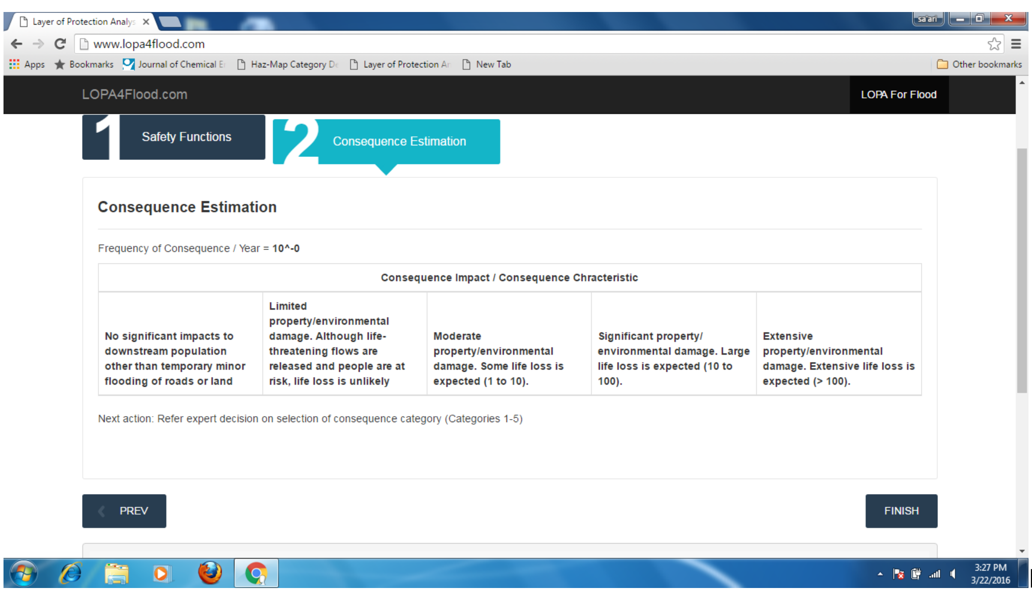

Figure 2: Output of Lopa4flood

3.0 Results and Discussion

Safeguards for control major flood are divided into structural and non-structural measures. Structural measures included dams, levees, embankments and concrete wall, retention detention ponds and diversion. Non-structural measures are river improvement, gaze ting the reserve forest, pond and emergency response plan. The non-structure measures can be considered one IPL or separately for each measure. All the proposed measures involve capital and operation costs, and need careful determination by the authority, organizations or agencies, and other stakeholders because they liable to huge government budget or expenditures for the construction and operation. Residue hazards then further be screened, their consequences will be determined by calculation/simulation by Lopa4flood. The proposed SIL is presented in Figure 3.

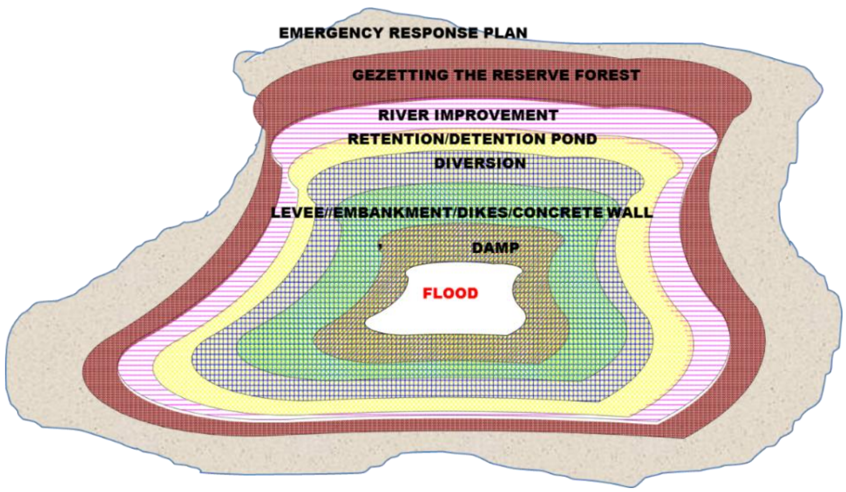

Figure 3 : Proposed LOPA for Flood Prevention and Control

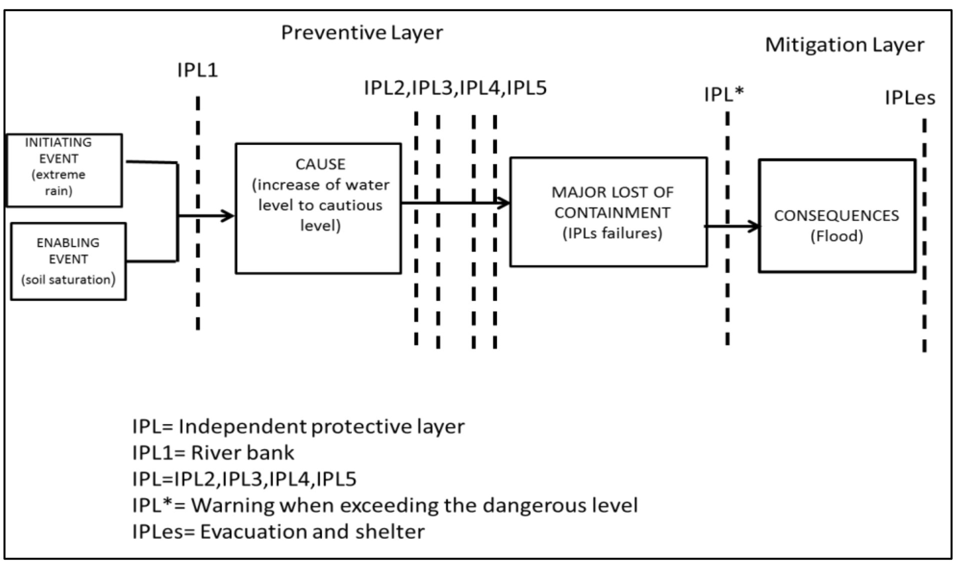

Figure 4: LOPA Scenario

An extreme rain is initiating event with enabling event to cause a major flood. A designed flood prevention system or SIL to maintain the vulnerable area to the safe region. There are seven Independent Protection Layers (IPLs) are proposed. User has given option to either to consider single IPL or multiple IPLs for the prevention analysis. First protection layer i.e. dam inherently safe. Safe design, if properly implemented can significantly reduce the frequency of consequences associated with a scenario. Generally, all structures in flood prevention are safely designed. For time being the measures are consider safer design and thus for calculation their frequencies are 0.1. Therefore, 0.9 is the frequency if the design is not properly safe. The frequencies of imitating and enabling event are considered 0.5 because major flood event in average occur every two years. Risk of the flood scenario was simulated by Lopa4Flood and it was generated essentially from risk tolerance criteria as shown in Table 2.

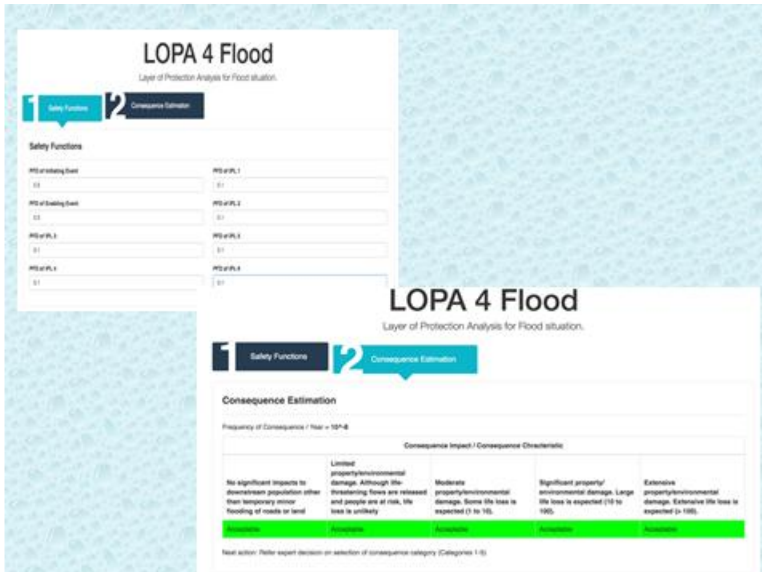

Figure 5: Input and Output of Lopa4Flood

4.0 Conclusion

Important findings of this study are summarized as follows

4.1 Lopa4flood software has been developed to determine the SILs for flood emergency risk management using LOPA method.

4.2 The methodology provided by LOPA was useful in achieving the risk decision making. The decision process was made by comparing the calculated scenario frequency with the risk tolerance criteria.

4.3 Furthermore, LOPA has resolved unwanted conflicts in decision making by giving flexible arrangement of IPLs for estimating the risk of the scenario.

4.4 Lopa4flood is user's fingertips for simulating flood scenario and rapid in obtaining result. It provides options to feasible feasible IPLs and their PFDs for minimizing the risk levels and in fact could satisfy the stakeholders and authorities in determining SILs for Flood Emergency Risk Management.

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PERFORMANCE EVALUATION OF RIVER BASIN ORGANIZATIONS IN CONTROLLING THE OCCURRENCE OF FLOOD - A CASE STUDY OF SUNGAI KELANTAN BASIN

Project Information

Project Leader	: Prof. Dr. Rahmalan Bin Ahamad
University	: Universiti Teknologi Malaysia
Address	: Department of Chemistry, Faculty of Science, UTM
Contact Number	: 012-7095716
Email	: rahmalan@utm.my
Project Members	: Assoc. Prof. Dr. Aweng Eh Rak (UMK), Prof. Dr. Muhammad Hisyam Lee Prof. Dr. Abdull Rahim Mohd Yusoff, Dr. Shamila Azman Dr. Irina Safitri Zen, Dr. Choong Weng Wai Siti Khadijah Dzulkiply

1.0 Introduction

In order to evaluate the performance of river basin organizations (RBOs) in operation within the Sungai Kelantan basin with respect to implementation of flood control strategies this research developed a composite index framework similar to the concept previously applied by Ayala & Juizo for water resources management elsewhere (Gallego-Ayala & Juízo, 2012). The composite index framework includes multidimensional key performance indicators selected from the universal indicators proposed by Hooper (2010). These indicators were aggregated into composite indexes using an additive aggregation method coupled with experts' opinion to differentiate their relative importance. This study aimed to demonstrate the usefulness of composite index methodology as a management tool to identify strengths and weaknesses of the flood control management strategy and areas in need of improvement. So far, there is no report available on the performance evaluation of RBOs with respect to flood control management utilizing composite indexes of multidimensional indicators particularly in Sungai Kelantan basin.

2.0 Methodology

The RBOs were selected based on their stipulated roles and functions that are relevant to flood mitigation strategies according to Hooper's functional description taxonomy (Hooper, 2015). The indicators were selected from a pool of Hooper's universal indicators based on the ability to measure RBOs performance in its multidimensional functions relevant to strategies for controlling floods in the context of integrated river basin management (IRBM) (Hooper, 2010). The ir (1) rs were grouped into different categories covering the RBO's multiple functions relevant to flo ntrol strategies. The qualitative ordinal indicators were transformed into numerical five point ranking system for normalization as follows: (1) non-implementation/non-existence/ no practice; (2) Poor performance/poor existence/poor practice; (3) Fair performance/ some existence/some practice; 4) Good performance/considerable existence/considerable practice; and (5) Excellent performance/full existence/full practice. Weightage assignment to the indicators was conducted via experts opinion approach (EPA). The indicators were aggregated using additive method (Eq. (1)) which allows total compensation among indicators and multiplicative aggregation methods (Eq. (2)) which only allows partial compensation among indicators (Gallego-Ayala & Juízo, 2012).

$$\mathrm{CIPERBO}_{\mathrm{additive}} = \sum_{k=1}^{k=30} w_k^* \, . I_k$$

$$\mathrm{CIPERBO}_{\mathrm{multiplicative}} = \prod_{k=1}^{k=30} I_k^{w_k^*} \qquad (2)$$

where w_k^* is the normalized weight related to indicator k, and I_k is the normalized value of the indicator k (a total of 30 base indicators identified).

The additive aggregation procedure was further applied to different components (i.e. the management categories) in order to establish the links between the composite index values and each component, useful for identifying the strengths and weaknesses in the implementation of flood control strategies at the river basin level by the RBOs. The relative performance of the flood mitigation implementation for each category was derived using expressions similar to Eq.(3) (given as example is the Coordinated Decision Making (CDM) category with three base indicators):

$$\mathrm{CIPERBO}_{\mathrm{CDM}} = \frac{\sum_{k=1}^{k=3} w_k \, . I_k}{\sum_{k=1}^{k=3} w_k} \qquad (3)$$

The primary data sources were gathered using two different types of questionnaires. The first questionnaire was developed to collect detailed information about the implementation performance of flood mitigation strategies by the RBOs. The second questionnaire was designed and administered to flood control and water resources experts relevant to Sungai Kelantan basin in order to determine the relative importance of each indicator and flood control management category. The said experts were selected based on their professional experience, reputation and in-depth knowledge that they have in the fields of flood control mitigation and water resources.

3.0 Results and Discussion

Eleven RBOs were identified relevant to the objectives of the present study. These are (1) the Department of Irrigation and Drainage Kelantan (DIDK), (2) the Department of Agriculture Kelantan (DOAK), (3) the Department of Environment Kelantan (DOEK), (4) the Department of Forestry Kelantan (DOFK), (5) the FELDA Head Quarters Gua Musang (FELDAGM), (6) the Kelantan Selatan Development Authority (KESEDAR), (7) the Gua Musang Municipal Council (MDGM), (8) the Kota Bharu Municipal Council (MPKB), (9) the Land and District Office Kota Bharu (PTJKB), (10) the Town and Country Planning Department Kelantan (TCPDK) and (11) the Kelantan State Economic Planning Unit (UPEN). In order to give a fair indication of their contribution towards flood mitigation, the RBOs were classified as 'authority', 'commission' or 'corporation' based on Hooper's functional description taxonomy (Hooper, 2015). Thus DIDK and UPEN were categorized as 'authority', while MDGM, DOAK, DOFK, TCPDK, DOEK, MPKB and PTJKB were classified under "commission", and FELDA and KESEDAR were categorized as 'corporation".

A total of thirty (30) indicators were selected and grouped into ten categories that are relevant to flood control management (Table 1).

Table 1 Weightage assigned to categories and key indicators for RBO performance evaluation

Category	Weightage	Key Indicator	Weightage
Coordinated decision-making (CDM)	14.24%	International coordination arrangements (ICA)	4.15%
		Consensus-based decision (CBD)	5.14%
		Flood management laws and regulations (MLR)	4.95%
Responsive decision-making (RDM)	11.21%	Dialogue as a decision making tool (DAT)	3.43%
		Address critical problems first (ACP)	4.05%
		Efficient flood control techniques (EFC)	3.74%
Goals and goal shift (GGS)	7.42%	Integrated river basin management (IRB)	3.09%
		Impact assessment procedures (IAP)	1.96%
		Well-defined objectives (WDO)	2.37%
Financial Sustainability (FNS)	10.15%	On-going funding (OGF)	3.81%
		Adequate funding (ADF)	2.96%
		Funding appropriations (APF)	3.38%
Organizational design (OGD)	10.00%	Successive administrations (PSA)	3.19%
		Land and water policies in flood management planning (PPP)	3.62%
		Realities of existing conditions (REC)	3.19%
Role of law (ROL)	8.94%	Enforceable legal and jurisdictional system (ELJ)	4.97%
		Legally trained staff (LTS)	3.97%
Training and capacity building (TCB)	9.09%	Training programs (TPM)	2.40%
		Well-trained staff (WTS)	3.41%
		Training programs in the concept of IRBM (TPC)	3.28%
Information and research (I&R)	10.61%	Information is accessible (RIA)	2.65%
		Utilization of GIS (GIS)	3.01%
		Integrated management system (IMS)	2.30%
		Research collaboration (RCO)	2.65%
Accountability and monitoring (A&M)	11.67%	Accountability mechanism (ACM)	4.86%
		Reporting mechanisms (RPM)	2.92%
		Monitoring system (MNS)	3.89%

Category	Weightage	Key Indicator	Weightage
Private and public sector roles (PPS)	6.67%	Community awareness and participation (CAP)	1.94%
		Manage public involvement (WPI)	2.32%
		Bottom sector initiatives (BSI)	2.41%

The results obtained for the composite indexes that reflect performance of Kelantan river basin organizations with respect to flood control management is summarized in Table 2. It is important to point out to the difference in values obtained for the two composite indexes, taking into consideration the degree of compensation among the indicators.

Table 2 Values of $\mathrm{CIPERBO}_{(additive)}$ and $\mathrm{CIPERBO}_{(multiplicative)}$ for RBOs in Sungai Kelantan basin

River Basin Organization	**Composite Index Values**	
	$\mathrm{CIPERBO}_{(additive)}$	**$\mathrm{CIPERBO}_{(multiplicative)}$**
Department of Irrigation & Drainage Kelantan (DIDK)	4.24	4.05
FELDA Head Quarters Gua Musang (FELDAGM)	3.20	2.82
Department of Environment Kelantan (DOEK)	2.97	2.70
Department of Forestry Kelantan (DOFK)	2.51	2.15
Kota Bharu Municipal Council (MPKB)	2.32	2.12
Department of Agriculture Kelantan (DOAK)	2.31	1.94
Kelantan State Economic Planning Unit (UPEN)	2.27	2.13
Land & District Office Kota Bharu (PTJKB)	2.17	1.92
Town & Country Planning Department Kelantan (TCPDK)	2.17	1.93
Kelantan Selatan Development Authority (KESEDAR)	2.07	1.82
Gua Musang Municipal Council (MDGM)	1.27	1.20

Further analysis of each RBO's performance based on the composite indexes of flood management categories are given in Figure 1. Identification of strengths and weaknesses in the implementation of flood mitigation strategies in the context of river basin management within Kelantan river basin is presented in Figure 2. The results indicate that flood mitigation management in Kelantan river basin fall within fair to poor performance ranged in the following order: accountability and monitoring (A&M) (3.29 or 65.8%), coordinated decision-making (CDM) (3.09 or 61.9%), organizational design (OGD) (2.85 or 56.9%), information and research (I&R) (2.84 or 56.7%), responsive decision-making (RDM) (2.51 or 50.2%), goals and goal shift (GGS) (2.34 or 46.8%), private and public sector roles (PPS) (2.25 or 45.1%), role of law (ROL) (1.80 or 36.0%), financial Sustainability (FNS) (1.69 or 33.7%) and training and capacity building (TCB) (1.68 or 33.6%). The overall results demonstrate usefulness of composite index methodology in identifying the main performance areas in need of improvement for better implementation of flood mitigation strategy. Effective flood mitigation requires high degree of concerted efforts and RBOs should be made aware of their respective roles in mitigating floods and actively involved in basin wide decision making process.

Figure 1. Comparison of the CIPERBOadditive components for the RBOs in Kelantan river basin

A&M: Accountability and monitoring
CDM: Coordinated decision-making
FNS: Financial Sustainability
GGS: Goals and goal shift
I&R: Information and research
OGD: Organizational design
PPS: Private and public sector roles
RDM: Responsive decision-making
ROL: Role of law
TCB: Training and capacity building

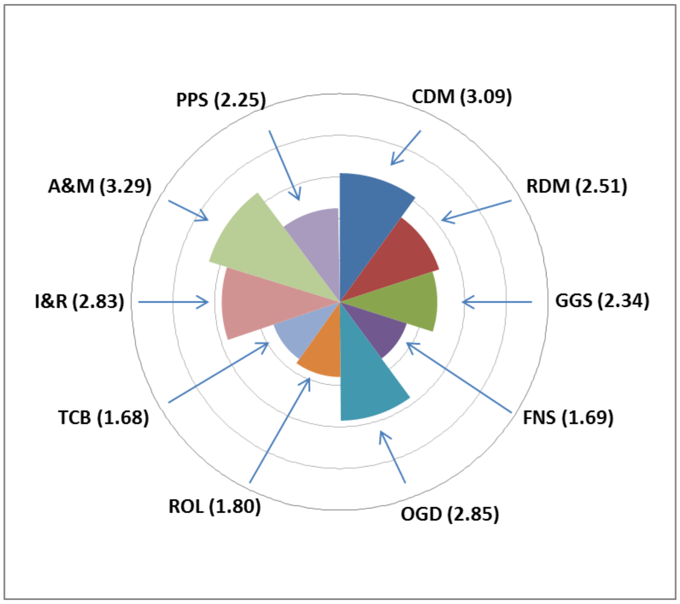

Figure 2: Overall scores of sub-composite indexes for performance evaluation of the flood mitigation management categories in Kelantan river basin.

A&M: Accountability and monitoring
CDM: Coordinated decision-making
FNS: Financial Sustainability
GGS: Goals and goal shift
I&R: Information and research
OGD: Organizational design
PPS: Private and public sector roles
RDM: Responsive decision-making
ROL: Role of law
TCB: Training and capacity building

4.0 Conclusion

In conclusion, the present study has successfully demonstrated that composite indexes methodology is applicable for evaluating river basin organization's performance with respect to
flood control strategies implementation in the context of an integrated river basin management. In the case of Sungai Kelantan basin, the flood mitigation management fall within fair to poor performance ranged in the following order: accountability and monitoring > coordinated decision-making > organizational design > information and research > responsive decision-making > goals and goal shift > private and public sector roles > role of law > financial Sustainability > training and capacity building.

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KESAN HAKISAN TEBING DAN SISI SUNGAI AKIBAT LURUAN AIR BANJIR 2014: KEPERLUAN GARIS PANDUAN PEMBANGUNAN ZON PENAMPAN SUNGAI DI MALAYSIA

Project Information

Project Leader	: Prof Dr. Mohd Ekhwan Bin Toriman
University	: University Sultan Zainal Abidin
Address	: East Coast Environmental Research Institute (ESERI), University Sultan Zainal Abidin (UniSZA), 21300 Kuala Terengganu, Terengganu.
Contact number	: 012-2808252
Email	: ekhwan@unisza.edu.my
Project Members	: Dr. Mohd Khairul Amri Bin Kamarudin Prof Madya Dr. Hafizan Bin Juahir Prof Dr. Muhammad Barzani Bin Gasim

1.0 Pengenalan

Sungai merupakan suatu khazanah yang amat bernilai dan berharga kepada pelbagai kehidupan, terutamanya manusia. Sungai juga bukan sahaja mempunyai kepentingan daripada aspek membekalkan sumber air bersih kepada manusia, malah ia turut digunapakai dalam sektor perindustrian, pengangkutan, perikanan, rekreasi, penjanaan tenaga dan pelancongan. Secara amnya, kualiti sungai dapat dikekal jika diurus dengan baik. Walau bagimanapun kualiti sungai mudah terjejas jika berlaku aliran ekstrem seperti banjir atau kemarau (Kamarudin et al., 2013; Abdullah et al., 2013; Toriman et al., 2012). Contohnya, fenomena banjir dapat mempengaruhi proses penghasilan sedimen dan kesannya akan menjejaskan ekologi sesebuah sungai dengan memusnahkan habitat di dalam dasar sungai dan turut menghapuskan tumbuhan akuatik serta meningkatkan kelajuan hanyutan serangga akuatik di dalam sungai yang akhirnya meninggalkan impak yang besar terhadap sungai dan persekitaran di sekitar kawasan tersebut (Md Din et al., 2012).

Banjir besar yang menimpa beberapa negeri pantai timur di Semenanjung Malaysia pada 2014 telah memberi impak besar terhadap persekitaran sungai dan masayarakat disekitarnya. Impak daripada banjir tersebut, kesan hakisan tebing dan sisi sungai dapat dilihat dengan jelas, akibat daripada luruan air banjir yang berkelajuan tinggi sehingga memusnahkan hampir semua sturcer yang berada di dalam zon banjir tersebut (Ghani et al., 2012; Kamarudin et al., 2015).

Kawasan yang terjejas teruk seperti di Sungai Kelantan kebanyakannya berada di kawasan luar bandar yang berada berhampiran sungai. Hal ini dilihat kerana terdapatnya kelonggaran atau kelompangan pada garis pantuan pembangunan sungai yang harus dikaji dan diperbaharuai bagi menagani pengurusan risiko banjir yang akan berlaku kelak. Kebanyakan mangsa banjir besar 2014 di Sungai Kelantan yang terjejas teruk adalah bagi penduduk yang tinggal di tepi sungai. Pembangunan di dalam zon penampan sungai tampa mitigasi dan garis pantuan yang betul akan menyebabkan berlakunya pelbagi permasalahan persekitaran. Malah pembangunan itu sendiri terdedah kepada pelbagi risiko seperti banjir, hakisan, tanah mendak dan sebaginya sehingga dapat meragut nyawa. Justeru itu, kajian ini dilihat amat penting dijalankan bagi cadangan memperbaharuai keperluan garis panduan pembangunan zon penampan sungai yang bukan sahaja di Sungai Kelantan, malah bagi sungai-sungai di seluruh malaysia dalam penyediaan pengurusan risiko banjir yang akan berlaku kelak.

2.0 Kaedah Kajian

Negeri Kelantan merupakan, salah satu kawasan yang sering kali menghadapi bencana banjir yang akan menyebabkan proses hakisan berlaku dengan aktif. Hampir setiap tahun di musim tenkujuh, negeri-negri dipantai timur akan ditimpa banjir kesan daripada monson timur laut yang melanda (Lun et al., 2011). Namun, ianya adalah tidak seburuk peristiwa banjir yang berlaku pada tahun 2014. Sungai Kelantan merupakan sungai utama bagi Negeri Kelantan, dimana luas lembangannya adalah kira-kira 11,900 km² yang merangkumi beberapa sungai utama yang mengalir masuk ke sungai ini seperti Sungai Nenggiri yang berpunca dari kawasan logging dan memasuki Sungai Galas dibahagian tengah sungai tersebut. Sungai Galas dari Gua Musang, Sungai Lebir dari Aring, Sungai Pergau dari Jeli yang memasuki Sungai Kelantan dan terus mengalir ke Laut China Selatan di kawasan Kota Baharu. Sungai Kelantan merupakan Sungai Terpanjang dan terbesar di dalam Negeri Kelantan (Rajah 1). Justeu itu, pelbagai permasalahan persekitaran dapat dikesan seperti hakisan, sedimentasi dan banjir yang mana ianya adalah saling berkaitan antara satu sama lain.

Rajah 1: Kawasan kajian di Lembangan Sungai Kelantan

Metodologi kajian ini adalah melibatkan kaedah yang digunapakai bagi mendapatkan maklumat mengenai ciri-ciri meander sungai yang dipengaruhi oleh luruan air sungai di Sungai Kelantan. Beberapa pengiraan akan dijalankan dalam menentukan zon penampan sungai yang idea bagi kawasan bandar dan lauar bandar. Di dalam kajian ini, aplikasi Sistem Maklumat Geografi (GIS) telah digunapakai dalam mengenalpasti sejarah perubahan meander sungai. Dimana, peta topografi berdasarkan data asas GIS yang berskala 1: 50 000m telah digunakan bagi merangkumi semua lembangan Sungai Kelantan yang menjadi satu set peta (Rajah 2).

Rajah 2: Analisis Indeks Sinuositi menggunakan GIS di Lembangan Sungai Kelantan

Seterusnya, setiap set peta ini melalui proses *geo-reference* dengan menggunakan *Projection: Kertau_RSO_Malaya_Meters* dan didigit menggunakan *polyline* bagi sungai dan *polygon* bagi lembangan. Memandangkan kajian memerlukan ketepadan yang tinggi, proses validasi *geo-reference* telah dijalankan sebelum proses pendigitan dijalankan dimana proses ini akan memastikan *total RMS error* berada ditahap yang minima dan diterimapakai berdasarkan skala yang digunakan (Aswathy et al., 2008; Chakrapani, 2005). Proses penilian bagi jajaran utama Sungai Kelantan dijalankan bagi mengenalpasti aliran utama dan sub-sub sungai utama yang mempengaruhi Sugai Kelantan. Seterusnya, melalui data asas GIS yang telah dikumpulkan, analisis indeks sinuositi dijalankan.

Indeks Sinuositi merupakan petunjuk utama bagi megenalpasti kestabilan sesuatu saluran. Justeru itu, analisis indeks sinuositi dijalankan bagi mengenalpasti jenis kestabilan dan kategori evolusi yang berlaku terhadap jajaran sungai utama (Rujuk Jadual 1). Indeks ini dikira berdasarkan data asas yang telah dianalisis melalui GIS dengan menggunakan formula berikut:

$$\textit{Indeks Sinuositi (IS):}\ \frac{\textit{Channel Length (L)}}{\textit{Valley Length (Z)}} \qquad (1)$$

Jadual 1: Kategori kestabilan evolusi meander sungai

Indeks Sinuositi (IS)	Kategori kestabilan sinuositi	Ringkasan digunakan
<1.2	Stabil	S
>1.2	Tidak Stabil	TS
>1.5	Sangat Tidak Stabil	STS

(*Disesuaikan dari Kamarudin et al. 2015*)

3.0 Hasil dan Perbincangan

Hasil kajian ini di dahuluai dengan analisis keluasan sungai di dalam lembangan Sungai Kelantan dan dibahagikan kepada sungai-sungai utama iaitu di antara 80 meter hingga 294 meter (Jadual 2). Jadual 2 menunjukkan purata tahap kestabilan sungai-sungai utama dalam lembangan Sungai Kelantan melalui Indeks Sinuositi adalah antara 1.1 (stabil) hingga 1.5 (sangat tidak stabil). Seterusnya, cadangan keluasan zon penampan sungai diperolehi daripada purata keluasan sungai dan tahap kestabilan indeks Sinuositi yang telah dijalankan.

Keluasan (Lebar) sungai di dalam Lembangan Sungai Kelantan adalah tidak sekata iaitu, Sungai Kelantan mempunyai lebar sungai yang paling luas dengan keluasan 293.55m berbanding dengan sungai-sungai yang lain. Hal ini kerana, Sungai Kelantan merupakan sungai utama di Negeri Kelantan, ianya menjadi satu titik pertembungan diantara sungai-sungai yang lain. Sungai Galas pula mempunyai keluasan lebar yang kedua terbesar iaitu 107.71m. Hal ini kerana faktor Sungai Galas menjadi tumpuan kepada sungai sungai kecil seperti Sungai Pergau dan Sungai Neggiri.

Jadual 2: Keluasan (Lebar) sungai di dalam lembangan Kelantan

Bil	Sungai	Purata Keluasan/Lebar (m)
1	Sungai Kelantan	293.55
2	Sungai Lebir	89.38
3	Sungai Galas	107.29
4	Sungai Nenggiri	80.71
5	Sungai Pergau	92.92

Kuala Kerau merupakan antara kawasan yang paling teruk dilanda banjir pada tahun 2014 (Bhonline, 2015), adalah antarnya disebabkan pertemuan antara dua sungai iaitu Sungai Galas yang seluas 107.29m dan sunga Lebir seluas 80.71m. Dengan hujan yang lauar biasa lebat melanda Lembangan Sungai Lebir dan beberapa sub sungai lain menyebabkan kapasiti air yang bertembung di kawasan tersebutterlalu besar dan tidak dapat ditampung oleh keupayaan sungai tersebut. Hal ini menyebabkan berlakunya peristiwa *back water* atau aliran sonsang seperti yang pernah di kaji oleh Toriman et al., (2009), di Sungai Chini, Pahang. Peristiwa ini telah menyebabkan kawasan kampung dan penempatan yang berada di Manik Urai di tenggelami air dengan teruk.

Jadual 3 pula menunjukkan data hasil dari analisis Indeks Sinuositi sungai utama dan sub-sub sungai utama yang terdapat di dalam Lembangan Sungai Kelantan, iaitu terbahagi kepada lima sungai utama, seperti Sungai Nenggiri, Sungai Lebir, Sungai Galas, Sungai Pergau dan Sungai Kelantan. Sungai Kelantan mempunyai corak aliran sungai yang berada ditahap stabil dimana sungai ini hampir kepada berbentuk lurus dan tidak bermeander. Hal ini menyebabkan aliran sungai yang berada di Sungai Kelantan dapat dialirkan dengan cepat. Namun bergitu, bentuk meander sungai bagi Sungai Lebir adalah tidak stabil, iaitu sedikit bermeander yang menyebabkan aliran air banjir mengalir dengan laju dan menyebabkan banjir mudah berlaku.

Kadar hujan yang tinggi iaitu bersamaan dengan 6 bulan hujan dikawasan tersebut turun dengan serentak dalam masa dua ke tiga hari menyebabkan Sungai Lebir dan Sungai Kelantan tidak dapat menampung aliran luar biasa tersebut dan berlakunya banjir besar (Bhonline, 2015). Luahan yang tinggi datang dari Sungai Galas dengan membawa luahan air dari lembangan yang besar di dalam Lembangan Sungai Kelantan ditambah dengan masalah pembukaan tanah di kawasan hulu lembangan Sungai

Kelantan memburukkan lagi keadaan banjir yang berlaku walaupun tahap kesetabilan sinuositinya adalah sangat bermeander.

Jadual 3: Purata tahap kestabilan sungai-sungai utama dalam lembangan Sungai Kelantan

Bil	Sungai	Indeks Sinuositi	Tahap Kestabilan
1	Sungai Kelantan	1.191261971	Stabil
2	Sungai Lebir	1.330075401	Tidak Stabil
3	Sungai Galas	1.515077216	Sangat Tidak Stabil
4	Sungai Nenggiri	1.50815308	Sangat Tidak Stabil
5	Sungai Pergau	1.337466026	Tidak Stabil

Hasil dari data keluasan lebar sungai, tahap kestabilan indeks sinuosity dan beberapa analisis lain, cadangan terhadap keluasan zon penampan sungai di dalam lembangan Sungai Kelantan dicadangkan seperti di Jadual 4.

Jadual 4: Cadangan keluasan zon penampan sungai berdasarkan data yang diperolehi

Bil	Sungai	Indeks Siniosity	Purata Lebar	Tahap kestabilan	Zon penampan yang dicadang (m)
1	Sg. Kelantan	1.191261971	293.5533333	Stabil	150
2	Sg. Lebir	1.330075401	89.37833333	Tidak Stabil	100
3	Sg. Galas	1.515077216	107.2952381	Sangat Tidak Stabil	50
4	Sg. Nenggiri	1.50815308	80.71416667	Sangat Tidak Stabil	50
5	Sg. Pergau	1.337466026	92.91888889	Tidak Stabil	100

Zon penampan sungai yang dicadangkan berdasarkan hasil kajian yang telah dijalankan adalah seperti berikut, Sungai Kelantan dengan keluasan 150m bermula dari datum sungai bagi kedua-dua belah kawasan sungai yang menjadikannya 300m + kelebaran datum sungai tersebut. Sungai Lebir pula adalah 100m, Sungai Galas 50m, Sungai Nebggiri 50m dan Sungai Pergau 100m.

Kawasan zon penampan sungai adalah amat penting bukan sahaja bagi mengurangkan risiko kerosakan yang akan ditanggung oleh para mangsa banjir, malah ianya adalah penting dalam mengawal banjir yang akan berlaku di kawasan hilir sesuatu sungai tersebut. kawasan ini juga penting di dalam kitaran ekosistem sesuatu sungai tersebut (Toriman et al., 2006; Armas et al., 2013; Issaad et al., 2008).

4.0 Kesimpulan

Hasil kajian bagi projek ini memenuhi dan menjawab objektif kajian iaitu:-

4.1 Menganalisis kesan hakisan tebing dan sisi sungai akibat daripada luruan air banjir 2014.

a. Kesan hakisan tebing dan sisi sungai akibat daripada luruan air banjir 2014 melalui analisis penindihan peta topo dan imej satelit bagai aligment utama Sungai Kelantan yang terjejas dengan banjir 2014 bagi tahun yang berbeza. Melaluai bantuan perisian GIS dan Erdas, analisis menilai dan mengukur perubahan bentuk plan sungai dijalankan bagi menentukan kesan hakisan tebing dan sisi sungai yang berlaku akibat daripada luruan air banjir 2014.
b. Terdapat banyak bentuk aliran sungai telah berubah disebabkan luruan air sungai ketika banjir 2014. Terdapat beberapa kawasan yang termendap di hilir sungai dan terdapat beberapa kawasan yang terhakis di pertengahan sungai.

4.2 Mengenalpasti zon penampan yang idea terhadap Sungai Kelantan selepas peristiwa banjir 2014

a. Analisis mengenalpasti zon penampan yang ideal kepada Sungai Kelantan dengan bantuan perisian GIS, XlStat2012 dan Microsoft excel 2007 bagi mengenal pasti punca dan impak keluasan perubahan yang berlaku secara saitifik. Seterusnya, zon penampan yang ideal dapat dikenalpasti berdasarkan pelbagai aspek.
b. Hasil dari analisis yang dibuat cadangan zon penaman seperti berikut

Bil	Sungai	Zon penampan yang dicadangkan (m)
1	Sg. Kelantan	150
2	Sg. Lebir	100
3	Sg. Galas	50
4	Sg. Nenggiri	50
5	Sg. Pergau	100

4.3 Mencadangkan garis panduan pembangunan zon penampan sungai di Malaysia

a. Hasil kajian yang diperolehi, pengkaji membina dan mencadangkan garis panduan pembangunan zon penampan sungai di Malaysia berdasarkan bentuk plan sungai, data-data sungai, permasalahan dan kesannya yang telah berlaku di Sungai Kelantan.

4.4 Secara keseluruhannya, analisis Indeks Siniosity berjaya di dalam penilaian bentuk aliran meander sungai di dalam kawasan Lembangan Sungai Kelantan. Hasil dari beberapa analisis ini, cadangan terhadap jumlah keluasan zon penampan sungai di dalam lembangan Sungai Kelantan dicadangkan. Cadangan zon penampan ini adalah amat penting bagi melihat semula garis panduan dan pelaksanaanya di semua kawasan termasuklah di kawasan bandar, luar bandar dan di dalam hutan. Hal ini adalah penting bagi memastikan system persekitaran yang ada seperti sisem kitaran hidrologi, system ekologi sungai dan keseluruhan system lembangan tersebut dapat dipelihara di dalam mengurangkan risiko banjir yang akan berlaku kelak

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PREPAREDNESS OF BASIC SANITATION REQUIREMENT AT RELIEF CENTER DURING FLOODING

Project Information

Project Leader : Prof. Dr. Hamidi Abdul Aziz
University : Universiti Sains Malaysia, 14300 Nibong Tebal, Penang, Malaysia
Contact number : 04-5996215
Email : cehamidi@usm.my
Project Members : Prof Madya Ir. Nik Fuaad Nik Abdullah, Dr. Husnul Azan Tajarudin
Dr. Nastaein Qamaruz Zaman, Dr. Nurul Hana Mokhtar Kamal
Mohamad Firdaus Mahamad Yusob

1.0 Introduction

Most of the evacuees during the 2014 Flood in Kelantan resided at the schools from 3 days to 1 month depending on their houses' conditions. Many problems have arisen when some of the relief centers need to accommodate more than its maximum capacity. The issues that arise are related to the sanitation, water supply and electricity supply. Sanitation facilities such as toilets and washrooms were inadequate. These problems have led to unsafe sanitation practice and increased risk of disease spreading (International Federation of Red Cross and Red Crescent Societies, 2015).

This study is conducted to evaluate the facilities provided at the relief centers. The evaluation is important in order to identify future flood preparation of the needs of the affected community and relief centers according to previous experience(Botzen et al., 2009,Siegrist and Gutscher, 2006, Bradford et al., 2012, Ho et al., 2008,Looney, 2012, Whitmarsh, 2008) and provide a better understanding, thus providing an additional insight for future references and planning. Relief centers have to be prepared to provide the affected people with basic human needs including accommodation, food and water. The main objectives of this study are as follows:

1. To establish site conditions of all used relief centers in last flood event (coordinate, elevation, effective space, number of people, Population Equivalent, etc.) thus, stating the suitability of the schools as relief centers.
2. To establish baseline data of availability of sanitation facilities at all relief centers in Kelantan (availability of electricity, water, toilet, etc.) and to correlate the data with the number of flood victim and satisfaction level acquired through questionnaires.
3. To evaluate and propose the type of fundamental sanitation requirement for flood relief centers.
4. To evaluate the existing (if any) and to propose a Standard Operating Procedures (SOP) for sanitation facilities as part of the preparedness programme.

2.0 Methodology

2.1 Study Areas

Kelantan is located in the north- east of Peninsular Malaysia (coordinates: 5°15'N 102°0' E) with total area of 15,099 km^2, which includes 10 provinces (Figure 1).

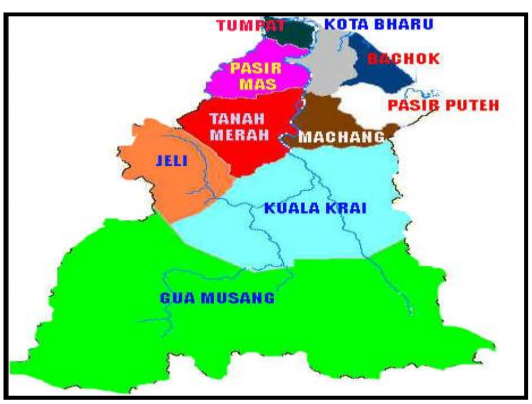

Figure 1: 10 provinces in Kelantan. Source: (Fadabi Nawi, 2006)

During 2014 Flood in Kelantan (22 December 2014 until 30 December 2014), 254 schools were listed as relief centers. The research team visited 249 schools which located in urban, rural and inland areas from 6 June 2015 to 29 October 2015.

2.2 Evacuees Satisfaction Survey

The questionnaire consisted of three major sections. The first section had 6 questions which referred to evacuees demographic; name of the school they received the questionnaire, name of the school they resided during 2014 Flood, name, gender, age, and number of the family members that stayed at the relief centers. The second section had 13 Likert-scale questions on a 5 point scale (1- strongly disagree, 2- somewhat disagree, 3- neither disagree nor agree, 4- somewhat agree, 5- strongly agree) related to the facilities provided at the schools such as electricity supply, clean water supply, sanitation and solid waste facilities. This section was structured to indicate to what extent they agreed or disagreed with the statements about the relief centers' facilities.

2.3 Elevation Measurement

Out of 249 visited schools, only 203 of all the visited schools functioned as relief centers and the rest remained as stand-by; no flood victim occupied the schools. The flood level was measured on-site using a distance measurement laser, 2LS- tools "VEGA Digital Laser Rangefinder" based on the mark left on the school building during the last flood event. The land elevations of each school were measured on the ground near the front gate of the schools using Global Positioning System (GPS) Garmin Montana 650 in ellipsoidal height. The coordinates of each school was measured using the GPS in West Malaysia Grid and Kertau1948 datum format.

The relief centers were classified into 3 qualitative classes of safe (not flooded), medium (less than 1 metre) and critical (more than 1 metres) based on the inundation depth. The difference between the water level of the flood and land elevation surface was considered as inundation depth.

2.4 Sanitation Facilities Data Collection

The research team conducted a survey on the infrastructure provided by the relief centers to accommodate the evacuees, including number of toilets available at the schools. Apart from that, data of the number of evacuees were collected from the school administration in order to produce a ratio between number of toilet and evacuees. The ratios were then used to evaluate the sufficient number of toilets that could comfort the evacuees while occupying the relief centers.

2.5 Crowdedness

All the useful and related data were collected on site from every visited school. These include the data on the total number of evacuees and the data on the total areas occupied by the evacuees. Calculations were performed to calculate the ratio of the total number of evacuees to the total available area that occupied by the evacuees during the floods in 2014. According to the specification provided by the Economic Planning Unit of Malaysia Prime Minister's Department, the standard area that should be allocated per person in a classroom is 2.25 meter squares (Economic Planning Unit, 2008). Based on the specification, all the calculations were divided into 2 categories; the relief centers with the ratio less than $2.25m^2$ and the relief centers with the ratio more than $2.25\ m^2$.

2.6 Water Demand Requirement Calculations

Water supply source available at the schools during the flood event was investigated. Data of the number of evacuees were collected from the school administration in order to compute water demand requirement of the total number of evacuees. The calculations of water demand requirement at the relief centers were as follow (USGS, 2016):

Drinking water = 2 litres X No. of evacuees X No. of occupancy day (1)
Bathing = 50 litres X No. of evacuees X No. of occupancy day (2)
Toilet Flushing = 9 litresX No. of evacuees X No. of occupancy day (3)
Clothes washing = 10 litresX No. of evacuees X No. of occupancy day (4)

2.7 Standard Operation Procedure (SOP)

This research attempts to discuss and propose Standard Operating Procedures (SOPs) for sanitation facilities and services as part of the pre flood preparedness activities in relief centers. This SOP is meant to prepare and guide relief committee members to response for the flood disaster more efficiently, especially on the sanitation related facilities (toilets, water supply, solid waste management and electricity supply).

3.0 Results and Discussion

3.1 Satiscfaction of Evacuees

A total of 3408 respondents involved in the satisfaction survey from 9 provinces; Kota Bharu, Pasir Mas, Tanah Merah, Jeli, Machang, Pasir Putih, Gua Musang, Kuala Krai and Tumpat. According to the results, 84.8% of the respondents dissatisfied on sanitation facilities, followed by clean water supply (76.6%), solid waste management(76%) and lastly electricity supply(74.4%). The results also show that Kuala Krai and Tanah Merah were the districts that recorded high percentage of dissatisfaction among the evacuees compared to the other provinces.

3.2 Elevation of Relief Centers and Inundation of Flood Level

203 functioned as relief centers while the remainder actedas stand-by.The relief centers were classified into 3 qualitative classes of safe(not flooded), medium(less than 1 metre) and critical(more than 1 metre) based on the inundation depth. From the results, 22.2% of the relief centerswere categorized in critical class, 24.6% moderate and 53.2% safe. In conclusion, the relief centers suffice as providing shelter from the harm of floods. However, in cases where the relief centers were severely inundated, this study suggested to remove the schools from the relief centerlist and alternatives are needed to better service the distressed victims.

3.3 Sanitation Requirement and Comparison with Satisfaction Level

It was found that 1 toilet could be shared up to 34 people during the flood event with high satisfaction among the evacuees. The Guidelines and Regulations of Building Planning Malaysia specified that sanitation facilities for primary and secondary schools should be within 1 unit of toilet for 20 students (1:20) encloses the 8 hours of schooling period. However, in the case of relief centers, the high number of evacuees accomodates the schools for 24 hours or more led to suggestion of 3 toilets should facilitate 20 evacuees (3:20) at the relief centers during flood events.

3.4 Crowdedness of Relief Centers

58% of the schools that served as relief centers during the floods in Kelantan provide less than 2.25 square metres of area per evacuee. Meanwhile,only 42% of the schools provide more than 2.25 square metres of area per evacuee (as shown in Figure 2). In order to prevent over crowdedness of evacuees at each school, it is suggested that each evacuee is provided with an area of 2.5 m^2. This value can be used as a guideline in the calculation of the maximum capacity of a relief center.

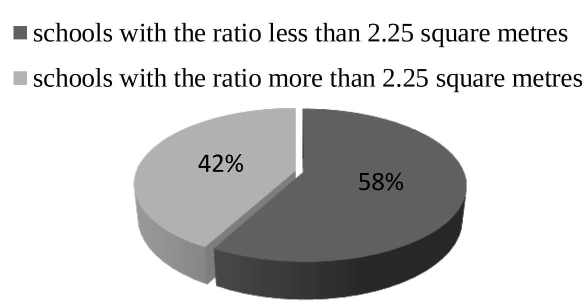

Figure 2: The ratio of the total number of evacuees to the total available area

3.5 Water Demands

The research team computed the water demand requirement at each relief center with the respective number of evacuees stayed. The current design of water demand requirement is 50 gallons/person/day or 225 m^3/person/day. However, based on the calculation made, it is suggested that 100 m^3/person/day is the maximum water demand requirement during an emergency such as flood event. Table 1 shows the reccommended water consumption amount for flood evacuees at releif centers.

Table 1: Suggestion of Water Consumption at the relief centers for every evacuee

Water consumption	**Amount (litres/day)**
Drinking	2
Washing	10
Bathing (once/day)	50
Toilet flushing (3 times/day)	27
Total	89

3.6 Standard Operation Procedure (SOP)

The suggested SOPs are as follows:

- All the relief centers that have been categorized in critical class should be removed from the list of relief centers.
- Refurbishment works should be conducted in all relief centers that are suitable as the evacuation centers.
- In order to avoid extreme crowdedness of evacuees at each school during the floods, it is suggested that the calculation of the relief centers capacity to accommodate the evacuees should be based on 2.5 meter square per evacuee.
- It is suggested that the committee members of relief centre, stick to the ratio of 3:20, where three toilets should only facilitate 20 evacuees.
- Committee members need to calculate number of dustbin required based on maximum capacity of evacuees that can be accommodated at their relief centre. The calculation can be done using the equation below:

$$Number\ of\ dustbins = \frac{\dfrac{number\ of\ evacuees\ \times per\ capita\ \ waste\ generation\ rates\ (kg/person/day)}{solid\ waste\ density\ (kg/L)}}{dustbin\ capacity\ (L)}$$

- Relief centre committee members should ensure that adequate amount of water is being supplied to the evacuees. As a guideline, a person needs 2 Liter/day of drinking water, 50 Liter/day for bathing (1 time bathing only per day), 9 Liter/time (3 times per day) for toilet flushing and 10 Liter/day for the laundry. It is recommended that 100 Liter /person/day is the maximum water demand requirement during emergency such as flood event.
- For relief centers that use 14 litres of toilet cistern, it is suggested to change the toilet cistern to 9 litres due to the less water consumption.
- A water treatment system introduced by Professor Ani Idris from UTM, which known as ‘compact, lightweight and high performance membrane for safe drinking water’ can be adopted at the relief centers. The system should be attached to the tank of the water tower. The treated water will be distributed to any desired location via the installed pipelines.
- Every relief centre should be provided with generators as preparedness for the flood event in order to have access to adequate electricity supply. Generator set with a specification of 25kW/ 240V is appropriate to be used in the relief centre. The ideal location for the genset is on the rooftop of the building. Alternatively, an extension of the floor on one of the levels could be constructed as a platform to put both the genset and fuel supply.
- Another way to ensure a continuous access to electricity supply is by doing some modification to the existing wiring system at the relief centre. This can be done by rewiring two separate sets of circuit, separated by different distribution board, one is for the lower floor and another one is for the upper floor of the building. The distribution board may be connected the gen set.
- Another alternative is to implement the solar power system as a backup or permanent source of electricity.

4.0 Conclusion

This study led to several conclusions regarding matters on relief centers and their facilities. About the evacuees satisfaction related to facilities at the relief centers:

4.1 Sanitation facilities at relief centers recorded the highest percentage of dissatisfaction among the evacuees with 84.8% followed by clean water supply (76.6%), solid waste management (76%) and lastly electricity supply(74.4%).

4.2 Comparing to the other developing countries, Malaysia is progressive in improving the infrastructures, especially by listing a huge number of the relief centers to manage the disaster.

4.3 In the case of relief centers, the high number of evacuees accommodated the schools for 24 hours or more led to suggestion of 3 toilets should facilitate 20 evacuees (3:20) at the relief centers during flood events.

4.4 In case these schools still need to be used as relief centers, the number of evacuees need to be restricted to a certain amount according to the calculation based on the suggested ratio, which is 1: 2.5 (2.5 square metres of area per evacuee).

4.5 In supplying the basic needs of clean water at relief centers, the research discovered that a person needs 2 litres/day of drinking water, 50 litres/day for bathing (1 time bathing only per day), 9 litres/time (3 times per day) for toilet flushing and 10 litres/day for cloth washing.

4.6 Many proactive approaches and precautionary measures are recommended in the proposed SOP based on the results of the research, which led to more effective and efficient ways to mitigate the flood risks.

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A HOLISTIC FLOOD RISK MANAGEMENT (HFRM) SYSTEM FOR MALAYSIA

Project Information

Project Leader	: Dr Intan Rohani Endut
University	: Universti Teknologi Mara
Address	: Fakulti Kejuruteraan Awam, Universiti Teknologi Mara
Contact number	: 03-55435262 (Office Telephone No) & 019-2105006 (Handphone No)
Email	: intan@salam.uitm.edu.my
Project Members	: Dr Janmaizatulriah Jani Dr Mazidah Mukri Prof Madya Wardah Tahir Nurul Elma Kordi

1.0 Introduction

Malaysia is one of the countries that experience the negative impacts of flooding in some of its states especially in East Coast region; Kelantan, Pahang and Terengganu. Based on the existing reports, 40% of the total damages in Malaysia are carried by flood (Tehrany, 2015). Flood is the most significant natural disasters in Malaysia that give impact to about 4.9 million of people and impose damage worth of several million Ringgit year by year (Abdul Mohit, 2013). About 9% of Malaysia's land or 29,720 square kilometers is prone to flooding (DID, 2005).

The Government of Malaysia has established the Natural Disaster Management and Relief Committee (NDMRC) in 1972 with task to coordinate flood relief operation at national, state and district levels with the combined objectives to preventing loss of human life and to reducing flood damage (Deparment of Irrigation and Drainage, 2003). National Disaster Management Agency (NADMA) as the key agency used Directive No. 20 and Fixed Operating Regulation (PTO) for flood disaster management. The Directive No. 20 described the purpose of responsibilities and function of the various agencies under NADMA. While, this PTO aims to provide more coordinate guidelines for actions to be taken by the department/agencies involved in dealing with flood evacuation operations. All agencies under NADMA has their own responsibility to convey flood relief delivery system for victims when flooding occur based on Standard Operating Procedures (SOPs).

Delivery system is one of important mechanism used by government and one of flood policies in the management of non-structured measure (Chan & Parker, 1996). In flood management, the roles of delivery system is used in a holistic manner for provide information and assistance for every phases. There are three phases of the flood deliver system in Malaysia which are pre-disaster, during and post-disaster. The implementation normally focusing on the rescue, shelter, food and medical supplies for victims. The current flood disaster management is focusing on the strategies to manage the flood disaster during the flooding. Therefore, the focuses of this study are to evaluate how effective is the implementation of SOPs during the flood event and evaluate risk for flood disaster.

2.0 Methodology

The study is conducted based on questionnaires and interviews with related agencies and flood victims. Besides that, the sources of information include the analysis and review of the existing documents that cover flood relief operation and flood response and rehabilitation process [Deen, 2015]. In general, this study is to investigate the implementation of SOPs during flood relief operation. Therefore, the main study areas are agencies offices at various level (district, state and national) and flood victims. The questionnaire survey and interview are the method used to evaluate the flood victim satisfaction and the effectiveness and practicability of current SOPs. Three sets of questionnaire survey were developed for different types of respondents. The first set is to evaluate the satisfaction level among flood victims on the flood evacuation operation. The second set for evaluation of effectiveness and practicability of the current SOPs and the third set to evaluate the risk of agencies in implementing the SOPs.

Mean comparison was used to obtain the overall views of a particular phenomenon, the standard deviation is used to detect variation in perception among the entire respondents (Syed Hussain, 2014) and Chi-square test was used to analyse the differences among respondents based on demographic information. The risk of agencies in implementing the SOPs was analysed based on HIRARC. Table 1 shows the determination priority of the risk.

Table 1: Determination priority of risk (DOSM, 2011)

Relative Risk	Description
15-25	HIGH
5-12	MEDIUM
1-4	LOW

3.0 Results and Discussion

3.1 Evaluation of effectiveness and practicability of the current SOPs

Looking at the flood situation as a whole, multiple agencies shared a number of potentially problematical features. Most of the SOPs are practical and effective to be used and applied during normal flood events. Although some of the answers from the respondents seemed to be diverged from one agency to another, the real situation still can be seen from the mean score. These variances might occur due to different level and expertise of the selected respondents.

The current SOPs need to be improved so that it can be used to face abnormal flood event. To improve these current SOPs, the application of knowledge outside of traditional emergency response fields and the coordination of interdependent tasks are required. Strong cooperation and integration between agencies is compulsory, in order to allow a coherent response to the emergency. However, cooperation does not seem to happen effortlessly during the implementation. Table 2 shows the summary of problems related to cooperation and integration between agencies.

Table 2: Summary of problems related to cooperation and integration between agencies.

Themes	Agency		
	Controlling/managing agencies	Search and rescue agencies (S&R)	Subsidiary agencies
Problems faced	They are prepared for usual normal monsoon flood every year, but not the abnormal flood situation.	Less cooperation given by the flood victims. They refused to be relocated to the relief centre. Multiple S&R agencies have limitation on the working hours. For example some of the agencies have to stop S&R activities before 6.00pm	Less cooperation given by the flood victims on the application of alarm/ siren system and the rain monitoring stations at remote area are not well maintained. Therefore, the alarm system is not functioning well.
Recommendation	Suitable location for diesel and food supply. Additional flood relief centre need to be identified for abnormal flood situation.	Trainings should be given to the citizen on how to act during the flood event.	Trainings should be given to the citizen on how to act during the flood event.
Assets/ facilities	JKM needs to have their own assets to facilitate the aids. Improvement for communication devices used during flood/ alternative satellite communication	Improvement on the rescue facilities (boat, trailer and amphibian vehicles) and improvement for communication devices.	More rain monitoring system should be allocated to cover the whole catchment area.

3.2 Level of satisfaction among flood victims on the flood evacuation operation

3.2.1 Demographic Profile of Flood Victims

In general, demographic characteristics of the respondents shows that 68% of respondents is female and 32% is male. Malay was dominated with 97.4%, followed by Chinese 1.4%, Indian and others respectively 0.4%. Total 36.0% of respondents has income less than RM900, while 41.2% of respondents earning between RM901-RM2001 and only 0.9% of respondents earning more than RM5000. It was found that 57.4% of respondent stay less than 1 weeks at flood relief center and remaining of respondent stay at relief center for 2-3 weeks and other more than 3 weeks are 40.4% and 2.2% respectively. 89.3% of respondents stay in their house after leaving from relief center and 6.7% of respondent stay at their brotherhood house/ neighbor house. While, 3.1% of respondents need to stay at the tent and 0.9% of respondents stay at house provided by government.

3.2.2 Flood Victims Satisfaction Analysis on SOPs

Total of 28 items on flood victims' satisfaction on the SOPs implemented have potential to be selected because mean satisfaction is moderate. All items selected were considered because the mean score are nearly to 3.0 and not less than 2.0 (limit for eliminate the items). The highest mean score are (3.12) shows availability of health officers to give health care and availability of ambulance/hospital field (military hospital) at the flood relief center. Figure 1 shows percentage value on availability of flood relief operation. 60% of flood victims claim there are health officers to give health care and Figure 2 shows 67% of them satisfied with the health care service given by the health officer. While, 50% of flood victims mention that there is ambulance/hospital field (military hospital) and 63% of them satisfied with the service given by the heath care at the ambulance.

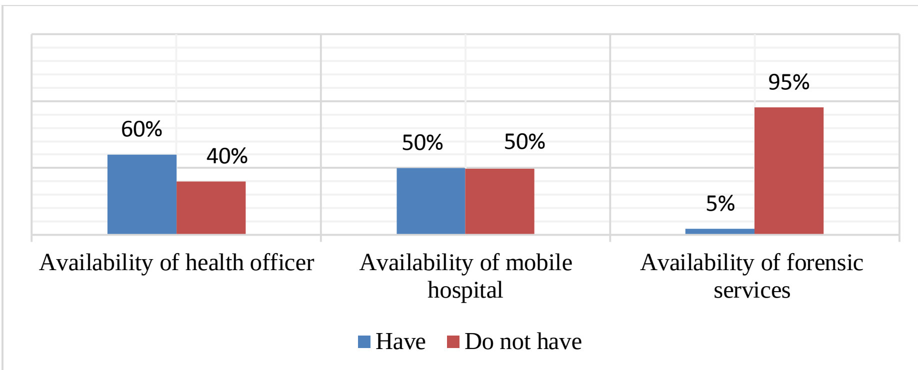

Figure 1: Availability of flood relief operation

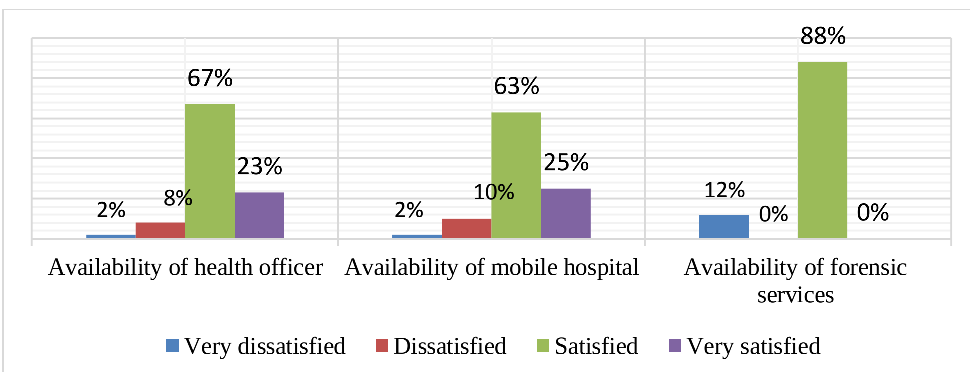

Figure 2: Flood victims' satisfaction level on flood relief operation

3.2.3 Overall Satisfaction on Flood Relief Operation

Figure 3 shows total of 59% flood victims satisfied and 14% of them very satisfied with the flood relief operation. While, 21% of them not satisfied with the flood operation and only 7% of them is very dissatisfied with the flood operation.

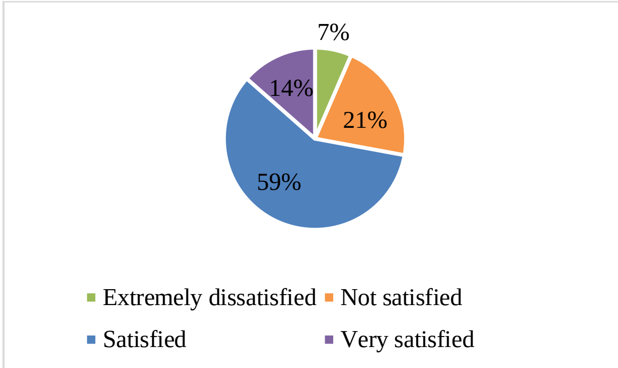

Figure 3: Overall satisfaction on the flood relief operation

3.2.4 Flood Victims Awareness on Availability of Flood Relief Operation

Figure 4 shows only 39.0% of flood victims are aware with existence of flood warning system at their area. However, Figure 5 shows 56.6% of them respondents have good awareness by listed the disaster warning system that available at their area such as siren and SMS. Multi-hazard warning system: advanced forecasting and warning systems contain elements that are similar for different purposes.

Flood victims did not aware on the existence of agencies that offer help after the flood and the existence of a flood relief center at their area. 94.0% of flood victim claimed that they aware with the existence of agencies that offer help after the flood. 96.7% of flood victims claimed that they aware with the existence of flood relief center at their area.

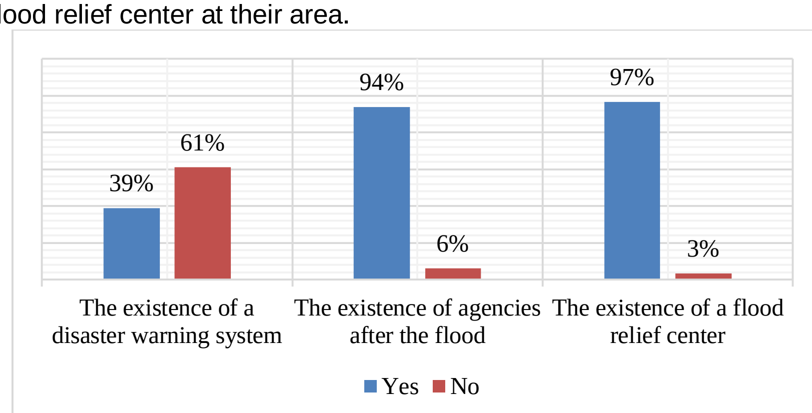

Figure 4: Awareness on availability of flood relief operation

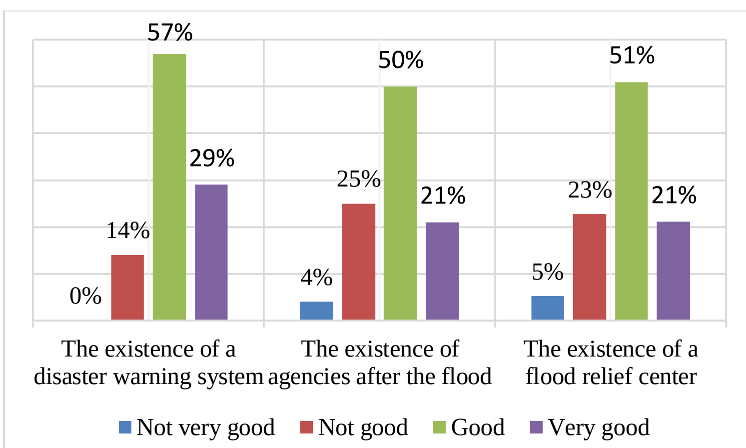

Figure 5: Percentage value of flood victims' awareness on flood relief operation

Significant Different In Perception by the Level of Education and Location

There are two significant factors in assessing the level of flood victims' satisfaction which are level of education and location. Result Pearson Chi-Square test for the flood victims perception by level of education showed a value of p = 0.033 (χ^2 = 22.461, df = 12, $p < 0.05$) with the frequency observed (22.461) more than expected critical value (21.02). It can be concluded that the level of flood victims satisfaction is influenced by varies in level of education in assessing the service of flood operation. Secondary school level of education is more satisfied with the flood operation service provided compared to higher level of education extremely dissatisfied the services provide during the flood operation.

Pearson Chi-Square test is p = 0.002 (χ^2 = 20.740, df = 6, $p < 0.05$) shows there is significant difference in perception by location. It was found that frequency observed (20.740) is more than expected critical value (12.59). In conclusion, it was found that the level of flood victim satisfaction is influenced by varies in location. Kelantan is the location that extremely dissatisfied with the flood operation, Pahang satisfied with the flood operation and Terengganu slightly very satisfied with the flood operation.

3.3 Risk evaluation on implementation of SOPs

In general, there is no HIGH risk in implementation of flood operating procedures. However, there are five (5) MEDIUM risk: 1) procedure carry out evacuation operations of flood victims from the flooded areas, 2) procedure conducting search operations of flood victims trapped for evacuees, 3) rescue operations of flood victims trapped for evacuees, 4) relief operations of flood victims to the evacuation center and 5) distribution of clean water using water tank to the evacuation center. Therefore, these procedures require a planned approach to controlling the hazard and apply temporary measure. The other procedures are at LOW risk.

4.0 Conclusion

In general, agencies at various levels (district, state and federal) should cooperation and integrate during the implementation of SOPs. Without proper cooperation and integration among agencies may reduce the effectiveness and efficiency of SOPs during flood relief operations. This may contribute to high risk for implementation of the SOPs. Flood victims were satisfied with the implementation of the current SOPs for the flood relief operations. This finding may help the government agencies to improve the effectiveness of implementation of SOPs during flood event.

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DEVELOPING CHARTER SCHOOL MODEL CURRICULUM FOR DISASTER AFFECTED AREAS: LESSENING THE MOE EXPENDITURE AND ADDRESSING EDUCATIONAL IMBALANCE

Project Information

Project Leader	: Dr. Mohamad Ridhuan Abdullah
University	: International Islamic University of Malaysia
Address	: 4.17 Dept of Curriculum & Instruction, Kulliyyah of Education
Contact number	: 014-9642105
Email	: ridhuanabdullah@iium.edu.my
Project Members	: Dr. Madihah Khalid, Dr. Faizah Idrus Dr. Azam Othman, Dr. Suhailah Hussein

1.0 Introduction

The concept of Charter School has been introduced and practiced in the United States of America since 1988. Charter school is a public school entity which is operated by the local community but monitored by the federal government. The federal monitors the progress and achievement of the designated charter school, while allowing the schools to be run with greater flexibility, innovative curriculum, and by creative teachers. More importantly, Charter schools provide educational equity and access to low socio-economic students because they are targeted to be built in disaster affected areas. Studies have shown that students of Charter Schools performed better than students of public traditional schools. The inception of the idea to establish Charter School in Malaysia was inspired by the astounding achievement of students who attended charter schools in New Orleans post the Hurricane Katrina disaster that destroyed the city in 2005. Hence, the study aims to identify the level of readiness amongst principals and senior teachers in Malaysian schools to open and operate charter schools, particularly in the rural areas that were affected by the flood in 2014.

2.0 Methodology

The study adopted the survey design and three indicators were developed for the questionnaire. These were the principals' (i) best management practices such as in finance and access to professional networks for learning assessment and good mentoring skills; (ii) academic management such as effective curriculum and instruction development, continuous academic improvement for students and teachers, and teaching and learning support from professional networks particularly during emergency and natural disaster; and (iii) effective management of non academic matters such as soft skills and effective counselling services for teachers and students.

3.0 Results and Discussion

Findings of the study indicated that the respondents' readiness in best management practices was higher than the readiness to manage charter schools in terms of academic matters and non-academic matters. However, all three indicators of readiness indicated very high medians of 4.67, 4.33 and 4.17, while the means were 4.42, 4.31 and 4.25 respectively. The results also showed that the respondents' readiness for best management practices is statistically significantly higher than the readiness for their provision to lead for academic matters and non-academic matters.

4.0 Conclusion

In conclusion, the study has shown that school management personnel's are ready to establish charter school in rural areas of peninsular Malaysia. However, rigorous training and information need to be disseminated particularly on how to develop/attain professional courses for their academic staff.

Despite the positive readiness shown among the respondents, I have some reservations and concerns related to the idea of Charter Schools. The concerns come from my readings, since the study is only inclusive to flood disaster population. It means before the implementation of charter school in large scale to Malaysian Education System, a pilot study needs to done thoroughly due to aforementioned reasons. They are:

a) Charter School can kill progressive educators/education. The orientation is towards profit making among the well prepared community due to its business orientation. Later it will develop bigger gap between established community (usually non Malay communities which have bigger capitals and skills) vs. non established community (e.g. rural areas, under development areas of Malay or other bumis). Federal especially Ministry of Education will have no means to control private Charter School. A good example is Dong Jiao Zhong and UTAR.

b) Charter School will lead to bigger segregation rather than unity. The gap developed due to better and well equipped community will develop better school because of its capital. I afraid there will be some school that will segregate the admission due to its nature of students' body due to racial differences or the contributor of the capital.

c) Capitalization of charter school for privatization will give more challenge and difficult times to government school (school under Federal) because it will be under scrutiny when the two(charters vs. public school) will be compared in terms of achievements and management. In one aspect, it is good because it gives more room to improve and see our own weaknesses but from other different aspects, the privatization of charter school will open up of weaknesses to the public scrutiny thus weaken the confidence to the government.

d) Charter schools ideas are related to empowerment and running away from government red tape, but do the MOE opens up to the idea of deregulation and greater accountability from Charter Schools?

e) Since Charter School will use a lot of public resources, MOE needs to be ready with a strong and transparent audit system.

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DEVELOPING MALAYSIAN PSYCHOLOGICAL DEBRIEFING (MY-PsychD) MODEL FOR DISASTER DEBRIEFIING TEAM

Project Information
Project Leader : Nabisah Ibrahim
University : Universiti Utara Malaysia
Address : Pusat Pengajian Psikologi Gunaan, Dasar dan Kerja Sosial
Contact number : office (04-9285713) h/p (019-5900635)
Email : nabisah@uum.edu.my
Project Members : Siti Rozaina Kamsani
Noor Azniza Ishak

1.0 Introduction

Natural disaster such as flood disaster affects people of all ages and can exacerbate or provoke mental health problem (Bisson & Deahl, 1994). Researches indicated that those who encountered this type of traumatic event mostly experienced extreme and heightened fear, felt numb and helpless (Hall, Hoerster, & William, 2015; Talbott, 2009). Consequently, flood survivors often struggle to regain control of their lives. In a worst scenario, flood survivors may develop more prevalent disaster related disorders such as major depressive disorder, social anxiety disorder, and Post-Traumatic Stress Disorder (PTSD) (Vernberg, Steinberg, Jacobs, Brymer, Watson, Osofsky, & Ruzek, 2008).

Realizing the significant effects of flood disaster on survivors' psychological well-being, professional and paraprofessional volunteers have used the Psychological Debriefing intervention to provide emotional and psychological support in the days immediately follow the traumatic event. This intervention consists of a discussion and review of the traumatic event or critical incident by the survivors through a series of phases that often facilitated by the debriefing team (i.e. the volunteers).

Currently, so many volunteers formally or informally used psychological debriefing in approaching flood survivors by asking them to express their feelings and sharing traumatic stories, however, a search of the literature on culturally fit psychological debriefing model found a significant gap on published local research with regard to this matter. Therefore, this study aims to develop a Malaysian Psychological Debriefing Model (My-PsychD) that can be used by the professionals and paraprofessionals volunteers to minimize the negative effects of aftermath. As part of the model development, this study examines the experiences of professional and non-professional volunteers as well as the flood survivor involved in the Psychological Debriefing intervention.

2.0 Methodology

Using a qualitative research design, this study has been conducted with 20 paraprofessional and 10 professional volunteers from different backgrounds such as counsellors, social workers, NGOs officers, and welfare officers. All of these participants had experienced working with Kelantan's flood survivors for at least one month. The participants of this study also consisted of 35 local flood survivors from the Kuala Krai area in Kelantan. Based on the Crisis Intervention Theory, the semi-structured interview questions were designed based on participants' personal background, flood involvement experiences, psychological debriefing exposures, and personal reflections on flood disaster. All participants were identified by means of purposive sampling technique and were interviewed through focus group and face-to-face interviews.

Data were analyzed using NVivo 10 (source, nodes, queries, model and classfication) software and were then categorizd based on objectives of the study and then broken into several tree nodes. Tree nodes were used to avoid ovelapping of selected categories based on the coded data. The My-PsychD model was then developed based on the emerged data related to the cultural components of the psychological debriefing model and factors associated with the standard procedures of conducting the Psychological debriefing.

3.0 Results and Discussion

3.1 Cultural Components

The result of this study reveals four important cultural components that need to be considered in providing any volunteer services especially to the disaster survivors in Malaysia. The four cultural components are: 1) local norms, 2) values, 3) belief systems, and 4) (local) language (refer figure 3.1).

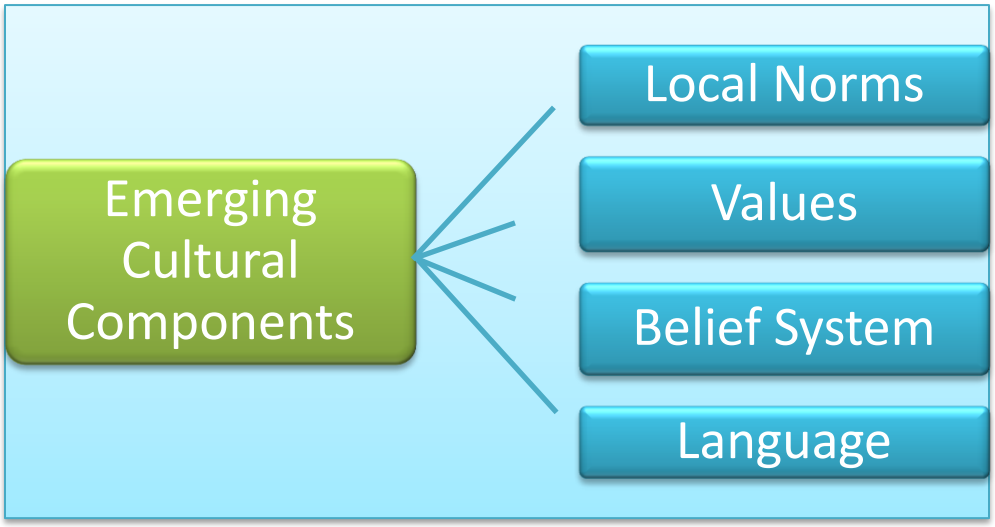

Figure 3.1: Cultural Components of Psychological Debriefing

Kelantan is a state in the Northeastern Peninsula of Malaysia, where we may still find people of Kelantan who are strongly upholding and practices their local norms and values. To maintain the prosperity of the community, everyone is encouraged to practice good values in their daily lives, which include respecting each other, be considerate, and caring for one another (Aziz, 2001; Wan & Hanapi, 1999).

> *"Jangan berselfie. Pakaian yang sesuai. Pengalaman saya semasa saya bersama mangsa, ada satu kumpulan ini, mereka berpakaian tidak menutup aurat, berpakaian ketat dan sebagainya.Sungguh tak sopan"(Flood Survivor)*

> *"Antara yang penting dilakukan oleh volunteer kepada survivors ialah reflect apa yang mereka alami dan tunjukkan empati kita bahawa kita dapat merasa apa yang mereka rasa dan supaya mereka tahu apa yang mereka rasa itu memang valid" (Professional Volunteer)*

Besides local norms and values, belief system is also identified in this study as an integral part of the local people as it guides their way of living. Islam is considered as the most influential religion in the state of Kelantan. This is because 95% of Kelantan's population is ethnic Malay. Under the Malaysian Constitution, all Malays are considered Muslims. Since Islam is the main religion among the Kelantan people, this religious belief does influence participants' belief system. Hence, this makes belief system as one of the important cultural components.

Even though Bahasa Malaysia is the official language in Malaysia, Kelantan people use their own language when communicating with each other known as Kelantanese dialect. The dialect is considered distinct and unique, even those who are fluent in Malay language may not be able to understand it. Since Kelantan people use their own dialect in communication, hence this makes language as one of the important cultural components for professional volunteers' consideration.

> *"kemahiran berkomunikasi maksudnya kita boleh menggunakan bahasa mereka gunakan. Kalau di Kelantan, kena faham dialek diorang ini. Kalau boleh cakap bahasa dialek itu, jadi mangsa-mangsa banjir pun suka dengar"(Professional Volunteer)*

3.2 The Integration of Cultural Components in the Malaysian Psychological Debriefing Model (My-PsychD)

The result of this study also revealed that all the four cultural components mentioned above served as the standard procedures that influenced the development of the Malaysian Psychological Debriefing model (My-PsychD). The model consists of three main phases as shown in figure 3.2.

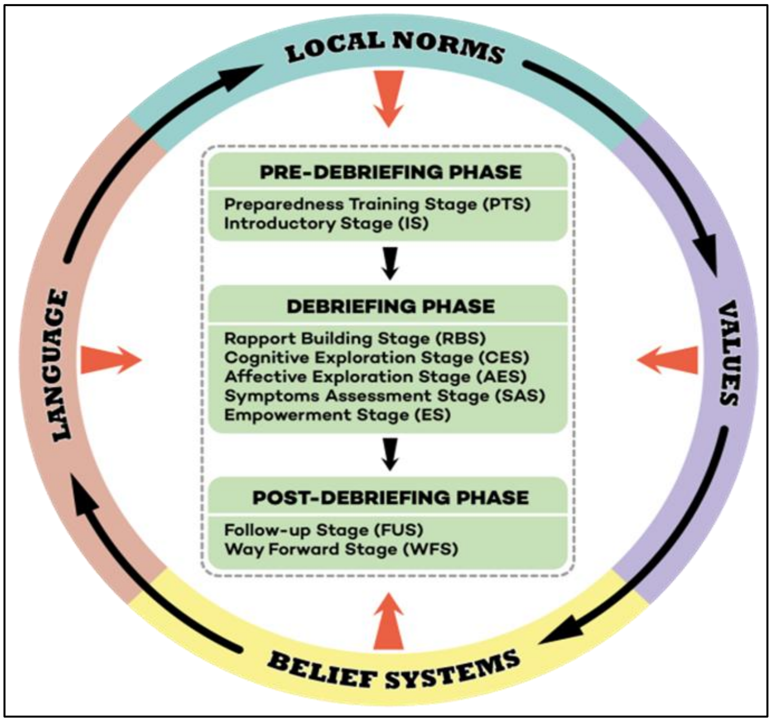

Figure 3.2: Malaysian Psychological Debriefing Model (My-PsychD)

Pre-Debriefing Phase

The result revealed two main themes under the pre-debriefing phase: 1) Preparedness training stage (PTS) and 2) Introductory stage (IS). The local norms of asking permission from the authority and the perception of having proper training before providing any psychological intervention have been integrated into these two stages.

> *"Kalau boleh sebelum bagi bantuan pada mangsa, rujukla pada pihak berkuasa macam JKM ke atau MKN ke supaya bantuan tidak redundant dan kita boleh monitor sapa yang dapat bantuan dan yang belum dapat lagi" (Paraprofessional Volunteer)*

The analysis of interview scripts showed that participant perceived that well-trained volunteers are more reliable than volunteers who do not have proper training experiences. They perceive that the well-trained volunteers are skillful to make connection with the survivors and instill hope in them to survive the aftermath.

Debriefing Phase

Five major themes emerged under the debriefing phase of My-PsychD model, which include Rapport Building Stage (RBS), Cognitive Exploration Stage (CES), Affective Exploration Stage (AES), Symptoms Assessment Stage (SAS), and Empowerment Stages (ES). Understanding local norms, values, belief systems and language are found to be imperative in the rapport building stage. In this stage, it is necessary for the debriefing team to introduce their team members before providing any psychological interventions to the participants.

> "S*eeloknye kenalkan diri dulu sebab ramai yang datang beri bantuan. Tapi kami tak pasti siapa dan kadang-kadang rasa tak selesa bila bercakap dengan sukarelawan yang tak bgtau nama pun...(flood survivor)*

The result of the study recommended volunteers not to conduct the psychological debriefing immediately after the disaster as suggested by previous western literature (Dyregov, 1997) but to wait until several weeks after the disaster so the survivors have ample time to focus on finding the important resources for their basic psychological needs such as shelter, foods, and clothes. Volunteers in this study had suggested conducting the psychological debriefing intervention within 2-3 weeks after the flood disaster to provide room for the survivors to focus on material and physical safety first before focusing on their emotional stability.

> *"..saya rasa bagi kami edar-edarkan makanan dulu, pastikan keadaan dah selamat dulu, mangsa dah ditempatkan ditempat yang selamat dulu...lepas tu kalua nak buat intervensi psychologi ni boleh la..." (paraprofessional volunteer)*

After building rapport, volunteers are advised to explore survivors' cognitive experiences before going deeper to their affective exploration. By exploring survivors' cognitive level, volunteers would be able to help survivors to share their thoughts and sensory information related to the disaster experiences.

> *"Waktu banjir besar, banyak pahit manis, tangis bersama. (tidak menahan kesedihan). Saya bersama lapan (8) keluarga dan membawa bersama enam (6) orang anak. (sebak tidak dapat menahan kesedihan)" (Flood survivor)*

In the debriefing phase, volunteers need to have basic knowledge on how to access symptoms of anxiety, depression or trauma. This is crucial especially in our culture as most systems of mental illness are portrayed through psychosomatic symptoms such as sleeping difficulty, body ache, and loss of eating appetite rather than through verbal expression of the symptoms (Buu, Wang, Wang, Puttler, Fitzgerald, & Zucker, 2011).

"Debriefing team perlu jugak tahu cara untuk mengenal pasti tanda-tanda seperti kemurungan atau trauma supaya lebih mudah memberi bantuan. Kena fokus kepada simptom-simptom fizikal sebab memang orang-orang kita tak cakap dia tertekan atau murung tapi simptom psikosomatik memang ada"(Professional Volunteer)

The next stage in debriefing phase is the empowerment stage. Volunteers suggested that empowering survivors in the debriefing process is pivotal as it is one way of helping the survivors to cope with the effects of aftermath.

> *"........bagi semangat supaya mereka tidak putus asa, beri maklumat mana boleh dapatkan bantuan, mana boleh dapatkan rumah sementara atau mungkin ajar cara-cara nak hilangkan stress teruatama pada kanak-kanak... " (Paraprofessional Volunteer)*

Post Debriefing Phase

The result showed two main themes under the post debriefing phase: Follow-Up Stage (FUS), and Way-Forward Stage (WFS). The data revealed that it is recommended by all three groups of participants to do the follow-up session with the disaster survivors after the debriefing process. Both professional and paraprofessional suggested that the volunteers especially those who want to do the psychological debriefing intervention with survivors should consider to do the follow-up on the first, third, and sixth month after the debriefing took place.

> *" ada keperluan untuk datang lagi dan buat follow-up tiga dan enam bulan selepas bencana untuk tengok balik keadaan mangsa-mangsa tersebut. Kalau hanya buat sekali (merujuk kepada debriefing intervention) selepas beberapa minggu bencana, saya rasa tak dapat membantu mangsa sangat sebab waktu tu mungkin mereka masih dalam keadaan denial..." (Professional Volunteer)*

> *"Bagi moral support lepas beberapa bulan sebab waktu ni lah diorang lebih memerlukan sokongan untuk teruskan hidup... jangan la datang tanya masa awal-awal aje sebab masa tu berita tengah panas. Atau sebab nak dapatkan maklumat berita aje" (Paraprofessional Volunteer)*

4.0 Conclusion

Important findings of the study are summarized as follows:

4.1 Local norms, values, language, and belief system of the survivors need to be considered in conducting My-PsychD model with disaster survivors.

4.2 Volunteers, regardless of their personal and professional background need to be aware about these cultural components so they can help the survivors to get the benefit of the model.

4.3 The integration of those four cultural components in the implementation of psychological debriefing intervention is what makes My-PsychD differ from the previous psychological debriefing model.

4.4 The My-PsychD model consists of three main phases namely: 1) Pre-Debriefing Phase: Preparedness Training and Introductory Stages, 2) Debriefing Phase: Rapport Building, Cognitive Exploration, Affective Exploration, Symptoms Assessment, and Empowerment Stages, and 3) Post-Debriefing Phase: Follow- Up and Way-Forward Stages.

4.5 There are timing variations in conducting the psychological debriefing intervention with the flood survivors.

4.6 Giving the specific example of flood survivors in Kuala Krai, this model can be used as an in-house training for disaster debriefing teams.

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KAJIAN PENGALAMAN BERHADAPAN DENGAN BENCANA: KE ARAH PEMBENTUKAN MODUL PSIKOLOGI PENGURUSAN PSIKOSOSIAL BENCANA DI MALAYSIA

Maklumat Projek

Ketua Projek	: Prof. Madya. Dr. Mohd. Dahlan A. Malek
Universiti	: Universiti Malaysia Sabah
Alamat	: Pejabat Am, Fakulti Psikologi dan Pendidikan, UMS, Jalan UMS, 88450, Kota Kinabalu, Sabah.
No. Telefon	: 088-320000/ Ext: 8010/8011, HP: 012-8393811
Email	: dahlanam@ums.edu.my
Ahli Projek	: Ferlis Bullare @ Bahari, Ida Shafinaz Mohamed Kamil, Adi Fahrudin, Zatul Karamah Ahmad Baharul Ulum

1.0 Pengenalan

Banjir merupakan bencana alam yang diberi perhatian kerana ia mampu mewujudkan pelbagai kerosakan harta benda dan mengancam kehidupan serta ekonomi negara khususnya penduduk yang terlibat. Menurut catatan Majlis Keselamatan Negara (2015), jumlah mangsa banjir mencapai bilangan 541,896 orang seluruh negara dan Kelantan menunjukkan catatan tertinggi. Sudah pasti, mangsa-mangsa banjir bukan sahaja terpaksa berhadapan dengan kerosakan besar, malah menghadapi masalah aspek psikologikal. Walau bagaimanapun sejauh manakah persediaan mereka dalam mengahadapi musibah yang menimpa mereka dan bagaimana pihak yang berkaitan menangani permasalahan ini. Kajian ini secara umum bertujuan untuk mengenalpasti tahap psikologi mangsa banjir yang pastinya memberi impak psikologi seperti kemurungan, reaksi psikososial, daya tahan, daya tindak dan juga trauma yang mungkin mencapai tahap yang berpanjangan dan membimbangkan seperti post-traumatic disorder. Bagi tujuan khusus pula, terdapat tiga tujuan yang ditekankan oleh penyelidik iaitu (i) mengetahui tentang persediaan psikologi mangsa pasca banjir, (ii) mengenalpasti tahap kesediaan psikologi dan kesejahteraan psikologi para mangsa banjir, dan (iii) mengenalpasti kemahiran dan strategi yang sesuai digunakan dalam menghadapi situasi yang memerlukan sokongan emosi dan juga kesejahteraan psikologi.

2.0 Metodologi

Kajian ini menggunakan reka bentuk *explanatory sequential design* yang mengandungi dua fasa: fasa kuantitatif kemudian ke fasa kualitatif. Set soal selidik digunakan pada fasa kuantitatif untuk memperoleh data dan fasa kualitatif untuk menerangkan data kuantitatif. Kajian ini melibatkan seramai 179 orang penduduk yang berada di sekitar Manek Urai termasuk Kg. Manek Urai Baru dan Kg. Manek Urai Lama yang merupakan salah satu kawasan yang terjejas teruk dalam daerah Kuala Krai, Kelantan. Responden kajian dipilih berdasarkan kaedah persampelan bertujuan (*purposive sampling*). Daripada 179 responden, 29 daripadanya terlibat dalam fasa kualitatif. Set soal selidik yang digunakan pada fasa kuantitatif terdiri daripada *Multi Depression Inventory* (MDI), *Disaster Psychosocial Response* (DPR), *Adolescent Coping Scale* (ACS), *Posttraumatic Stress Disorder Checklist* (PCL) dan *The 14-item Resilience Scale* (RS-14). Kemudian, kaedah temubual berstruktur digunakan bagi mendapatkan data kualitatif.

3.0 Keputusan Dan Perbincangan

Hasil analisis melaporkan terdapat tiga tahap yang utama bagi kemurungan, reaksi psikososial, daya tahan, daya tindak serta trauma iaitu tahap rendah, sederhana dan tinggi. Berdasarkan dapatan, kemurungan berada pada tahap tinggi, reaksi psikososial berada pada tahap sederhana, strategi daya tindak berada pada tahap tinggi, trauma pada tahap sederhana dan daya tahan berada pada tahap yang tinggi. Keputusan juga menunjukkan hubungan antara reaksi psikososial dan trauma menunjukkan hubungan positif yang kuat dan signifikan. Hubungan antara acute stres dan trauma juga menunjukkan hubungan positif yang kuat dan signifikan, manakala hubungan antara acute stres dan daya tahan menunjukkan hubungan positif yang lemah tetapi signifikan. Melalui dapatan kajian kuantitatif, penyelidik turun menemukan dapatan kualititaf yang menerangkan situasi yang dihadapi oleh mangsa. Dapatan menunjukkan bahawa walaupun mangsa banjir menghadapi musibah banjir yang amat memberi kesan yang mendalam terhadap psikologikal mereka, namun, strategi daya tindak dan daya tahan yang mereka miliki amat membantu mereka dalam berhadapan dengan bencana banjir. Strategi daya tindak yang menjadi fokus utama dalam kalangan masyarakat di kawasan kajian adalah berkaitan dengan spiritual dan keagamaan. Dapatan menunjukkan mereka redha dengan ketentuan dan takdir bencana yang menimpa mereka dan pengalaman menghadapi banjir pada masa lalu turut membantu mereka dalam meningkatkan daya tahan diri mereka dalam berhadapan dengan bajir besar pada penghujung tahun 2014 tersebut.

4.0 Kesimpulan

Melalui kajian yang yang dijalankan, terdapat beberapa kesimpulan yang dapat dilakukan iaitu:

i) Kajian ini merupakan satu platform dimana penyelidik dapat meneroka isu yang dibangkitkan yang melibatkan pengurusan bencana alam di Malaysia. Oleh yang demikian, keperluan untuk mewujudkan kesedaran kepada semua pihak berkaitan dengan persiapan psikologi dalam menghadapi bencana dilihat sangat penting dan perlu diberi penekanan untuk penyelidikan akan datang.

ii) Dapatan kajian ini juga diharapkan dapat membantu untuk menghasilkan satu modul psikologi pengurusan psikososial terhadap bencana di Malaysia. Modul yang dihasilkan boleh menumpukan kepada keperluan sesebuah masyarakat dalam satu kawasan mengikut budaya, kearifan lokal (*local wisdom*) dan sebagainya.

iii) Cadangan untuk mewujudkan SOP (Standard of Procedur) dalam pengurusan bencana di Malaysia. Walaupun SOP tersebut telah wujud, namun kesepakatan dari semua pihak amat diperlukan bagi memastikan perkara tersebut dapat berjalan dengan lancar sebelum, semasa dan selepas kejadian bencana.

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INVESTIGATING OLDER PERSONS AND NGOS FLOOD PREPAREDNESS AND TO IMPROVE NGOS RELIEF PROGRAMS BY DEVELOPING EFFECTIVE STANDARD OPERATING PROCEDURES (SOPS) IN REDUCING VULNERABILITIES ASSOCIATED WITH AGEING

Project Information

Project Leader	: Assoc. Prof. Dr. Sharifah Norazizan Syed Abd Rashid
University	: Universiti Putra Malaysia
Address	: 43400 Serdang, Selangor
Contact number	: 012-3081210
Email	: sharifah@upm.edu.my
Project Members	: Dr. Amna Md Noor, Mr. Bukryman Sabri Mr. Mohd Fadzillah Bagat, Mr. Mohd Rizal Hussain

1.0 Introduction

Globally, the proportion of older persons is growing faster than any other age group. Malaysia is experiencing a faster rate of ageing at lower levels of development. The 2010 census report indicated that of the total population of 28.25 million, about 2.2 million (7.78%) consisted of older persons aged 60 years and older. Malaysia is expected to reach 'aged nation' status within the next two decades, when the proportion of the older persons reach the 15% mark (DOSM, 2011). The growing number of older persons make them a significant part of society.

The impact of natural disasters on the older population is unlikely to diminish in the years to come due to the increasing number of older persons in Malaysia. The Asia Pacific region where Malaysia is located is the most disaster prone area in the world. The 2014 'tsunami like disaster' which hit Kelantan, Trengganu and Pahang was the most significant and the largest recorded flood in history. Kelantan suffered the greatest damage in which 202,000 victims were displaced (Su Lyn in Kamarul Aryffin et al, 2015) and the victims and authorities were all caught unprepared. Thus Malaysia and around the world, disasters continue to challenge the disaster management sector from preparedness through to recovery phases. The experience of the 2014 flood have highlighted issues regarding the role of the aid agencies both government and non-governmental (NGOs). The NGOs were the quickest in providing local relief and nearly every national, regional, and local charitable organizations in Malaysia also abroad contributed assistance to the recent flood victims.

Recent trends with respect to management of natural disasters have highlighted the role of NGOs in all phases of disaster management. Research showed a notable difference emerged between the perceptions of the older persons and those of the respondents from aid agencies (government and NGOs) dealing with emergencies. The common problems in emergencies identified by the older persons compared with the most common activities of the NGOs surveyed and the common problems that NGO staff thought older persons would face in an emergency differ. An understanding of older persons and natural disaster is fundamental to fulfil their special needs as well as to reduce vulnerability. This paper presents information on how the older persons deal with emergency in terms of their needs and problems they faced and on how the older persons interpret disaster preparedness. The roles and functions of the NGOs facing emergencies in all phases of disaster management and the suitability of their relief programs organized were also presented.

Against this background, this research was conducted with the following objectives.

1 To investigate how the older persons are impacted objectively and subjectively by the recent flooding.
2 To identify issues, problems and to address the needs of the older persons during the recent flooding.
3 To identify the roles and functions of the NGOs for disaster preparedness, at all levels (community, district, state and federal levels).
4 To document the experiences of the older persons, the NGOs and other emergency response agencies during the disaster.
5 Making recommendations to improve on the relief programs that best suited and provide long term benefits to the older recipients.

To develop effective Standard Operating Procedures (SOPs) for NGOs to meet the special needs of the older persons and reduce vulnerability associated with ageing.

2.0 Methodology

Qualitative (Focus Group Discussions FGDs and In-depth Interviews IDIs) and quantitative (interview surveys) approaches were utilized in this study. A total of 36 participants were involved on a selected and voluntary basis in FGD sessions conducted in Selangor and Kelantan at the end of year 2015. The participants involved were from various agencies which include the federal and local authorities (Pejabat Tanah & Jajahan Kuala Krai, Pejabat Daerah Kuala Krai, Bomba, JPAM, RELA), NGOs (Medical Relief Society Malaysia (MERCY), Persatuan Kebajikan Prihatin Bangi (BANGI CARE), Malaysian Chinese Muslim Association (MACMA), Yayasan Darul Hijrah (DARUL HIJRAH), Pertubuhan Kembara Amal (PEKA), Briged Bakti Malaysia (BBM)) and older persons. All FGDs were conducted by trained Moderators and assisted by Rapporteur (note-taker). For the IDIs, five interviewees were involved which include the District Officers from Kuala Krai, Tanah Merah, Gua Musang, and Pasir Mas and Social Welfare Officer from Kuala Krai, Kelantan. This research also conducted face-to-face interviews by trained enumerators using questionnaire developed based from the findings of the FGDs conducted earlier. A total of 397 respondents aged 60 years and above in selected areas affected by the flood in Kelantan were randomly chosen for the survey. Respondents were briefed about the study and asked to sign a consent form before participating. The Department of Social Welfare provided the listing of respondents to be included in the survey. Questionnaire covers background information of the respondents such as socio-economics, health and specific questions related to issues, problems and needs during flood disaster. In addition, observations were also carried out on selected areas where disaster occurred to observe the details of the physical impact of the flooding on the environment and the facilities, infrastructures, operations, procedures and other related services provided by the federal, the local authorities and NGOs. Related information from all this various sources were used as input to develop the Standard Operating Procedures (SOPs) for NGOs to meet the special needs of the older persons and reduce vulnerability associated with ageing. Data were analyzed using Statistical Package for Social Science (SPSS).

3.0 Results and Discussion

3.1 FGDs and IDIs

Findings from FGD showed that majority of the NGOs agreed that it was neither possible nor desirable to prioritise one group, such as older persons over others in emergencies. Eventhough majority of them did not prioritise any particular vulnerable groups, their target was whoever were the most vulnerable. However, the NGOs came to a consensus that emphasis be given to the older victims and proper plans be developed in collaboration with the government agencies. The 2014 flood showed that the NGOs have played an important role and a vital stakeholder in the conventional relief and response effort as part of the larger coordinated and collaborative system for disaster response. Role of NGOs in disaster response was more overwhelming than during disaster preparedness. The NGOs were involved in relief assistance complementing the government efforts by collecting, stocking, transporting and distribution of relief materials to the affected community; documentation procedures etc. The NGOs also provided assistance in terms of shelter and settlements. NGOs were not involved in the dissemination of early warning information and evacuation of communities in times of need. District administration should involve NGOs during this phase. The district administration's lack of logistical support to the NGOs for the distribution of relief materials led to the unfair distribution of these relief materials to the older victims. This clearly showed the failure during the preparedness phase where there was a lack of cooperation, coordination and consultation between the GO-NGOs and the older persons. There was a lack of NGO involvement in the SAR (search and rescue operations) because of its highly specialised nature. However, the NGOs contributed in terms of helping with registration, disaggregated data collection and documentation of the people evacuated. (This is supported by the IDIs where the local villagers specifically stated that SAR operations were taken over by their local heroes).

There was a mismatch between what the older victims needed in emergencies and what the NGOs delivered. During the disaster, there was loss of appliances and utensils and power cuts that lasted for a few days. Therefore following the disaster, what the victims needed were at least a 3 day supply of foods that require NO refrigeration, preparation or cooking. This is of importance for the older victims who may lack the ability to cook. Following the disaster, many NGOs from all over the country came into the rescue and without prior preparation and consultation among the NGOs themselves and the district management. There was a clear evidence of duplication of relief materials. Instances where lorry loads of similar relief food and materials were brought in which led to wastage and failure to meet needs. The relief given was not based on a systematic assessment of needs.

3.2 Face-to-face Interview (Survey)

The total number of respondents surveyed was 397 aged 60 years and above. Majority of the respondents were Malay (99.5%), female (58.7%), with primary school qualifications (58.3%), mostly married (51.9%), majority are house owners (77.6%), mostly 'kampung' house (87.7%). Majority of the respondents are living with family (67.3%), not working (42.3%), and those working with household income RM1000 and below (92.4%). The respondents' perception on health status are moderate (74.2%). Majority of the respondents have high/low blood pressures (51.6%), followed by muscle weakness/joint pains (27.5%), diabetes (23.9%), eye problem (17.9%) and heart problem (8.3%).

Regarding flood experience, more than 90% of the respondents surveyed had experienced flooding before. There was a good mix of respondents surveyed where 54.4% said that their areas were hit by flood for the first time. Majority said that it is all based on their experience and observations by looking at the water levels to knowwhether flooding will occur. Majority of the respondents (80%) said that no warnings from authorities were given with regards to flooding. When asked who gave warnings about the flood, more than 64% said that it was via the electronic media, the local leaders (19.5%); government agencies (14.6%) and the NGOs (1.2%). More than 90% said that the information and warnings were of importance and effective for them to prepare for the disaster. Majority of the respondents (90.2%) had to be relocated when the flood disaster striked. Majority (53.1%) of the respondents took shelter with family and friends, in mosques and open areas while 35.8% took shelter in schools. When asked who assisted them with the relocation when the disaster striked, majority of them (50.8%) said the villagers were the first to help, followed by family members (42.4%), the safety regulatory body (2.8%) and the NGOs (0.6%).

Findings also showed the lack of relief assistance (49.4%), basic needs (43.1%) and basic facilities (42.6%) were main issues and problems faced by elderly during the flood in 2014. In terms of its impact, 66.2% of the respondents experienced social and psychological traumas that afflict them. The material losses of the respondents were also recorded. Majority of them lost their home appliances (92.7%) and lost in monetary terms of RM5000 and below (43.8%), However, majority of the respondents received help and were compensated for the losses incurred (86.4%) and cash were given as a form of compensation (93.7%). All these assistance and compensations were given through the Committee either at the village, state or federal levels (61%), and 39% were given direct to the flood victims. The respondents also were asked about their plans for the future and majority (86.3%) will not leave their place of stay and 10.6% will move to a new home.

3.3 Standard Operation Procedure on Flood Disaster for Older Persons

There is a general consensus towards addressing the needs of the older persons in disasters. This does not necessarily mean that numerous special services should be established for older persons. The older persons clearly have special problems and there is thus the need to improve on the existing SOP with clear emphasis on the guidelines for mainstreaming the needs of the older persons in disaster situations. Opinions were sought with regards to the need of a SOP for older persons and majority (99.2%) believed that there is a need for a SOP for the older persons. This research has come out with several procedures on flood disaster for older persons as recommendation that can be used by NGOs to support the Department of Social Welfare as the main agency under the Welfare Scope as stated in the National Disaster Plan Management (Arahan 20 MKN).

4.0 Conclusion

Summary of Project Findings:

4.1 This Report focusses on the lessons learned from the 2014 Kelantan flood disaster. The Research identified key observations, findings, and recommendations that have implications for all phases of disaster management namely preparedness, response, recovery and mitigation.

4.2 The role of the NGOs were more prominent during the response phase as compared to the preparation phase. Regardless of the nature of the disaster, its management must involve four phases: mitigation/prevention, preparedness, response and recovery. These phases must be well coordinated across all relevant agencies.

4.3 Based on findings, the older flood victims relied on experiences in preparing for disaster and majority had no emergency plan, had never participated in any disaster preparedness educational program, and were not aware of the availability of relevant resources. The question of how prepared were the older victims in facing the disaster pointed to the deficits in the disaster preparedness among the older victims. They did not have any basic supply of food, water or medical supplies in case an emergency situation arises.

4.4 The NGOs did not prioritise any particular vulnerable groups and they targeted whoever were the most vulnerable. However, the NGOs came to a consensus that emphasis be given to the older victims and proper plans be developed in collaboration with the government agencies.

4.5 SOPs need to be kept in writing for various phases of the disaster i.e., from the activation of it to the post-disaster phase. These SOPs must be tested and drilled with all personnel involved at regular intervals.

4.6 Because no one can guarantee that the record-setting flood of 2014 will not recur, disaster preparedness, response and right through the recovery phase are without a doubt the best way forward.

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PARTICIPATORY APPROACH OF TRAINING AND AWARENESS PROGRAM TO DEVELOP COMMUNITY-BASED PREPARATION, RESPONSE AND RECOVERY TEAM TO BUILD RESILIENT COMMUNITIES

Project Information

Project Leader	: Prof. Dr. Zailina Hashim
University	: Universiti Putra Malaysia
Address	: Jabatan Kesihatan Persekitaran dan Pekerjaan, Fak Perubatan & Sains Kesihatan
Contact number	: 0176361367
Email	: zailina@upm.edu.my
Project Members	: Dr. Vivien How, Dr. Emilia Zainal Abidin Dr. Sarva Mangala Praveena, Dr. Karmegam Karuppiah Dr. Sharifah Norkhadijah Syed Ismail, Dr. Irniza Rasdi

1.0 Introduction

As have been reported on 25-30th Dec 2014, the east coast states of Malaysia experienced heavy floods. Many of its population was caught off-guard during the unprecedented scale of the recent flood and was not in the position to self-sufficiently prepare themselves to confront the disaster even as flooding occurs on a smaller scale during a seasonal timescale during the northeast monsoon seasons. The state of Kelantan was badly affected by the flood with as many as 45,000 evacuees with 22 missing persons and deaths reported (The Malay Mail, 2014). Kelantan state was the worst state hit, especially Kuala Krai which is the second largest district in Kelantan after Gua Musang with area 2,329 km^2.

Existing flood management system have been in place in Malaysia and consist of flood control, forecasting, warning and evacuation systems (Mohamad Sukeri and Shazwani, 2015). Despite having a good delivery system and plan in flood management, the process is still a reactive instead of a proactive process. Some of the evacuation operation was slow and the recovery phase in the aftermath took a long time and the impact on the affected community was substantial due to the cases of mortality and the loss of many properties.

Considering that it is the people at the community or village level who suffer its adverse effects, it is important that the community learn to cope and use survival strategies to respond to emergency situation at the point of its occurrence before the arrival of outside help from the authority or the government arrives. In essence, there is a need for the community to be prepared in order to create a more resilient community in facing such disastrous flood. In doing so would enable the community to protect themselves from damage and further harm.

Thus, a community which have been trained will not hamper or cause delay to the authority during search, rescue and evacuation operations and will be able to reduce their own vulnerability in the recovery phase. Furthermore, a community-level ERP program can be sustainable and can be applied in any future natural disaster episodes.

The disaster management plan in Directive No. 20 under the Majlis Keselamatan Negara for flooding under natural disaster is already a comprehensive crisis management tool. Should the community-based participatory approach method to formulate and develop a preparation, response and recovery team is successful, the model can be used as a supplement which will not contradict the disaster management plan, but will support its implementation.

2.0 Study Objectives

1. To assess the level of knowledge, attitude and practice among the selected community in relation to training and awareness program on emergency preparedness, response and recovery related to flood disaster
2. To develop a community-based participatory approach training and awareness program on emergency preparedness, response and recovery related to flood disaster.
3. To develop and formulate community-based participatory approach preparation, response and recovery team related to flood disaster.

This study had several expected outcomes, namely i) to build a resilient community, ii) to reduce the vulnerability of the community and society in the face of an unexpected, unprecedented disaster by empowering them on how to address such situations and iii) as a sustainable management tool for flood disaster based on close-knit community setting which will ensure a continual participation and outreach of the community.

3.0 Methodology

Study Location and respondents

The study was conducted at Ulu Mengkebam *Penggawa* district, Kuala Krai from 31st of May till 16th November 2015 (Figure 1).

Temporary shelter

There were about 150 families at the temporary shelters and some have moved to more permanent locations. When the questionnaire survey was carried out, only about 100 families were at the temporary shelters, namely Mercy Temporary Shelter, PEKA's Shelter, Desa Sakinah Kg. Guchil, Desa Rahmah Kg. Pahi and Lions Shelters.

Permanent Houses in Villages

There were 17 villages which were heavily affected by flood in Ulu Mengkebam District namely Kg. Keroh, Kg. Kuala Pertang, Kg. Bedal, Kg. Pasir Era, Kg. Sungai Durian, Kg. Batu Jong, Kg. Chenulang, Kg. Kenor, Kg. Guchil, Kg. Batu Lada, Kg. Tualang, Kg. Bekok, Kg. Pahi, Kg. Bahagia, Kg. Pasir Kelang and Kg. Temalir. Due to time constraint, purposive sampling of 5 villages around the Ulu Mengkebam Penggawa District within the 10 km radius from Kuala Krai downtown was carried out. Kg. Bekok, Kg. Tualang, Kg. Batu Lada, Kg. Guchil and Kg. Sg Durian were selected based on these justifications:

i. The villages are located near to the river/stream whereby Kg. Tualang and Kg Bekok are located close to the Sungai Lebir; Kg. Batu Lada and Kg. Guchil are located close to Sungai Kelantan while Kg. Sg Durian is located close to the Sungai Durian.
i. Water level rises every year during Monsoon season in these areas
ii. All the villagers were affected by flood (about 70 to 100 families)

The families from the temporary shelter were sampled randomly. The respondents were selected from each family and interviewed using questionnaires. Within the stipulated time, only about 70 head of families were interviewed giving a response rate of 70%. Meanwhile, about 16 respondents from each of the 5 villages were selected randomly from the name list provided by the Village Head / *Ketua Kampung* which totaled to 80 respondents involved in the survey. The interviewed was conducted using the questionnaire.

Study Instrument

Questionnaire

The questionnaire consisted of questions on their knowledge on the sources of information, place of shelter from natural disaster, attitude on handling disaster, risk communication, response to emergency, and preparedness in term of preparing emergency and sanitary kit, mean of communication, etc. The questionnaire consisted of questions on attitude toward community, local authority and assistance provided by the relief center. Practices include what the families prepared before, during and post disaster .

Study design

The cross sectional design and methodology of this study were based on the Awareness and Preparedness for Emergencies at the Local Level (APELL) developed by UN Environmental Programme. The study was conducted in three stages.

Phase 1 (At Month 2/9 months)

The level of knowledge, attitude and practice were assessed as a baseline data (Objective 1). During this stage, existing problems and priority areas were identified at the selected areas. Training modules on basic (generic) emergency preparedness, response and recovery for flooding were given to the community to increase their awareness (Objective 2). The training program would draw on the community's previous experience on flood response. The aim of this phase was to raise awareness and participation and would include a promotion campaign (poster, buntings etc) at the community level.

Phase 2 (At Month 5/9 months)
During this stage, the 2nd training module would specifically be tailored to the community using their experience as recorded in Phase 1. At this stage, it is expected that the campaigns at the community level to be physically evident as the outcome of Phase 1. During this stage, the community were trained on how to formulate, form and implement a preparedness, response and recovery team among their own community (Objective 3). The level of knowledge, attitude and practice were assessed (Objective 2).

Phase 3 (At Month 8/9 months)
At this stage, monitoring and evaluation of the community's preparedness, response and recovery team the 3rd training module consisted of the simulation for a flood-related emergency lead by the community's preparedness, response and recovery team and its effectiveness and drawbacks were assessed. The simulation would include school population participation. At the last stage, the level of knowledge, attitude and practice were assessed again (Objective 3).

4.0 Results and Discussion

Socio-Demographic Information of respondents

The ratio of female respondents to male respondents was about 7:3 with total of 70 respondents in temporary shelter. Majority (95.7%) of them was married. With regards to the education levels, 34.3% had no formal education, 24.3% received only primary education and majority had 35.7% had secondary education Most of the respondents in the temporary shelter group were women who were housewives. Majority of the men from both groups were self-employed (Table 1).

Knowledge on natural disaster before and after the Interventions

Generally, respondents (65.7%) were able to identify and describe the natural disaster in their area and almost all respondents (95.7%) were well aware that flood could cause disaster and posed severity problems (Table 2). A bit of unexpected findings given was that only small percentage (2.9%) were reported to have experienced natural disaster in the past 5 years, while others had less than 5 years of their lives.

When asked about whether flood water can rise to a dangerous level within a few hours' time, majority respondents agreed (94.3%) and they reported that preparation for flood evacuation should include securing of important documentations; which from the findings 97.1% of respondents agreed, though only 1 respondent had attended disaster training previously.

Table 1: Socio-demographic Information of respondents

Variable	Temporary shelter	Village homes
Gender		
Male	21(30%)	40(50%)
Female	49(70%)	40(50%)
Status		
Single	3(4.3%)	2(2.5%)
Married	67(95.7%)	78(97.5%)
Education		
No education	24(34.3%)	22(27.5)
Primary	17(24.3%)	13(16.2%)
Lower secondary	6(8.6%)	10(12.5%)
Upper secondary	19(27.1%)	28(35%)
STPM/Diploma	4(5.7%)	5(6.2%)
Tertiary	0	2(2.6%)
Occupation of respondents		
Self-employed	16 (22.9%)	12 (15%)
Rubber tappers	1 (1.4%)	6 (7.5%)
Civil Servants	3 (4.3%)	7 (8.8%)
Pensioners	2 (2.9%)	12 (15%)
Housewife	30 (42.9%)	13 (16.2%)
Own business	5 (7.1%)	5 (6.3%)

Unemployed	7 (10%)	9 (11.2%)
Labour/contract workers	6 (8.5%)	16 (20%)
Disable member in homes	13 (18.6%)	10 (12.5%)
Total respondent	**70**	**80**

In term of consequences after the disaster, the awareness of health problems in relation to the floodwater apart from mortality and economic damages were high (Ardalan et al., 2013). Majority of respondents (88.6%) were concerned that drinking uncooked water during flood episodes could lead to diarrheal disease. Furthermore, 74.3% also felt that the he common communicable disease during flood episode is leptospirosis (kencing tikus) (Table 2)

Harmful impacts of floods which include direct mortality and morbidity and indirect displacement and widespread damage of crops, infrastructure and property (Doocy et al., 2013; IPSS, 2007). The aftermaths of floods are water pollution, water borne-disease and other epidemics. Loss of human life and livestock, escalation of price, social insecurity and costs of rebuilding infrastructure were additional layers of constrains that affected region have to bear after the floods along with resource diversion for immediate response, rescue, relief and early recovery activities (Ghatak et al., 2012).

Disaster training is important where a study in Nepal stated that the government efforts, NGOs have started different programs to build awareness within the community through different activities. Activities include immediate response during flood, training for preparedness, training for flood response activities, providing information on flood shelters and for post rehabilitation through distributing pamphlets, posters and other materials in assisting with emergency relief (Dewan, 2015). Amilasan et al. (2012) found an outbreak of leptospirosis occurred in Metro Manila, Philippines and 10.8% died. A confirmed outbreak also found in Guyana after severe flooding, resulting in a massive chemoprophylaxis campaign to try to limit the morbidity and mortality rate (Dechet et al., 2012).

Based on the results, all agreed that older person were more vulnerable during flood episodes. Research found that age is particularly relevant which the impact of flooding on health varies significantly with age. Infirm older people and those of seventy-five years or more are more likely to be adversely affected by the cold, damp conditions caused by flooding (Tapsell et al., 2002). Similar pattern as demonstrated by REACH-KAP study in Myanmar. As in the result, all respondents stated that there was a risk of drowning especially among children during flood seasons. This is perhaps due to the lack of awareness among them on what they should do during a disaster. According to Codreanu et al. (2014), children were categorized as vulnerable population with regard to their competency to prepare and respond to the aftermath of a disaster as well as limitations in emotional and psychological maturity.

With regard to the early warning system, all respondents reported that the function of flood alarm is to indicate the needs for preparedness impending flood disaster. Results showed that their knowledge significantly improved after the Intervention 2 ($p<0.001$), respondents were now well informed that the disaster management system in Malaysia led by the National Security Council. Furthermore, data clearly showed that they were also familiarized that the commander of the disaster is the Police Force ($p=0.002$). Notably, about 72% respondents stated that mass media (TV) was mainly the source of information on the disaster.

Attitude when facing disaster and perception on risk of communication after interventions

In this section (Table 3), respondents were asked about their attitude when facing disaster and their perception on risk of communication during actual disaster and about their feelings and what would they do when they heard a forecast about flood. Based on the results, there was a slight improvement after the Intervention 1 and Intervention 2 in their attitudes as to whether they were ready to serve the community ($p=0.914$) and ready to learn first aids ($p=0.003$) respectively. However, respondents showed no difference in attitude ($p=0.305$ and $p=0.242$) regarding the community readiness to serve others during the disaster after both Interventions. This perhaps was due to that they could rely on the authority for help during the flood disaster and they know who could they turn to for support, as per discussed in KAP survey by REACH (2015), that their respondents were likely to rely on family members (52%) and close friends (43%).

Theoretically, disaster preparedness comprised risk appraisal knowledge, decision for preventive reaction, which preeminent to risk reducing attitude (Codreanu et al., 2014). Initially in a case where respondents were asked about their opinions on preparedness before flood disaster, it did not seemed to be an important element ($p=0.012$). However, after Intervention 2, respondents showed significantly ameliorate attitude ($p<0.001$) where they stated the preparedness and training were important in facing the disaster. Same trend occurred where respondents were asked whether the community was responsible for the emergency during the flood disaster. At the beginning of the Intervention 1 ($p=0.003$), respondents reported that their community was not responsible for emergency action, nonetheless the result showed great improvement in their attitude after Intervention 2 ($p<0.001$). Hence, it clearly showed that the education intervention would enhance knowledge, skills-knowledge, and change in the approach and attitude of the respondents (Codreanu et al., 2014).

Preparedness before flood is important similarly other author stated that procurement of essential drugs in advance, management of firewood, improvement such as creation of small drainage in each plot of land, homestead raising and increase of the height of hand pumps were the activities people perform as part of their preparedness to flood disaster (Dewan, 2015).

One issue raised in the survey was the attitude of respondents whether to evacuate immediately upon request by the authorities during flood disaster. Thus based on the result of Intervention 1 ($p=0.279$), respondents showed poor attitude when they refuse to evacuate with their whole households. There might be several circumstances for not evacuate everyone, for example some of family members are needed to protect their property and hence forced them to stay at home or could be the lack of evacuation planning and not knowing where to go (REACH-KAP, 2015). Nevertheless, respondents' attitude with regard to the need to evacuate immediately when floods occurred, showed significant improvement after Intervention 2 ($p <0.001$).

In terms of knowledge, education and building capacity among respondents in emergency preparedness element, findings demonstrated enhancement in their attitude on community after the Intervention 1 ($p=0.004$) and Intervention 2 ($p=0.001$). Notably when asked about flood safety plan for family, only small group of respondents had such plan and when there were Interventions on this subject, ($p<0.001$), respondents showed great attitude and stated that they had set up flood safety plan of disaster management for their family. As p concluded by Spiekermann et al. (2015), the lacked of knowledge was not the major threat, however, the losses lies more on risk interpretation, mentalities, power structures, personal attitude and many other elements. Intervention study by Bradley et al. (2014), the Intervention group improved in knowledge of they were more likely to have discussed communication plan with family (20.2% to 43.4%) and be able to find out family contact methods (46.5% to 70.7%).

Respondents were then asked about meeting points during disaster, and only some respondents stated had discussed with their households. Along with Intervention 1 and Intervention 2, the respondents' attitude seemed compelling higher ($p<0.001$). Respondents were than was asked their actions about preparedness for emergency kit for instance foods, clothes, important documents for evacuation periods. Based on the finding in both Interventions, respondents show significantly improved attitude ($p<0.001$). Hence from results above, majority of respondents display an improved attitude after Interventions. The intervention education programme by Ardalan et al. (2013) also focus on household emergency planning including the importance of conducting a preparedness meeting, having a communication plan, preparing kit with emergency personal information card.

Perception on risk of communication after interventions

In this section, respondents were asked several questions on their perceptions towards the risk of communication during flood disaster in their area. When asked whether local authority played an important aspect and well prepared in order to interact with community during disaster, respondents were extensively agreed with the statement ($p<0.001$). Risk communication in disasters has historically been a one-way transfer of information from authorities to the public, rather than an interactive flow of information (Glik, 2007).

Another significant element related to communication's perceptions among respondents was, they concurred that communications help in the distribution assistance for instance clothes in relief center ($p<0.001$). Subsequently, respondents also highlighted that national center will be informed by local authority for immediate action ($p<0.001$). According to Ejeta et al. (2015), behaviors of human were developed from various factors, which could be extent from people's risk perception to lessons either from direct or indirect past occurrences of disasters as well as emergencies through to interaction. Ejeta et al. (2015) also states that the above factors played an important domination of people's disaster and emergency preparedness level in which these efforts focus solely on human behaviors.

Risk communication aims to provide the public with information about the effects of an event, and how actions may affect the outcome of the event. Communication between authorities and the public about disasters occurs in all four stages which are mitigation and prevention, preparedness, response and recovery with different aims at each stage. Communication is a potentially valuable way of avoiding and reducing harm caused by disasters (Reynolds and Seeger, 2012). Disaster risk communication may take place through many different channels, including some that have been recently developed or expanded. Potential channels of communication include face-to-face conversations, telephone calls, group meetings, mass media such as television, tailored mass media and interactive social media (Bradley et al., 2014).

Table 3: Differences on attitude when facing disaster between baseline with Intervention 1 and 2

Attitude when facing disaster & perception on risk of communication	Baseline/ Intervention	Mean	Standard deviation	p-value
Ready to serve community	Baseline	4.23	0.972	0.914
	Intervention 1	4.25	0.977	
	Baseline	12.36 [a]	136.00 [c]	0.069 [d]
	Intervention 2	16.61 [b]	299.00 [c]	
Ready to learn first aids	Baseline	3.84	1.172	0.725
	Intervention 1	3.77	1.175	
	Baseline	3.89	1.171	**0.003**
	Intervention 2	4.40	0.531	
Community ready to serve others	Baseline	12.50 [a]	150.00 [c]	0.305
	Intervention 1	15.20 [b]	228.00 [c]	
	Baseline	11.15 [a]	111.50 [c]	0.242
	Intervention 2	13.46 [b]	188.50 [c]	
Opinions on preparedness	Baseline	16.36 [a]	180.00 [c]	**0.012 [d]**
	Intervention 1	19.44 [b]	486.00 [c]	
	Baseline	10.00 [a]	20.00 [c]	**<0.001 [d]**
	Intervention 2	14.32 [b]	358.00 [c]	
Community responsible for emergency	Baseline	4.05	1.086	**0.003**
	Intervention 1	4.55	0.502	
	Baseline	4.02	1.101	**<0.001**
	Intervention 2	4.68	0.471	
Evacuate immediately during flood	Baseline	4.71	0.494	0.279
	Intervention 1	4.80	0.401	
	Baseline	4.70	0.503	**<0.001**
	Intervention 2	5.00	0.00	
Knowledge, education and building capacity	Baseline	18.68 [a]	205.50 [c]	**0.004 [d]**
	Intervention 1	21.19 [b]	614.50 [c]	
	Baseline	11.00 [a]	44.00 [c]	**<0.001 [d]**
	Intervention 2	18.90 [b]	586.00 [c]	
Flood safety plan for family	Baseline	2.05	1.285	0.495
	Intervention 1	2.27	1.578	
	Baseline	2.04	1.300	<0.001
	Intervention 2	3.51	1.353	
Meeting points during disaster	Baseline	1.95	1.197	0.008
	Intervention 1	2.75	1.610	
	Baseline	1.89	1.187	<0.001
	Intervention 2	4.11	0.751	
Emergency kit for evacuation	Baseline	2.50	1.427	0.001
	Intervention 1	3.52	1.629	
	Baseline	2.40	1.391	**<0.001**
	Intervention 2	4.66	0.478	
Local authority well prepared	Baseline	3.00	0.915	**<0.001**
	Intervention 1	4.14	0.923	
	Baseline	3.02	0.909	**<0.001**
	Intervention 2	4.72	0.455	
Distribution assistance in relief center	Baseline	3.23	0.853	**<0.001**

Attitude when facing disaster & perception on risk of communication	Baseline/ Intervention	Mean	Standard deviation	p-value □
	Intervention 1	4.27	0.774	
	Baseline	3.23	0.854	**<0.001**
	Intervention 2	4.73	0.448	
National center	Baseline	2.95	0.796	**<0.001**
	Intervention 1	4.36	0.586	
	Baseline	2.92	0.756	**<0.001**
	Intervention 2	4.74	0.445	

[a] Mean rank for negative ranks   p-value significant at < 0.05
[b] Mean rank for positive ranks   Intervention 1 (n = 53) and Intervention 2 (n = 56)
[c] Sum of ranks
[d] Wilcoxon sign rank test
□ Paired samples t-test

Practices when facing disaster after interventions

In this section, respondents were asked about their household practices in antecedent to the beginning of a flood disaster and their reactions amid an actual one. Respondent's household shows considerably ready to deal with flood disaster as stated in result where they has prepared a three-day supply of water, three-day supply of nonperishable food for instance canned food that does not require refrigeration of cooking as well as three-day supply for those who are taking prescribe medicine for use during flood.

Data from the result provided further information on respondent's practices after both Interventions where they stated that their household has never prepared a battery operating radio and a power supply or generator for use during flood disaster. These trends somehow due to the respondents were unable to identify the importance of those devices. Contemplating to the practices above, the respondent's household however has prepared a battery operating phone and working flashlights (with batteries) for them to use amid flood disaster. Respondents were then asked if they had a written safety evacuation plan for a flood disaster, and surprisingly all respondents said none existed. Hence, clearly shows that all respondents were not aware of their vulnerabilities and their abilities to respond if the flood disaster occurs. However, some of the respondents have discussed with their family members about the meeting point during disaster should be if they are separated after Interventions (p=0.139).

Practices in other study stated that the communities apply pre-flood preparations as part of the flood management. These include management of basic materials such as cooking utensils, dry foods, fuel, matches and etc. Advance psychological preparedness (building awareness on do's and don'ts during floods) and other practices include storage of all items (Dewan, 2015).

In Bradley et al. (2014) study, the authors used Disaster Awareness Game to educate school children about disaster preparedness for floods, hurricanes, volcanoes, landslides and mud flows. The game played in schools and supplemented with additional discussion, promotes increases in knowledge about all the natural hazards presented, as well as increases in knowledge about how to prepare, evacuate and recover from disasters. The result showed knowledge of the hazard of flooding increased from 65% to 87%. Dewan (2015) concludes that along with governmental and non-governmental initiative, traditional knowledge and indigenous practices should also be incorporated to reduce the socioeconomic impacts and vulnerabilities.

The overall knowledge, attitude and practice (KAP) scores.

The overall knowledge scores of the respondents were already good, thus it did not differ even after 2 interventions. However, they were informed that the management system in this country is led by the National Security Council and the Police Force is the commander of the disaster. The overall attitude improved tremendously. The respondents were more willing to learn, have better opinions and felt more responsible on preparedness for any emergency. After the Intervention 2, they were ready to evacuate immediately when flood occurred. They were also prepared with the safety plan for the family, for example preparation for first aid and sanitary kit boxes, felt positive towards the services rendered by the local authority, relief center and the national centers.

There was no difference in the overall practice of the respondents. This is probably because they were not able to practice what they know since the disaster did not occur yet. The respondents were also not ready with 3 days water preparation, canned food, battery, power bank and generator because some of these item were costly and that at present, they are not even in proper home and they cannot afford to buy them even after 2 intervention. After the 2 intervention programmes, they were given some monetary token, but the emergency and sanitary kits were only for the lucky winner.

5.0 Conclusion

Findings from the questionnaire survey showed the KAP of the temporary shelter dwellers were lower but not significantly different from the permenant home villagers. Only 53 respondents from the temporary shelters were involved in the both interventions. The KAP were assessed at the end of both interventions.

5.1 Findings showed no significant difference found on the the temporary dwellers' knowledge because their knowledge were already good except for which parties responsible during the disaster between the baseline, Intervention 1 and 2.

5.2 Practises did not show improvement since respondents cannot actually practise the emergency response plan and some the items to be prepared such as battery, power pack and generators were costly and not within their budget.

5.3 However, the program managed to improve on the attitude especially after the 2nd intervention for 11 out of 13 items reported ($p<0.001$) especially on the families' preparedness, responsibilities, interest to learn and the readiness of the local authority and the national centre to serve the flood victims.

Recommendation: Since only the attitude of the respondents improved, it is advisable to continue the programme in the future to reinforce the KAP further annualy before the monsoon season, in order to create a more resilient community.

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A DECISION AID MODEL FOR AN ADAPTIVE EMERGENCY EVACUATION CENTRE MANAGEMENT (AEECM)

Project Information
Project Leader : Dr Nor Laily Hashim
University : Universiti Utara Malaysia
Address : School of Computing, Universiti Utara Malaysia, 06010 Sintok, Kedah
Contact number : 0195110666
Email : laily@uum.edu.my
Project Members : Assoc Prof Dr Yuhanis Yusof, Nor Aziah Che Pa
Dr Azham Hussain

1.0 Introduction

Identified evacuation centres are normally located at secure places which have small chances from being drowned by flood. However, due to extreme flood situation in January 2015, several evacuation centres in Kelantan were unexpectedly drowned. Currently, there is no study done on proposing a decision support aid to reallocate victims and resources of the evacuation centres when the situation getting worsens. Therefore, this study proposes a decision aid model to be utilized in realizing an adaptive emergency evacuation centres management system. This study will undergo three phases which are information gathering, development of algorithm and models; and evaluation of the proposed algorithm against existing swarm algorithms and user acceptance test of the developed adaptive system. The proposed model operates based on a multi-objective optimization algorithm that creates an optimal schedule for the relocation of victims and resources for an evacuation centre. The schedule includes solution on the quantity of victims that is required to be transported to other identified centres. Such a solution is proposed based on one of the swarm intelligence algorithms which is known as Firefly Algorithm (FA). The proposed decision aid model and the adaptive system can be applied in supporting the National Security Council's respond mechanisms for handling disaster management level II (State level) especially in providing better management of the flood evacuating centres.

2.0 Methodology

Phase One: Information Gathering

Phase One contains the following steps: (1) preliminary study on the optimization algorithm to be applied on reallocation of victims and resources of the affected evacuation centres, (2) literature study and content analysis on the functionalities, local and global variables of the evacuation centres in design the AEECM, (3) to identify suitable system design of mobile apps and web-based of AEECM.

Phase Two: Development and Design

The first step in the real building of the working system will be at the development stage, and development is a systematic method of research. Therefore this phase will be designated through (a) develop Firefly multi-objective to be adapted in AEECM; (b) develop the mobile apps and web-based of AEECM. This stage involves using the output from the gathered information phase to plan a strategy for developing the instruction.

Phase Three: Evaluation

There are three parts of evaluation. The first part of the evaluation is on evaluating the requirement model of AEECM where three experts will conduct review inspection on the documents produced. The second evaluation is user acceptance test of AEECM where the respondents are among the officer of department of social welfare, the rescuing teams and the staff of evacuation centres at one district in Kelantan. The third evaluation is on evaluating the AEECM that uses Firefly multi-objective optimization against AEECM that applies other swarm intelligence algorithms. The evaluation is done to compare the utility value and computational time.

3.0 Results and Discussion

Proposed AEECM

This decision support tool provides solutions for relocation of victims to other ECs when the existing centres are drowned. The proposed solution will provide information on the number of victims that are required to be transported to the new evacuation centres. The application is developed on a web-based platform and Android mobile application. The proposed solution operates using Firefly multi-objective optimization algorithm that creates an optimal schedule for the relocation of victims and resources for an EC. The AEECM application can be downloaded and installed on Android devices.

AEECM is developed for authorities who are managing evacuation centres; System administrator, District Officer (JPDB), JKM welfare officer, rescuers, and the head of villagers (JKK Kampung). As a start, Kuala Krai, Kelantan is chosen involving 109 evacuation centres from four districts; Guchil, Mengkebang, Manek Urai, and Dabong. Figure 1 presents the main functions supported by AEECM. In this paper, only the functions provided for system administrator are presented.

For managing an EC, a system administrator managed the information related to all ECs (name of EC, address of EC, EC's GPS location, maximum number of evacuee capacity, EC distance with other ECs, EC distance from the nearest river, JKK Kampung in charge at each EC, including name and contact number). System administrator also has to update data related to water level at every one hour by viewing this information from the Department of Drainage and Irrigation web site for selected rivers. He also manages request to close of an EC when: he received calls from head of villagers or instructed by District officers. When an EC is closed, the system will generate a reallocation plan by suggesting a list of ECs with the capacity of evacuee to be moved. A system administrator is able to view current condition of ECs: (1) Red for ECs that are closed as they were drown; (2) Orange for ECs that are needed to be closed due to water level – alert will be shown; (3) Yellow for ECs that is reaching 90% full - alert will be shown; (4) Green for ECs that have 75% capacity; and (5) Blue for ECs that have 50% capacity.

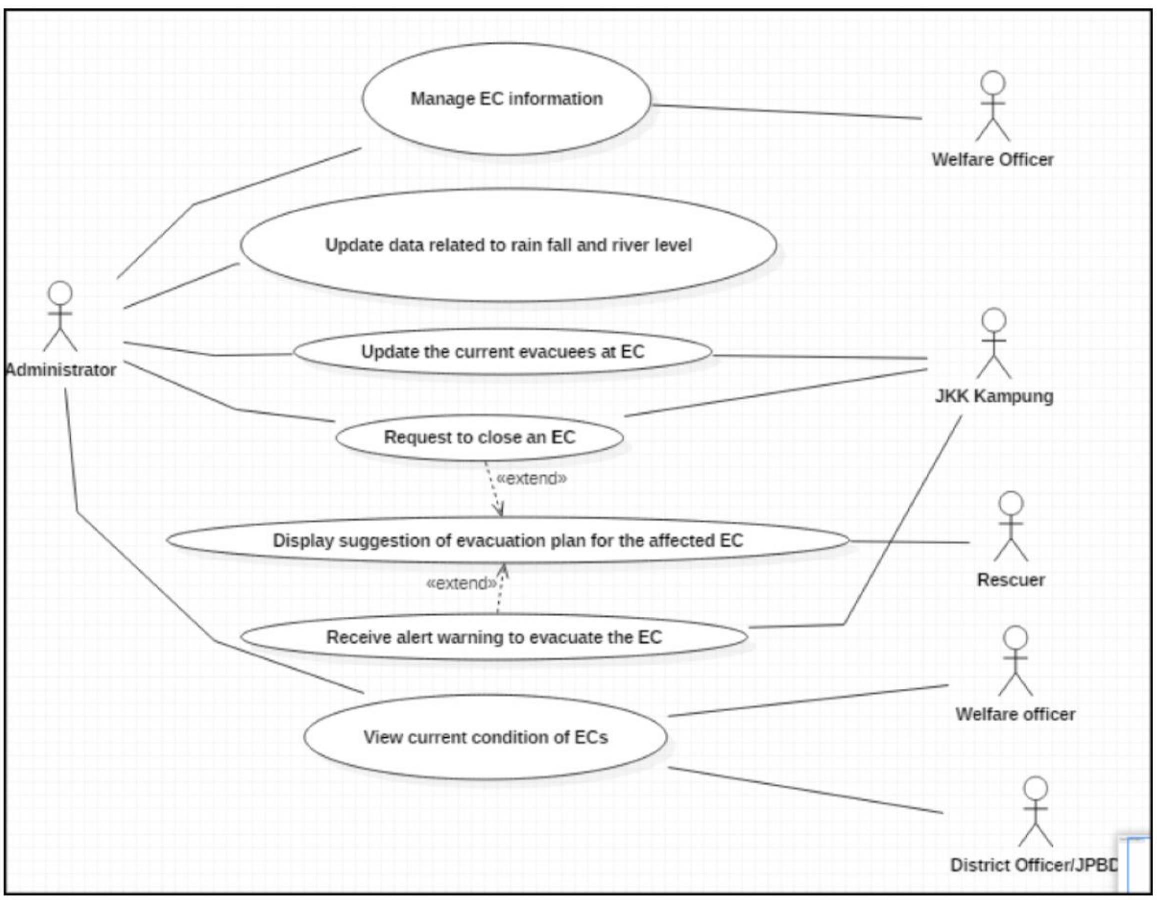

Figure 1: Main functions of AEECM

Firefly Algorithm for Optimal reallocation of victims

Firefly algorithm (FA) is adapted in finding the best available ECs to relocate the victims if the existing EC itself is predicted to be closed. Based on its strength, FA is capable of achieving the mentioned objectives. Parameters to be considered in selecting other ECs are size of an EC (V_1), distance of an EC to a nearby river (V_2), water level of a nearby river (V_3) and distance of an EC to a nearby river (V4).

The pseudo code of proposed Firefly algorithm (FA_{Flood}) in decision making for AEECM is illustrated in Figure 3. Further, the input of the proposed $FA_{Flooding}$ needs to be defined some important parameters for operating the algorithm such as the light absorption coefficient γ, where it set to 1 in the algorithm, the value of initial attractiveness β_0, where it sets to 1, the number of max generation, the value of capacity which is equal to the value of number of victims that needs to be in safe places, the number of fireflies which is equal to 10% from the number of records in dataset, and finally is the number of initial solution which is equal to the number of fireflies.

The proposed $FA_{Flooding}$ starts to operate by generating the initial solutions which are represented in binary form [0 or 1], where the dimension of one solution equals the number of records in dataset. The generating of the initial solutions are undertaken in two ways: If the variable V_1 in one record passes the capacity, it will take it as one solution by assigning 1 in solution, else, the solution will be generated randomly that takes more than one record in one solution. Then, the generated solutions are undergone to check the constraint which is the summation of V_1 of all record in one solution and passes the capacity value. After that, the generated initial solution is undergone to be evaluated using an objective function (Utility function) as shown in Equation 1. Assign the inverse of utility value (fitness) of each solution to each firefly as initial light (I). Then, the initial position of each firefly is determined, which is represented by the solution.

Utility function F= Summation of (75% of V1) of available EC +
Summation of V2 of available EC +
Summation of V3 of available EC –
Summation of V4 of available EC
(1)

The proposed objective function is of minimum problem as most of the included parameters V_1, V_2, and V_3 prefer small values. For example, an EC with a smaller distance to the closed EC is preferred when compared to the EC that has farther distance. On the other hand, the fourth parameter which is V_4 is of maximum value as the system needs to avoid EC that is near to a river. In addition, the first variable includes the constraint of 75% usage as we need to ensure that there is no EC that is 100% occupied for safety and convenience purposes. The fireflies competed between them to determine the best solution that has maximum fitness value. The firefly with the brightest light attracts the brighter ones by firstly determine the distance between two solutions using Hamman distance are calculated as shown in equation 2.

$$r_{ij} = \frac{\textit{the number of dissimilar bit in i and j solutions}}{\textit{the number of records in dataset}} \quad (2)$$

Then, the attractiveness between two solutions using the equation 3 are calculated.

$$\boldsymbol{\beta = \beta_0 \exp^{(-\gamma r_{ij}{}^2)}} \quad (3)$$

Then, the brighter firefly move to brighter firefly using equation (4).

$$\mathbf{X^i = X^i + \beta_0 \exp^{(-\gamma r_{ij}{}^2)} * \ X^j - X^i \ + rand - 0.5} \quad (4)$$

<u>Input:</u>

Step 1: Input the dataset that includes four variables [v1, v2, v3, v4].
Step 2: Define light absorption coefficient γ, where γ=1.0
Step 3: Define initial attractiveness $\beta_0 = 1$
Step 4: Determine the Max Generation.
Step 5: Determined the Capacity.
Step 13: While (t < Max Generation)
Step 14: For i=1 to N (N all fireflies)
Step 15: For j=1 to N
Step 16: If (Ii>Ij) {
Step 17: Calculated the distance between two solutions using the following equation:
Step 18: Calculated the attractiveness between two solutions using the following equation:

Step 6: Determined the number of fireflies which equal10% from the number of records in dataset.
Step 7: Determine the number of initial solution which is equal the number of fireflies.

Process:

Step 8: The solutions are represented in binary form [0 or 1], where the dimension of one solution equal the number of records in dataset.
Step 9: Generated the solutions are undertaken in two ways:
Step 9.1: If the variable v1 in one record pass the capacity, it will take it as one solution by assigning 1 in solution.
Step 9.2: If the v1 in one record less than the capacity, then, the solution will generated randomly that take more than one record in one solution.
Step 9.3: Check the generated solution must pass the constraint which is the summation of v1 of all record in one solution pass the capacity value.
Step 10: Calculated the initial utility function for each solution.
Utility function Fi= summation of v1 of all record+ summation of v2 of all record+ summation of v3 of all record+ summation of v4 of all record
Step 11: Assign the utility value to each firefly as initial light (I).
Step 12: Determine initial position of each firefly, which represent the solution.

$\beta = \beta_0 \exp^{(-\Upsilon r_{ij}^2)}$ **Step 19:** Move brighter firefly to less brighter firefly (minimization problem)

$$X^{i} = X^i + \beta_0 \exp^{(-\Upsilon r_{ij}^2)} * \ X^j - X^i \ + \text{rand} - 0.5$$

Step 20: If summation of v1 in new solution >= Capacity
Step 20.1: Calculated the utility function for new solution.
Step 20.2: Compare with old solution.
Step 20.3: Replace old solution with new solution.
Step 21: Else if summation of v1 in new solution < Capacity
Does mutation for one bit random in new solution until pass Capacity.
Step 21.1: Calculated the utility function for new solution.
Step 21.2: Compare with old solution.
Step 21.3: Replace old solution with new solution.
Step 22. End For i
Step 23. End For j
Step 24. End While
Step 25. Rank the fireflies and find the current global best utility function, and best solution.

Output

Step 26. Sort the best solution based on the v1 variable.

FIGURE 2. Firefly multi-objective pseudocode

After moving, a new solution is generated. If the summation of V_1 in new solution is greater or equal to the capacity, then, the utility function and fitness for a new solution is calculated and compared with the older solution. If the new solution is better than the old solution then replace it. In a situation where the summation of V_1 in a new solution is smaller than the capacity, a mutation process is conducted on the new solution by adding one bit randomly until it passes the capacity value. Then the utility function of the new solution is calculated and compared against the old solution in order to identify the best solution. Once the predefined number of iteration is reached, the fireflies are sorted based on their brightness that indicates the utility value.

Evaluation Results

To evaluate the proposed model, two types of evaluation were conducted; performance test of the proposed optimization algorithm and user acceptance test on the AEECM prototype. From the first evaluation, 38 tests cases have been constructed. For comparison purpose, AEECM which runs using FA (FA_{Flood}) was compared with Tabu Search (TS_{Flood}) (Koora, Satpute, & Adiga, 2012).The effectiveness of TS_{Flood} and FA_{Flood} is evaluated based on two criteria; utility value and computational time. The AEECM prefers the method that produces solution with the lowest utility value and computational time. This scenario investigates solutions for a to-be closed EC with number of victims that is larger than the capacity of any available EC. Meaning that the solution is expected to consist of a combination of ECs. The proposed algorithms were executed for three times for the to-closed EC. Assuming the closed EC is ECID_76 and the number of victims in this EC is (298) greater than the capacity of any EC. The utility values of FA_{Flood} are (5635.15, 5235.45, and 4068.59) which are smaller than TS_{Flood} which are (5754.95, 5545.95, and 4521.59). However, the execution time for TS_{Flood} (305, 368, and 295) is better than FA_{Flood} which took 676, 641, and 641ms. Results of the experiments show that the average value of utility function produced by FA solutions is smaller than the one obtained by Tabu Search. Nevertheless, it is noted that FA consumes larger computational time compared to Tabu Search.

User acceptance test (UAT) of AEECM was conducted in Kuala Krai, Kelantan involving respondents among the officer of Social Welfare department (JKM), the rescuing teams, head of villagers, and the manpower of EC. A total of seven respondents have participated in the user acceptance test activity. A combination of system demo, hands-on activity and interview has been used in the test. User from each category has been given chances to use and test the system. The main objective is to measure their satisfaction of using the system. User's satisfaction reflects and indicates user behavior towards the system. It measures user overall satisfaction on performance and system acceptability. Overall, majority of respondents are satisfied with the functions provided in the system as proposed. However, there are some suggestions given for improvement purpose. Comments and suggestions for system's improvement are depicted in Table 1.

TABLE 1. Respondents' Suggestions

No	Comment	Suggestion for Improvement
1.	To provide details data entry for number of victims. Requirement from National Security Council, JKM need to separate the number of victims according to adult (Female/Male), child (Female/Male), OKU and total of families at the EC	To extract and link the data from e-Banjir website (Kelantan) or e-Bencana system because the format of report for number of victims is same as per requirement from National Security Council
2.	To provide print function	Create a button to print the report for status number of victims according to EC
3.	The information of water level from Department of Drainage and Irrigation website to be extracted into AEECM every 1 hour	To extract and link the data from Department of Drainage and Irrigation system
4.	Disable editing on water level data for each river station	
5.	To standardize the menu and label in Bahasa Melayu. i.e : Open, Closed	

4.0 Conclusion

4.1 The requirement of AEECM that is documented in a requirement model which consist of a use case diagram, use case specifications, sequence diagrams, class diagrams and an architecture model). This model has been inspected by 3 experts to evaluate in terms of its correctness, consistency, and completeness.

4.2 A multi-objective optimization algorithm (based on Firefly Algorithm (FA)) that schedules the allocation of victims for and between evacuation centres was produced. This algorithm has been evaluated in terms of its effectiveness against Tabu Search Algorithm based on two criteria; utility value and computational time. Results of the experiments show that the average value of utility function produced by FA solutions is smaller than the one obtained by Tabu Search. In addition to that, FA consumes larger computational time compared to Tabu Search.

4.3 A prototype of AEECM in mobile and web-based AEECM were developed. This prototype has been evaluated using a user acceptance test where majority of respondents are satisfied with the functions and process flow provided by the system. They also agree that the prototype is good for flood disaster management. Comments and suggestions for system's improvement were also given.

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NATIONAL STUDY OF NURSES' DISASTER PREPAREDNESS IN FLOOD PRONE AREAS IN MALAYSIA: AN ACTION RESEARCH APPROACH

Project Information

Project Leader	: Assoc. Prof. Dr. Zuraidah Ali
I/C Number	: 701002-04-5256
University	: Universiti Tenaga Nasional
Address	: Jalan Ikram-Uniten, 43000 Kajang, Selangor
Contact number	: 03-89212152 / 017-2728644
Email	: Zue@uniten.edu.my
Project Members	: Sharul Azim Sharudin, Dr. Zainal Ariffin Ahmad Ms. Jeya Devi Coomarasamy, Dr. Soon Lean Keng Nik Rozilan Yaacob

1.0 Introduction

The recent Yellow Flood 2014 caught many hospitals and healthcare professionals especially nurses by surprise. The hospital emergency response system was unprepared for the unprecedented disaster and the medical and nursing services were compromised or even paralyzed by the flood. The problem is that whether the nursing services can be better prepared for future disasters. The objective of this action research is to study nurses disaster preparedness and how to be prepared for impending disaster in vis-à-vis other healthcare professionals and essential services.

Based on the International Congress of Nursing (ICN) framework, the national study will employ action research using both quantitative and qualitative approaches, such as interviews, surveys, focus group discussion involving 3 Malaysian Nurses Association chapters in Kelantan, Terengganu and Pahang. The study will illustrate the social, economic and environmental impact of hospital-based and community-based nurses to better serve and mitigate the negative impact of flood or other disasters on the affected communities and simulation of disaster preparedness of nurses during disaster. The findings of this study bear implications to nursing education and nursing service in Malaysia.

2.0 Methodology

This study comprises both qualitative and quantitative methods based on the ICN Framework of Disaster Nursing Competencies.

2.1 Research Design

This study was an exploratory study employing both qualitative and quantitative methods. During the Malaysian Nurses Association (MNA) 66th AGM on 21-23 March 2015, we sought cooperation from MNA to work with the Research Team in conducting the focus group discussion and pilot test the instrument with nurses from three MNA branches in Kelantan, Pahang, and Terengganu. During Phase One, after reviewing the literature and identifying the problem, the Research Team conducted three focus group discussions (FGD) with selected nurses who were involved in the 2014 Yellow Flood. Based on the FGD results, we developed and pilot tested the survey questionnaire based on the International Council of Nurses (ICN) Framework of Disaster Nursing Competencies. We obtained copyright for the National Disaster Preparedness Inventory (NDPI) and utilized it as a tool for our research.

An application was then submitted to the National Medical Research Register (NMRR), Ministry of Health (MOH) to secure permission from the Medical Research Ethics Committee (MREC). In the meantime, we also developed the Nurses Disaster Preparedness Inventory (NDPI) Apps and applied for and granted copyright from MyIPO. We secured bronze medal at the PECIPTA 2015 on 4-6 December 2015 and Malaysian Technology Expo (MTE) on 18-20 February 2016. In Phase Two, with further refinements from the pilot study, the actual data gathering was conducted in selected hospitals only in the three states—Kelantan, Pahang and Terengganu based on the feedback from the MOHE Briefing 2015. We presented the progress report at the Persidangan Kajian Bencana Banjir 2014.

Upon receiving the data from the three states, we proceeded to conduct data analysis and interpretation and prepared the final report and journal articles. We also prepared 4 modules for Nurses Disaster Preparedness Training Workshop and presented to the MNA 67th AGM 1-4 April 2016. After further refinement, the final report was submitted on 31 May 2016.

2.2 Qualitative Study

During Phase One, we conducted Focus Group Discussions (FGD) among a sample of 18 nurses who were directly involved in the 2014 Yellow Flood. The FGD was centred to answer the following research questions:

a) What are the attitudes, practices and perceived preparedness, management and communication of nurses in Malaysia towards a disaster event?
b) For better preparedness in a disaster, what could have been done better and more efficient by nurses?

2.3 Quantitative Study

For Phase Two of this study, we collected quantitative data using survey instrument aimed at determining nurses' attitude, practices, perceived preparedness and management during a disaster in Malaysia.

Specific Objectives

The specific objectives of this research study were to:

i) Determine the association between the socio-demographic variables and the attitude scores towards disaster event.
ii) Determine the association between the socio-demographic variable and the perceived preparedness scores towards disaster event.
iii) Determine the association between the socio-demographic variables and the management scores towards disaster event.
iv) Determine the association between the socio-demographic variables and the communication practices scores towards disaster event.

2.4 Instrument

The Research Team developed a reliable instrument (Nurses Disaster Preparedness Inventory - NDPI) that hospitals/ health care organizations could administer to assess attitudes, preparedness, management and communication practice during disasters from the perspective of their nurses. To develop the NDPI instrument, the Research Team referred closely to the ICN Framework of Disaster Nursing Competencies and adapted it to the validated self-administered questionnaire of Ng and Soon (2014). Whereas the original instrument comprised 34-items that measure attitude (10-items), familiarity (14-items), and management (10-items) during a disaster event, the ICN Framework of Disaster Nursing Competencies recommended communication and information sharing. The Research Team adapted the items for communication and information sharing from the ICN Framework and pre-tested the items during the focus group discussion. Hence, the instrument was expanded to include one more factor which was communication practice during a disaster event (12-items). Thus, the present NDPI questionnaire contained 46 items as shown in the English version (Appendix B) and the Malay version (Appendix C). Each question was scored on a five-point Likert scale. An acceptable model fit was identified using confirmatory factor analysis.

2.5 Site Selection

Out of 12 river basins, after the MOHE Briefing on 3rd April 2015, we were advised to focus on the river basins in the states of Kelantan, Pahang, and Terengganu. We worked via the Malaysian Nurses Association (MNA) Branches for the three affected states in coordination with the Research Team members.

2.6 Population And Sample

The total population of registered nurses in the states of Kelantan, Terengganu and Pahang is 14,879 (Ministry of Health, Malaysia, 2015). Based on Krejcie and Morgan (1970), the sample size required was 375.

Table 3.3 Population and Sample (Source: Ministry of Health, Malaysia)

State	Nurses Population	Sample
Kelantan	6,396	300
Pahang	4,045	100
Terengganu	4,438	100
Total	14,879	500

3.0 Results and Discussion

3.1 Findings from Focus Group Discussions

Findings from the focus group discussions show that nurses expressed some challenges in communicating with each other as well as patients and collaborative organizations during the flood disaster. Two predominant categories entail: Whatsapp Communication and Inter-organizational Communication. Three predominant categories of communication approaches utilized during the disaster are Counselling, Persuasive and Procedural communication.Based on the interviews, the nurses highlighted several ways they communicated and the challenges they faced during the flood. They also shared some ideas on how the interpersonal and inter-organizational communication can be improved as follows:

1. *The use of existing communication system such as CommSat, or commercial applications such as Whatsapp or Facebook Messenger should be intensified in order to enhance nurses' interpersonal and inter-organizational communication channels.*
2. *The nurses must attend training with the Fire Department on disaster procedure, i.e. transporting patient using boats and helicopters.*
3. *Nurses must learn how to communicate using the emergency protocol used by the other emergency services such as the Fire Department, Public Defense Department (JPAM), helicopter and boat rescue during disaster.*
4. *One contra measure is to use IT communications via handphone (Whatsapp) or CommSat to keep constant contact with respective hospitals as well as their family on their whereabouts and situation.*

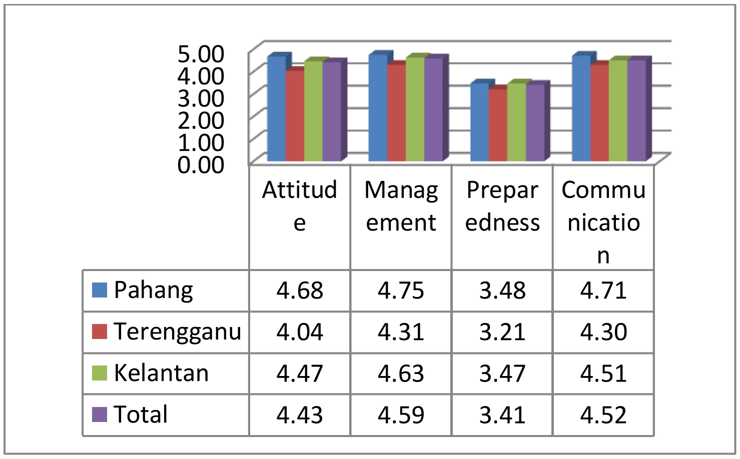
The researchers identified eight ways of communication employed by the nurses during the Yellow Flood. The Disaster Plan Guidelines clearly indicate the flow of communication in the event of a disaster. However, the three approaches were observed by the researchers during focus group discussions with the respondents.

3.2 Findings from Quantitative Study

The aim of this research study is to determine the nurses' attitude, perceived preparedness and management towards disaster events in Malaysia. The specific objectives of this research study were:

i) To identify level of agreement for Attitude, Management, Preparedness and Communication during disaster among nurses in Pahang, Terengganu and Kelantan.
ii) To identify level of agreement between the socio-demographic variable and the perceived preparedness scores towards disaster event.
iii) To identify the level of agreement for Attitude, Management, Preparedness and Communication during disaster among nurses with and without experience working in accident and emergency unit.
iv) To identify the level of agreement for Attitude, Management, Preparedness and Communication during disaster among nurses with and without practical experience in handling disaster.

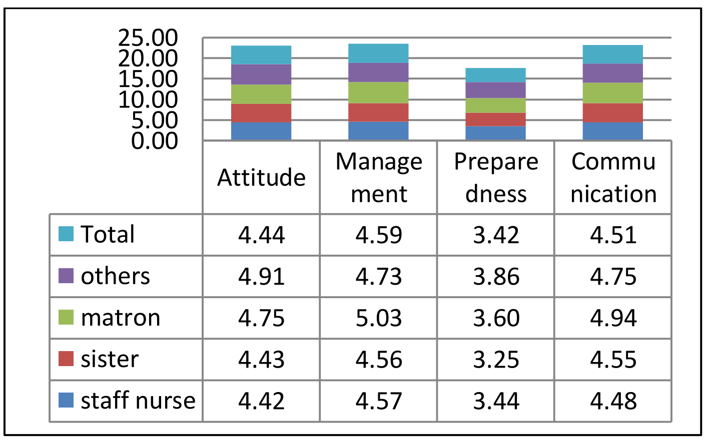
Based on the findings, it can be said that nurses in the state in Pahang reported higher scores for attitude, management, preparedness and communication during disaster while nurses in the state of Terengganu show lower scores in all aspects.



	Attitude	Management	Preparedness	Communication
Pahang	4.68	4.75	3.48	4.71
Terengganu	4.04	4.31	3.21	4.30
Kelantan	4.47	4.63	3.47	4.51
Total	4.43	4.59	3.41	4.52

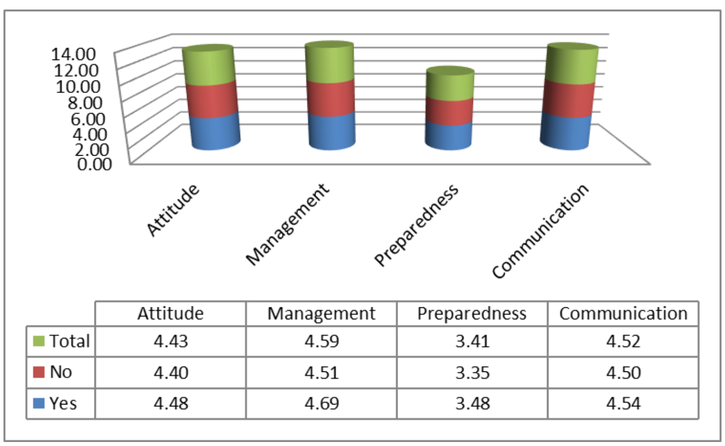
Figure 1 Level of agreement for Attitude, Management, Preparedness and Communication during disaster among nurses in Pahang, Terengganu and Kelantan

Based on the findings, it can be said that matrons reported higher scores for attitude, management, preparedness and communication during disaster while nurses in other positions show lower scores in all aspects. This is deemed appropriate as matrons are more experienced and knowledgeable in the nursing field.



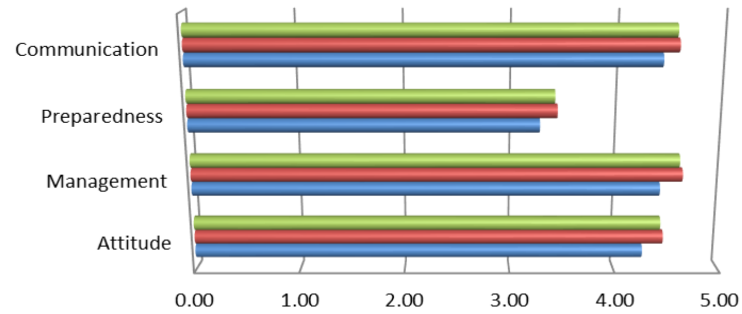
	Attitude	Management	Preparedness	Communication
Total	4.44	4.59	3.42	4.51
others	4.91	4.73	3.86	4.75
matron	4.75	5.03	3.60	4.94
sister	4.43	4.56	3.25	4.55
staff nurse	4.42	4.57	3.44	4.48

Figure 2 Level of agreement for Attitude, Management, Preparedness and Communication during disaster and nursing positions



	Attitude	Management	Preparedness	Communication
Total	4.43	4.59	3.41	4.52
No	4.40	4.51	3.35	4.50
Yes	4.48	4.69	3.48	4.54

Figure 3 Level of agreement for Attitude, Management, Preparedness and Communication during disaster among nurses with and without experience working in accident and emergency unit.



	Attitude	Management	Preparedness	Communication
Total	4.43	4.59	3.41	4.51
no	4.46	4.62	3.43	4.54
yes	4.27	4.41	3.27	4.39

Figure 4 Levels of agreement for Attitude, Management, Preparedness and Communication during disaster among nurses with and without practical experience in handling disaster

4.0 Conclusion

In summary, the following conclusions can be derived:

4.1 Two types of communication categories which nurses found assistive during disaster are whatsapp and inter-organizational communication.
4.2 Three types of communication approaches utilized during disaster are counselling, persuasive and procedural strategies.
4.3 Nurses in the state of Pahang reported higher levels of agreement with the NDPI items.
4.4 Matrons reported higher levels of agreement with the NDPI items.
4.5 Nurses with experience in accident and emergency unit reported higher levels of agreement with NDPI items.
4.6 It is interesting to note that nurses without practical experience in disaster reported higher levels of agreement with NDPI items.
4.7 Based on the findings, nurses will need some further training on disaster handling to be better equipped for unprecedented and upcoming disasters.

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THE FLOOD EVACUEES PERCEIVED QUALITY AND SATISFACTION WITH SERVICES AT EVACUATION CENTERS

Project Information

Project Leader	: Siti Falindah Binti Padlee
University	: Universiti Malaysia Terengganu
Address	: Pusat Pengajian Pengurusan dan Perniagaan Maritim, 21030 Kuala Terengganu, Terengganu, Malaysia
Contact number	: 09-6684240
Email	: siti.falindah@umt.edu.my
Project Members	: Dr. Azizul Yadi Yaakop, Dr. Zuha Rosufila Abu Hasan Dr. Siti Nur Atikah Zulkiffli, Dr. Wan Norhayati Mohamed

1.0 Introduction

A safe evacuation for flood victims in Malaysia is among the most important emergency response activities after the occurrence of floods, or other disasters or hazards (Bologna, 2010). Nevertheless, evacuation and emergency sheltering remain to be challenging issues reported by some researchers (Hosseini et al., 2014), hence, the motivation for this study to examine the management issue of evacuation centres in regards with perceived quality and satisfaction. The main objectives of this study are twofold: (1) to examine the level of importance and perceived quality of each key attribute of services at flood evacuation centres in the east coast states; and (2) to examine evacuees' overall satisfaction level with service attributes associated with the evacuation centres. The additional objective is to analyse the demographic profile of flood victims in east coast states.

2.0 Methodology

A number of questionnaires have been distributed to evacuees at the identified major flood-affected areas in the states of Pahang, Terengganu and Kelantan. The three major areas that were affected with severe flood events in 2014 are Temerloh (Pahang), Kemaman (Terengganu) and Kuala Krai (Kelantan). With the permission of the National Security Council of Malaysia, the primary data were collected by research assistants, and the surveys were administered in three weeks at the three mentioned areas. Respondents were selected using the random sampling technique, where everyone has the potential to be a respondent of this study (Sekaran, 2003). A total 600 questionnaires were distributed by four enumerators. They were properly instructed and requested to ensure a 100 percent response rate for the distributed questionnaires. Due to some limitations in reaching flood respondents, 481 questionnaires were returned initially, with a final response ratio of 80.2 percent. However, four questionnaires were disregarded because they were incomplete. Finally, a total of 477 questionnaires were used for the analysis.

A total of 54 items were developed to measure evacuees' perception and satisfaction. The measurements of importance and perception were measured on the seven dimensions included in this study:

FCQ = Food Catering Importance/Quality;
HSQ = Health and Service Importance/Quality;
TQ = Transportation Importance/Quality;
VQ = Volunteering Importance/Quality;
SSQ = Site Service Importance/Quality;
TLCQ = Telecommunication Importance/Quality;
SFSNQ = Special Facilities for Special Needs Importance/Quality

For the data analysis, statistical procedures were applied using SPSS 21.0. Descriptive statistics were analysed to summarise the means of the seven dimensions, and demographic characteristics of the respondents.

3.0 Results and Discussion

The total respondents for this study comprised 477 evacuees. According to Table 1.0, the number of male respondents (238, 49.90%) is higher than female respondents (234, 49.06%). The highest respondents were from the age ranges of 30 years old and below (183, 38.36%), while the respondents in the age range of 45-50 years old (47, 9.85%) had the least contribution. Most of the respondents were Malay (462, 96.86%), followed by Chinese (6, 1.26%) and Indian (2, 0.42%). Meanwhile, secondary school (250, 52.41%) was the highest respondent level of education, and only a few of the respondents were Bachelor's degree holders (58, 12.16%). About 64.77% of the respondents are married, 27.04% respondents are single, and widowers/widows comprised 3.98%. Most of the respondents were not working (38.78%) because of the age factor. About 28.51% of them were business owners, and only 21.38% worked as government officials. Another 32% of the respondents were working in the private sector.

Table 1: Demographic Profile of Respondents

Sex	Frequency	Percent (%)	Age	Frequency	Percent (%)
Male	238	49.90	30 and below	183	38.36
Female	234	49.06	31 - 35	52	10.90
Missing	5	1.04	36 - 40	48	10.06
Race	Frequency	Percent (%)	41 - 45	55	11.53
Malay	462	96.86	45 - 50	47	9.85
Chinese	6	1.26	51 and above	86	18.03
Indian	2	0.42	Missing	6	1.25
Others	1	0.21			
Missing	6	1.25			
Level of Education	Frequency	Percent (%)	Status	Frequency	Percent (%)
None	36	7.55	Married	309	64.77
Primary School	59	12.37	Single	129	27.04
Secondary School	250	52.41	Widow/Widower	19	3.98
Diploma	60	12.58	Missing	20	4.21
Bachelor	58	12.16	Profession	Frequency	Percent (%)
Master	3	0.63	Government	102	21.38
Missing	11	2.3	Private Sector	32	6.71
			Own Work	136	28.51
			Not Working	185	38.78
			Missing	22	4.62

Table 2 shows the mean score and ranking results of importance and perceived quality for each of the dimension. The highest rank is "Volunteering Service", with a mean score of importance of 6.45, and a perceived quality of 6.07. The second rank is "Site Service", with mean score of importance 6.43, and a perceived quality of 5.85. The third rank is "Food Catering Service", with the mean score of importance of 6.42, and a perceived quality of 5.91. The dimension of "Health and Safety Quality" is ranked fourth place, with the mean score of importance of 6.41, and a perceived quality of 6.01. Meanwhile, the dimension of "Transportation Service" and "Special facilities for Special Needs Quality" share the same mean score of importance (6.39), and a mean score of perceived quality of 5.87 and 5.91 respectively. The dimension that was ranked last is "Telecommunication Service", with a mean score of importance of 6.15, and a perceived quality of 5.35.

Table 2: Importance and Perceived Quality of Dimension

Rank	Dimensions	*I*(mean)	*PQ*(mean)
1	Volunteering Service	6.45	6.07

2	Site Service	6.43	5.85
3	Food Catering Service	6.42	5.91
4	Health and Safety Service	6.41	6.01
5	Transportation Service	6.39	5.87
6	Special Facilities for Special Needs Service	6.39	5.91
7	Telecommunication Service	6.15	5.35

Notes: *I* = Importance mean score; Likert-scale = “1” very not important to “7” very important; *PQ* = Perceived Quality mean score; Likert-scale = “1” – strongly disagree to “7” – strongly disagree (perceived quality)

Table 3 shows the results analysis of overall satisfaction, which was analysed through the combination of mean scores and frequency analyses. The analysis of the mean score indicates that evacuees were very satisfied with the services provided at the evacuation centers in East Coast Malaysia (Mean = 5.31; Standard Deviation = 1.48). The results from the frequency analysis show that the majority of evacuees were satisfied, with the majority choosing a value of 5 and above (73.8%). There were only 15 evacuees (3.1%) that were very dissatisfied. Of the remaining, 24 evacuees (5%) were not satisfied, and 21 evacuees (4.4%) were little dissatisfied. Meanwhile, there are 65 evacuees (13.6%) that were neutral; they did not care about the services in the evacuation centres.

Table 3: Overall Satisfaction Level with Services at Evacuation Centers

Level of Overall Satisfaction	Number of Respondents	Percentage
1 (Very Dissatisfied)	15	3.1%
2	24	5%
3	21	4.4%
4	65	13.6%
5	124	26.1%
6	152	31.8%
7 (Very Satisfied)	76	15.9%
Total Number of Respondents	477	100%

4.0 Conclusion

The following are the summaries of the project:

4.1 The three services of evacuation centres that were highly rated on perceived quality by evacuees were (1) volunteering service, (2) health and safety service, and (3) food catering service and special facilities for special needs service.

4.2 The three services of evacuation centres that are important to evacuees were (1) volunteering service, (2) site service, and (3) food catering service.

4.3 This study also suggests that evacuees were satisfied with all services provided at the evacuation centres. This means that all services provided at the evacuation centres have met their expectations and their level of satisfaction.

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MODELING CRISIS COMMUNICATION DISASTER INTERVENTION FROM 2014 FLOOD IN MALAYSIA

Project Information

Project Leader	: Prof. Dr. Azizul Halim Yahya
University	: Universiti Teknologi MARA
Address	: Faculty of Communication & Media Studies
Contact number	: 014-3375392
Email	: azizul928@salam.uitm.edu.my
Project Members	: Azizul Halim Yahya, Wan Norbani Wan Noordin Saraswathy Chinnasamy, Massila Hamzah & Melina Mahpuz

1.0 Introduction

The threatening nature of disaster challenges the ability of the affected community to confront the adversities and survival. At the core of survival is the emotional impact of disaster survivors is depression and anxiety that affected the quality of life of those affected (Johari & Ahmad Marzuki, 2013). In terms of length and duration of traumatic implications of disaster, researchers have indicated that posttraumatic distress can last for a long term (Nandi & Vlahov, 2005; Norris, Baker, Murphy & Kaniasty, 2005; Warchal & Graham, 2011). The breadth of long established research also indicated that natural disasters which cause disruptions of physical infrastructure can create emotional instability towards the victims (Morgan et. al, 2003; Galea, Nandi & Vlahov, 2005; Nasir, Zainah & Khairudin, 2012; Seyle, Widyatmoko & Silver, 2013). As Bradel (2014) elucidates, the exposure to traumatic natural mishap causes distress and impairment towards the psychological conditions of victims who are caught without any measures of preparedness for survival. Comparatively, Man, Jalal and Ullah (2014) investigated the extent of posttraumatic stress disorder (PSTD) and psychiatric complexities among the 2010 flood victims in Pakistan. The correlations were explicated with three aspects of relations disaster exposure characteristics, cognitive distortions and emotional suppression. The severity of distress among flood survivors who are at risk for developing posttraumatic sequels involves women and children, a vulnerable group that suffer from depressive symptoms, stress, anxiety and impaired well-being (M. Shafique Sajid, 2007; Ugwu & Ugwu, 2013). Likewise, Bradel and Bell (2014) in their research found that women who suffer extreme exposure to a disaster interpret the disaster in a negative way and are most likely to develop negative psychological outcomes. Hence, substantial intervention support the survivors to recuperate is crucial. The struggle for survival and having the ability to recuperate and in maintaining a relatively stable, reciprocal and functional fitness for posttraumatic emotional distress among flood survivors' in Malaysia demanded for investigation to be carried out. In as much as emotional sufferings differ in the way the flood survivors' emphasize, it is crucial to observe the circumstance and how it affects the individuals to face, recuperate and have control over the predicament of flood aftermath.

The emphasis on building an environment that enhances quality of life is however included in the current 10th Malaysia Plan (10MP) (PM tables RM230bil 10th Malaysia plan, 2010). The Malaysian government stressed on the importance of ensuring that the society's quality of life improves in order to achieve strong and sustainable growth. Measures to improve the role and status of women are also given top priority in the 10MP as women are said to be a good indicator of a dynamic and progressive country (PM tables RM230bil 10th Malaysia plan, 2010). To correspond to the to the government's commitment, scarce literature in examining flood disaster impact which focus on potential social psychological impact (Bevel, 2010) which is often overlooked therefore, must be integrated in future intervention plans. The magnitude of flood disaster in Malaysia shed light on critical factors in determining the need to establish targeted policies as an intervention plan into the disaster risk management policy in Malaysia. The fact that flood risk management across the globe are changing and moving towards a comprehensive approach in response to new scientific approaches, research findings on posttraumatic emotional distress is limited thus it is vital to investigate in order to effectively minimize the emotional sufferings to flooding while ensuring the resilience for survival. Indeed, the need to integrate the intervention of treatment and care warrant an urgent call for national initiatives to assist these vulnerable flood survivors to recuperate following the 2014 flood crisis in the Malaysian context. Considering the numerous events of disaster occurring around the globe in recent years, and in particular, the case of Malaysia, it is imperative that posttraumatic intervention be given more attention than it has in the past. Consequently, new interventions are vital and must be implemented to ascertain that flood survivors are able to face less long-term negative traumatic outcomes possible.

2.0 Methodology

The dominance of qualitative approach has been well debated, stressing on its strengths and limitations. As echoed by Denzin and Lincoln (2008), a qualitative researcher stressed on socially constructed nature of reality, the intimate relationship between the researcher and what is studied and the situational constraints that shaped inquiry to answer questions that focused on how social experience is created and given meaning. Thus, this research will be conducted using the qualitative method. The method allows the researchers to collect non-numerical data, acquire deep understanding of a phenomenon and reveal the respondents' range of behaviour (Miles & Huberman, 2006). Data will be collected from 20 victims and survivors from Kuala Krai in Kelantan who were affected by the recent East Coast floods. Data collection through in-depth interviews on a one-on-one basis in a natural setting will be adopted. The natural setting is vital in order to avoid the researcher controlling or manipulating the environment (Miles & Huberman, 2006). The researchers intend to select victims and survivors using the convenience sampling method whereby those who are willing to share their thoughts and feelings will be taken to participate in the research. The selection however will not be bias in terms of gender, race, age, and religion. Due to the short period of research (9 months), the research that will be conducted will be non-clinical therefore data collected will be solely based on the feelings and emotions of the victims and survivors on the tragedy. Data gathering will also adopt a series of protocol and format of how the interview sessions will be conducted through the process of recording, transcription and analyzed so as to formulate rational and sound recommendations for the study. Most importantly, the sequence of methods will be used in this research, taking into account the process through planning the research, data gathering process until the phase of analyzing and reporting the findings. Data gathered will then be analyzed for codes or themes using the NVIVO software. These themes help to determine the patterns of posttraumatic emotional symptoms of those affected thus assisting in developing an intervention plan to recuperate and reconstruct the lives of the victims and survivors.

3.0 Results and Discussion

I. The degree of coordination between authorities, publics and stakeholder

The incident of floods in the East Coast Malaysia shows that these problems arise because the federal government, especially the MKN has no Standard Operating Procedure (SOP) comprehensive covering all aspects. At the same time, the state governments, especially the Kelantan's state government has no comprehensive SOPs to coordinate the movement of victims through the JKKK. In this case, the responsibility dealing with the major flooding cannot be totally by the federal government but also by the state government. They have been elected by the people because of the trust and so that they have to be responsible too in dealing with the flooding in order to maintain the safety and welfare of its citizens through state agencies and JKKK. The main problems of non-preparedness federal government and the state governments in dealing with major flooding disaster were due to the attitude of senior government officials who are still in the comfort zone. In earlier incidents, the federal and state governments usually see a perspective based on the perspective of the current, which are all considered to be no problem. The study shows that all agencies and communities must be engaged in disaster management to be more efficient (Kafle, 2005). Mounting officials with expertise is highly desirable to coordinate the regional level, local and regional. Improve training for local authorities, especially in mitigation and preparedness.

II. The state of MKN- Experts

The function of MKN at that time, especially the national Disaster Management Centre is to coordinate the management of disaster at the national level. So in this building, the task of National Disaster Command Centre is to gather all inputs or reports from not only Kelantan but also from all states that were affected too. MKN will deploy manpower through army, polis, JPAM, MKNs role during disaster. MKN involved High rank officers, which include ATM, PDRM, Professors in various fields and many more. Floods requires management strategic and include the proper planning to enable affairs and matters concerning flood issues can be effectively addressed, particularly in reducing the number of victims killed and property destroyed (Kafle, 2005). The identification, analysis, treatment, monitoring and evaluating of a disaster risk are called as Community-based disaster risk management (CBDRM) in which at risk communities that actively engaged to reduce their vulnerabilities and enhance their capacities. The program involves the local communities to create awareness throughout training, sharing knowledge and risk assessment mapping, technical training in first aid, search and rescue, firefighting and disaster management to specialized groups of volunteers in the community and also establishing the Community Emergency Response Team (CERT) at the community level and helping the communities in developing crises/Emergency plans and providing the essential items on need and emergency basis.

III. Lack of coordination between authorities, agencies, publics-excerpts

IPK Kelantan, the headquarters contingent of state police, opened one operational room/center. Then we have the MKN operational room that is the center of coordination. Other department such as the police, fire brigade, the Army has their own centre as well. Army-they just waits for orders. We also have those that were opened by the SUK for each state. In that operational room/center also requires the involvement from the police, army and others. Reliability and accuracy of news either through formal channel or social media is questionable, during disaster, causing confusion among victims. People are confused with orders from various authorities. It is supposedly from MKN to the Police Force and then orders are disseminated to the respective authorities. Traffic and crime related will be the responsibility of PDRM. However, there are conflicting information from different centers. Latest information are not shared in most time. This complicates our tasks". In Malaysia, the floods occurred every single year, especially in the East Coast states during the northeast monsoon. To reduce the impact and effect on the victim in the face of this phenomenon, the concerted action and cooperation among government agencies, NGOs, the voluntary, private sector and the public need to be adjusted to mount a response to disasters. Flood disaster management should be strengthened and coordinated with government agencies that have responsible with the tasks and roles according to their expertise and the goal that was created.

The pre-crisis phase, the crisis situation and its aftermath are the ongoing process of crisis communication (Ulmer, Sellnow, & Seeger, 2007). The purpose of the communication is to reduce uncertainty about the response, resolution, the negative perception and the blame of the situation (Stephen, Malone, & Bailey, 2005). For authorities, the goals of crisis communication are to help restore order and minimize damage to people and property, prevent panic by providing information related to the crisis event, facilitate informed decision making and strengthen the self-efficacy of citizens. The effective crisis communication must have strong stakeholder relationships so that it may prevent breakdown in established organizational structures (Ulmer, Sellnow, & Seeger, 2007).

The different message strategies need to be addressed to different stakeholders since the needs; expectations and media use vary between public group (Stephen, Malone, & Bailey, 2005). As we know, the flow of information is crucial to make the efficient communication between the response organizations, how the public groups response to the organization in form communication expectations and provide the consistent information about the problem in hand. The information must be provided timely so that it can help minimize the negative impact to the stakeholders and also the organization (Huang & Su, 2009).The mistake that we can see when the authorities communicating with the citizens is when they were keeping it silent in order to prevent the panic among the citizen. The availability of information will gives the public the opportunity to evaluate the risk and make informed choices on actions (Reynolds & Seeger, 2005). The golden lines of crisis communication are the honesty, candor and openness. To reduce anxiety, the accurate, extensive and timely information have been expected and to activate people in self-efficacy and protective measures. For response organizations it is a challenge to conduct communication that is timely, accurate and consistent. In crisis situations, people want explanations of what happened as well as answers to what is being done to minimize similar risks in the future.

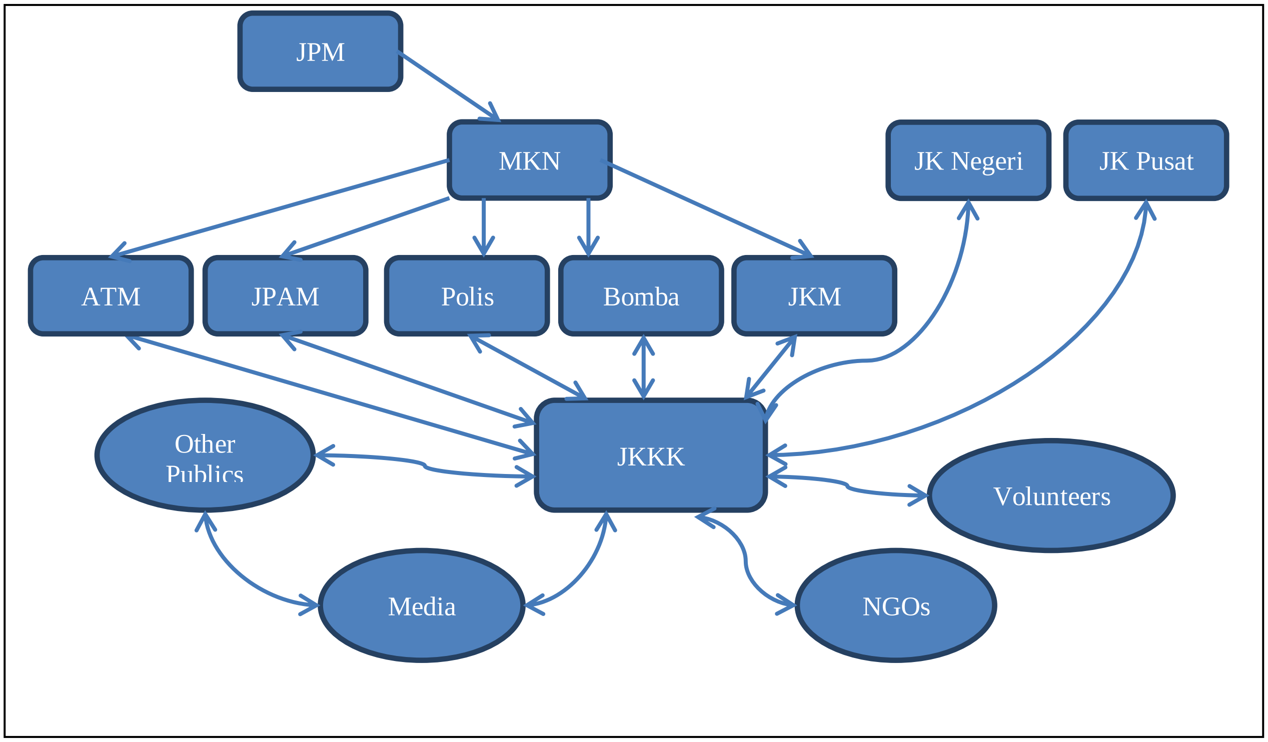

Figure 1: Actual Communication Process during the Disaster

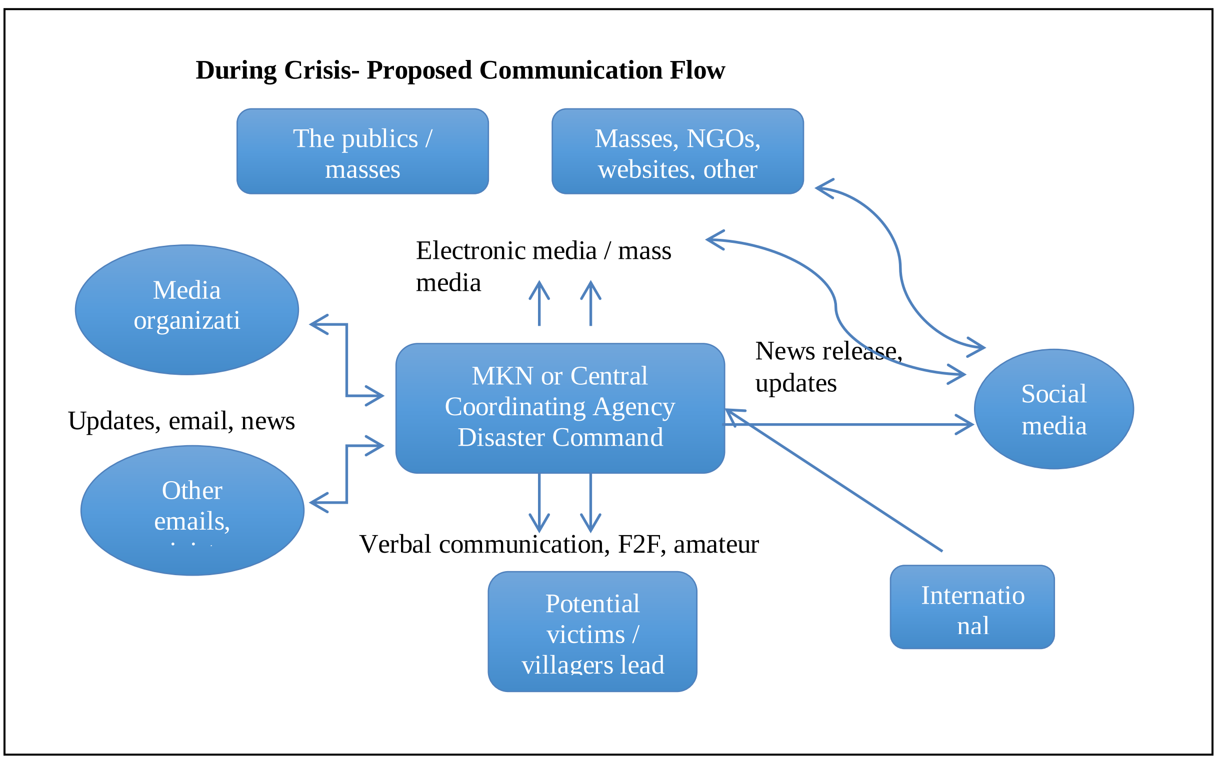

Figure 5: Proposed Communication Flow during Communication Flow Preparedness by authorities, publics and stakeholders

4.0 Conclusion

There are a lot lessons that could be learned during the 2014 flood catastrophe and we have identified some recommendation could be used in future for policy formation, planning structure and crisis communication execution. Some of them are as follows:

4.1 Early preparation and simulation of what we have and what works need to be done and tested multiple times and continuously

4.2 The need for a known centralized body where everyone can refer to is crucial. The level of commands and communication need to be transparent for effective communication flow and crisis communication and management

4.3 Integration, unity and teamwork among all of us are needed especially during a disaster. Put aside political, religious and personal belief but need to focus on supporting humanity

4.4 Transparency in the dissemination of information should be done effectively

4.5 Each group's function and responsibility should not only be clear to the group but also to others as well. This is to avoid redundancy of tasks where during crisis; it can cause money, time and lives.

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LAND-USE AND LAND-COVER: INTEGRATION OF ECOSYSTEM SERVICES FOR DISASTER RISK REDUCTION IN LAND-USE PLANNING

Project Information

Project Leader	: Professor. Dr. Wan Ruslan Ismail
University	: USM
Address	: School of Humanities, Universiti Sains Malaysia, 11800 Pulau Pinang
Contact number	: 013-4207727
Email	: wruslan@usm.my
Project Members	: Dr. Asyirah Abdul Rahim, Dr. Mardiana Idayu Ahmad Dr. Widad Fadhullah, Prof. Madya Dr. Narimah Samat Prof. Madya Dr. Zullyadini A. Rahaman

1.0 Introduction

Many experiences from around the world point to the potential benefits of ecosystems for disaster risk reduction. The focus on development planning which is a process that involves multistakeholders (local community, local government, state agencies, federal government, industry, etc) to improve human wellbeing, by addressing social, economic and environmental issues in an integrated manner. There is a need to mainstream ecosystem services in development planning but for it to be operationalised and used by decision makers for local development, requires understanding of the implementation context for development planning and management (Asyirah and Mohd Azmeer, 2014; Sitas et al. , 2014a; Sitas et al., 2014b) and the opportunities and challenges for ecosystem services in this context are needed. Therefore, this study aims to illustrate the importance of bioregion land-use assessment approach for river catchment health. The objectives are: to determine health of Sg Galas sub-catchments; and to investigate relationships between the land use pattern and health of Sg Galas sub-catchments.

2.0 Methodology

A case study of Galas river catchment was conducted to determine catchment health. Galas river catchment represents the upstream of Kelantan river and among the most affected during the 2014 flood. 16 sampling sites were selected within the Galas river catchment (see Figure 1). Water samples were collected as surface grab samples from highway/ road bridges and few from the bank and brought back to the laboratory for analysis. The parameters including temperature, conductivity (CND), dissolved oxygen (DO), turbidity (FTU), alkalinity, total suspended solids (TSS), total diluted solid (TDS), nitrite (NO_2-N), nitrate (NO_3-N), ammonia (NH_3-N), phosphate (PO_4), and total nitrogen (TN). Catchment temperature, CND, and TDS are measured by using YSI Meter Multiprop Model 556. In addition, sediments were also taken from sites for analysis. The second phase involved mapping the health of Galas River at subcathment level. Based on land use maps obtained from the Kelantan State Town and Country Planning Department, each subcatchment boundary was first digitized and added to the Gua Musang and Kuala Krai land use maps. Then, water quality results of NH_4-N, NO_3-N and TSS were integrated into the database according to LAWA and INWQS classification. The third phase investigated the landuse within each subcatchments and compared to the subcatchment health analysis performed in the earlier phase. The area and percentage of landuse type and activities for each subcatchment were extracted and tabulated. Further analysis to determine the relationship between landuse activities and catchment health using bioregion boundaries.

3.0 Results and Discussion

Figure 2.0 shows the distribution of TSS concentrations based on INWQS classifications where Sg. Kenderong, Sg. Setong, and Sg. Lah Up Stream are mostly Class I (lowest TSS) and as we move downstream the river quality changed to Class V (highest TSS). The highest TSS in catchment could be due to land use activities in term of runoff from soil and bank, rainfall and water velocity (Alan & Castillo, 2007). Therefore, heavy rainfall has affected TSS concentration as runoff went into the river and at the same time, deforestation (land clearing) at the river has led to erosion (Liu & Chan, 2003).

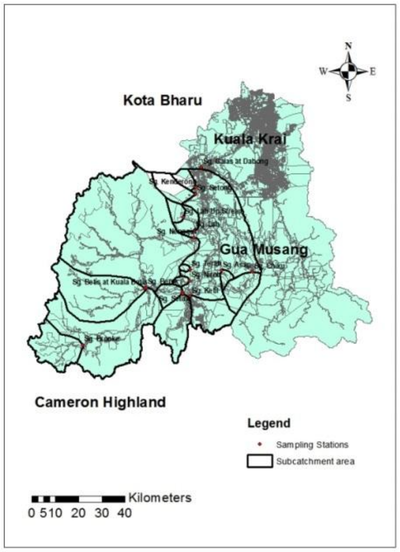	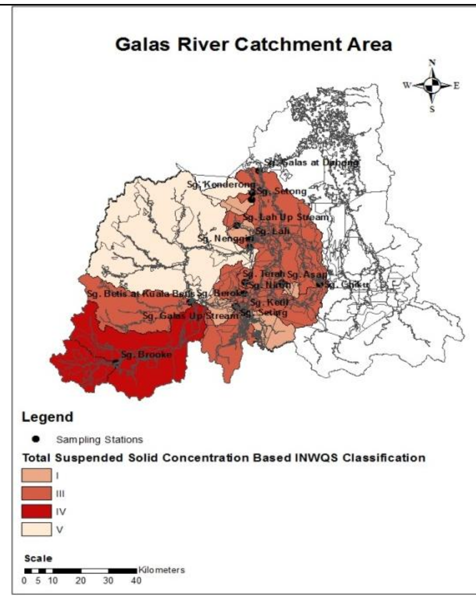
Figure 1: Map showing Sub-Catchment of Galas River	Figure 2: TSS concentration in Galas River Catchment based on LAWA classification

It is important to note that the water quality of Sg. Galas deteriorate from Class II to Class II-III and also Class III in some parts of the catchment. Sg. Galas catchment lies within the Gua Musang District and Kuala Krai District. However, the nutrients input (source) originates from the surrounding area within each subcatchment and finally flow into Sg. Galas. Table 1.0 shows the land use at Sg. Galas at Dabong which has the moderately polluted to heavily contaminated catchment. Human activities have negative impacts on the environment as a consequence of the way they are carried out. Many factors contribute to the concentration of the pollutants in the water such as land use, land cover, slope, type of vegetation etc.

Table 1: Landuse Activities in hectare based on Sub-Catchment of Sg. Galas

River	Type of land uses	Type of activities	Area (Ha)	Area(%)
Sg. Galas at Dabong	Water Bodies	Swamp, river, lakes	1501.18	1.27
	Forest	Land Forest & Permanent Reserves Forest	65871.15	55.71
	Industry	Light Industry, quarry	21.79	0.02
	Infrastructure & utility	Electrical substation, Sewage Treatment Plant,water tanks, Telecommunication towers, Waste disposal site s	22.09	0.02
	Institution and public amenitiest	Education, Safety, religoious, cemetery, Government Usage	366.38	0.31
	Kediaman Dwelling	Planned Housing estates, Unplanned Housing	486.52	0.41
	Transport	Road, railway	1286.51	1.09
	Farming & Aquaculture	Fresh water, and other farming	4.26	0.004
	Business and Services	Shops, Workshops, unplanned business sites, petrol stations	37.22	0.03
	Agriculture	Idle land, orchards , oil palms, rubber, other agriculture	48328.01	40.87

	Bare land	Grass land, bushes, Construction sites, Unfinish project sites	281.42	0.24
	Open spaces & Recreation	Local parks, Garden, Botanical garden, buffer zones,playing field	42.17	0.004
			118248.7	**100**

Land use in the catchment may affect water quality. Some main rivers are becoming shallower and narrower because of the high erosion rate in the hilly area. This is the result of extensive land use change from forest and plantation into residential and industrial areas in the upper part of the city. In effect, magnitude and extend of flooding is increased. Land subsidence is another factor in enhancing the flood risk (Wang, 2001). Ample evidence indicates that better environmental management could effectively support disaster risk reduction, by land use planning and design. A change in land use planning will cause a change for the complete bundle of services provided by that ecosystem. River catchment management therefore is a trans-boundary (administrative boundary) and requires bioregional approach especially for disaster risk reduction via land use planning. The results although is a measure of catchment health in terms of ecosystem processes, also provides an indication of environmental and societal health of the area (Brierley and Fryirs, 2005).

4.0 Conclusion

A land use map, when overlaid on maps of river, provides an essential context for prioritization in the future. Knowledge of locations of these areas would help to define priorities for further state action. These layers comprise the essential databases for prioritization of catchment within the state. This part of the process may suggest effective strategies for catchment health in the planning area and specific analyses to be conducted. The approach employed in this research promotes the concept of regional (ecosystem scale) level management in physical planning especially trans-boundary issues related to disaster risk reduction in Kelantan and other parts of Malaysia. Sg. Galas river water analysis suggests that mitigation measures to reduce pollutants and initiatives to improve catchment health require ecosystem scale approach which is beyond local planning boundaries and jurisdiction.

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DEVELOPING A NATIONAL DISASTER RISK REDUCTION FRAMEWORK (DRR) FOR FLOOD RISK MANAGEMENT

Project Information

Project Leader : Prof Dr. Ahmad Shukri Yazid
University : Universiti Sultan Zainal Abidin (UNISZA)
Address : Fakulti Ekonomi Dan Sains Pengurusan, Universiti Sultan Zainal Abidin, 21300 Kuala Terengganu, Terengganu, Malaysia
Contact number : 09-668 8898 / 019-982 4907
Email : shukri@unisza.edu.my
Project Members : Professor Dr Mohd Rasid Hussin, Associate Prof Dr Wan Norhayate Wan Daud Prof. Dr Abdul Aziz Abdullah , Dr Fauzilah Salleh

1.0 Introduction

Flood is one of the major disasters affecting many countries over the world. Flood occurs due to widespread prolonged of heavy rainfall resulting in a large concentration of water which is very much in excess of the capacities of streams and rivers (Wing, Buletin Ingenieur). It causes damage to lives, natural resources and environment as well as economic loss and health. Among the impacts of flood are pollution, erosion, damage to building structures, loss of properties, loss of life, damage to the drainage system, contamination of food and water, disruption of socio-economic activities, including the transportation, telecommunications, and services network, and loss of environmental services resulting from effects such as the degradation of agricultural soil (Ahmad Fizri et al., 2014)

In Malaysia, monsoon floods and flash floods have been identified as the most severe of climate related natural disasters (ASRD, 2005) The frequency of flood, as well as the resultant damages, has increased due to the effects of global warming and it caused billions of Ringgit of losses both economy wise and human lives (Low and Ahmad Jamaluddin, 2001). Based on National Hydraulic Research Institute Malaysia (NAHRIM, 2006), in Malaysia, localized climate projection indicate a substantial increase in monthly rainfall over the North East Coast where else monthly rainfall in the West Coast of Peninsular Malaysia is expected to decrease, by the year 2050. By 2050, the northeast region shows the greatest projected increase in average annual rainfall at 9 percent while the central region of Peninsular Malaysia projected a reduction in average annual rainfall of 5 percent. It is worrying as the study by NAHRIM shows that the northeast region is projected to experience the greatest increase in maximum monthly rainfall that is an increase of 50 percent.

Malaysia has been hit by one of the largest natural disaster in the history of flood disaster in the East Coast State of Peninsular, namely Kelantan, Terengganu, Pahang and Johor. This time around, the State of Kelantan was hit the hardest with a record high and suffered the most among the four states affected by flood. Flood that hit Kelantan was the worst in the history of the state. It was estimated that the recent flood losses caused huge financial losses amounting to a staggering RM934.4 million. National Security Council (NSC) declared that changing climatic patterns and the adverse weather effects is the main cause while the result of abandoned land management, illegal logging and exploitation of land resources suspected to be the other reasons of the disaster. Thousands of villagers lost their homes.

Therefore, as a response to the flood risk, the Malaysian government has intensified its efforts to have effective flood mitigation measures as one of the disaster preparedness. The purpose of preparedness is to reduce the residual risk through early warning systems and measures which can be taken to mitigate the effect of flood disaster (Khalid and Shafiai, 2015). In line with this, Malaysia is indeed committed to disaster risk reduction as a part of Disaster Risk Management (DRM) which describes the development and application of policies, strategies and practices that minimize vulnerabilities and disaster risks throughout a society. Besides, it can help to avoid or limit the adverse impacts of hazards, within the broad context of sustainable development and continues its efforts towards implementing the priority areas of the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 to cope better with the disasters that threaten development goals (Davies et al., 2008). Hence, this study is very timely in adderessing the issue of disaster mangement.

The primary objective of this study are: i) to examine the effectiveness of the existing DRR Framework in mitigating flood risk and ii) to propose a new DRR framework for mitigating flood losses. This study is significant because the findings could assist the National Security Council (NSC) and stakeholders in reducing flood losses in the future.

2.0 Methodology

This is a qualitative study that specifically focussed on multiple case studies. Creswell (2007) defines a case study as "an empirical inquiry that examines a contemporary phenomenon within real-life context; when the borders between phenomenon and context are ambiguous evident, and in which various sources of evidence are used". These definitions were used to guide the implementation of the study.

A total of twenty nine people representing various stakeholders involved in flood management in Kelantan were interviwed. They are from various goverment bodies such as Natioanl Security Council, Fire & Rescue Department, Health Department, Police Department, and Social and Welfare Department. The rationale behind choosing them as a sample population is because the researcher is interested to get feedback on a national DRR framework for mitigating flood risk. For data collection, this study used a semi-structured interview process, non-participant observation and document analysis; the researchers were the key instrument for data collection. The data analysis technique used in the study was content analysis and was analysed using Atlas.ti 7 software.

3.0 Results and Discussion

The findings are reported according to two research questions which are (1) Is the current DRR framework effective? and (2) What is an alternative DRR framework to mitigate flood losses?
Research question 1: Is the current DRR framework effective?

i) To what extent do you know, understand or are familiar with the NSC Directive No. 20?

Based on the interviews conducted with a number of representatives from selected government agencies, some of them were unaware of the NSC Directive No. 20. Among them were representatives from Department A and Department B.

Respondent 1
I think we are not familiar with the NSC Directive No. 20. I had never heard of it and the NSC did not come to enlighten us about it. When I joined a meeting with all agencies including the NSC, I think there was nothing said about it, or it was only us who did not know about it. Honestly, I would say we did not know about it, let alone our departments in the districts in Kelantan.

Respondent 2
We had never heard and never knew about Directive No. 20. The District Council was not the head that handled the disaster. Land Office was. Perhaps they knew about Directive No. 20 .

The situation was different with the representatives from departments C and D; they did have knowledge of Directive No. 20. In fact, they acknowledged that their work was mostly guided by Directive No. 20. They also realized that during disasters, they were in charge and thus they needed to understand and obey every instruction.

Respondent 3
We are very familiar with Directive No. 20 because it gives us direction or guides us to act in times of disaster. We took the instructions seriously as we were the commanders in chief, in charge of keeping the situation under control when the disaster occurred. We needed to understand them thoroughly because we were the leaders there.

Respondent 4
Directive No. 20 is a guide to us and we really follow what is written in the directive. We were informed that this is our priority in the event of a disaster, and we do emphasize the importance of the NSC Directive No. 20 to our members.

Unlike other agencies, representatives from Department F said that some staff might not have knowledge of Directive No. 20. Even so, they acknowledged that Directive No. 20 must be understood by all staff.

Respondent 4
Recently, I saw some agencies who do not understand the responsibilities given to them in terms of work, guidance, direction and their roles during a disaster, when in fact it is all written in Directive No. 20. We are already familiar with the work related to disaster management, but the other agencies might not be, as they work within office hours while we are trained to do 24-hour on call work. The responsibilities that have been given need to be fully understood in order to facilitate the management of disasters.

ii) Has Directive No. 20 been explained to all staff involved in your department?

In departments C and E, all staff were informed of Directive No. 20. Emphasis on the instructions were made, and all staff understood the roles they had to play before, during and after the disasters. The situation was slightly different with Department F, as the description of Directive No. 20 was given to all heads of districts in Kelantan. Since meeting with all staff from every district would take up too much time, all district heads were directed to inform the details of Directive No. 20 to their staff. Because of this, some staff did not get detailed information on Directive No. 20. Thus, the department developed a self-published guidebook for disaster management. This book is also used to replace the description of the action plans in each district.

iii) To what extent is the role of your agency in flood management?

Department E is responsible for providing supplies for a period of 3-7 days and delivering them to the front base. This includes getting the allocations for the purchase of food and basic necessities to be sent to the front base before the flood season begins. The department also manages aid and recovery for victims after the flood. Below are descriptions of what constitutes 'aid and recovery':

Respondent 5
(…)*Asset aid (includes) registering evacuees who are still left behind in evacuation centers. This is the main duty of Department E after the floods subside. We also continue providing food aid and basic necessities to people who are still living in tents as well as shelter for victims who have been evacuated.*

Respondent 6
We stick with the usual role, which is to assist in supply and recovery. For example, in Gua Musang and Kuala Krai, there are victims who are still living in tents because their homes are not completely built yet. Helping these victims is still our responsibility. Based on the data that we have, there are 20 settlements involving 400 households in Kuala Krai, and there are 14 families still living in tents.

Department A also sends rescue teams from the Education Curriculum Center to the public. The rescue teams were said to be able to help the victims because the curriculum center had all the equipment and facilities needed for rescue.

Respondent 7
We sent a rescue team from the Education Curriculum Center to the public. This rescue team not only helped the public, but also the flood victims in the evacuation centers.

Respondent 8
They could provide assistance to civilians because the curriculum center had sufficient facilities and equipment such as canoes, boats and so on.

In addition, Department A also served to provide a place for evacuees to gather as suggested by respondent 9.

Respondent 9
Department A only provides classrooms, desks, chairs, and halls as preparation for receiving flood victims.

Preparations depend on current information received from both the state government and the NSC via the 'WhatsApp' online service. The venues that were to be used as evacuation centers had been gazetted; most were schools. This gazette is important as it contains information on the maximum number of flood evacuees allowed in each evacuation center. This helps Department E's distribution of food to each registered center. Department E did not send food supplies to areas that were not official, because the government provision and aids could only be channeled to areas authorized by district officers. The same rules apply when it comes to providing aid to victims before and after the flood. Only those who registered at the evacuation centers would receive government funding. Victims stranded in mountainous areas did not receive assistance after the flood, as they were not declared victims.

During the flood, Department A was responsible for briefing all the officers, school principals and centers involved in the SPM examinations, an end-of-year exam for secondary students. They were instructed to lock all important school assets such as desks, chairs and computers in the classrooms to keep them safe from the flood water. Department A had also created a group called the SMART SUPPORT TEAM to help residents prepare for the flood, and to offer psychological help to the victims after the flood.

iv) What were the problems faced by your agency (before, during and after the floods)?

3.1 Problems before the flood

In the data obtained, none of the agency representatives specified any problems they had before the floods.

3.2 Problems during the floods

A number of problems were encountered during the floods. Below are some of the problems faced by the agencies involved:

Flood Preparations

Although departments E, F and B had made careful preparations prior to the flood, their preparations were insufficient and did not meet the needs of a large scale flood. As a result, they faced problems which included insufficient food supply and limited transportation. At such short notice, food suppliers were scarce and no transportations were available for transporting food.

Respondent 10

We did not make preparations for a large-scale flood last year. In that particular year, we only prepared food for 150,000 victims, but we received a total of 300,000 victims. As a result, we had problems providing food supplies for victims immediately because there were other issues that arose, such as the absence of suppliers and no forms of transportation for delivery of the food.

Preparing the evacuation areas was also problematic, as many places were submerged in water and many people were affected. The designated centers could not accommodate large numbers of victims. As a result, many victims were forced to seek shelter in places that were not authorized as evacuation centers.

Respondent 11

The hall that became an evacuation center was too small and could not accommodate the large number of victims. For instance, about 600 people had to stay in the Sri Gucil Hall that was less than 100 square feet. Some did not stay in the authorized evacuation center. I stayed in the Al-Falah building that was three storey tall. There were many victims, and we did not receive any food supply for two days. We only drank rain water.

Lack of Staff/Committee Members/Rescuers

According to Departments E and D, during the 2014 floods, they were short of staff because the floods affected too many people. Because the floods came unexpectedly, many officers who were also appointed as the committee members were unable to do their jobs because they themselves were victims.

Respondent 12
Rescue teams from outside of Kuala Krai only arrived after the flood subsided and the water were no longer at a dangerous level. We saw hovercrafts and big boats arrive after a week of the flood, from the 26th of December to the 1st of January. Before that, there was no help from the outside. There were only military personnel and local agencies here, but no assistance from outside.

Many committee members and rescuers could not carry out their duties because they were trying to save themselves and their families.

Lack of Awareness
Departments E and C said that they had problems with people who refused to move despite the order that had been issued. This complicated the rescue mission and made it difficult for the evacuation process.

Respondent 13
Yes, this is a big problem because they were too obsessed with the idea of historical floods than the older generations. The areas they lived in were never hit by floods, so persuading them to move was difficult, and this complicated the transfer process.

Communication Problems
Among the main problems that occurred during the flood involved communication. Losing contact made flood management more difficult. This was acknowledged by the representatives from departments F, A, D and B. Below is a review of the communication problems they faced:

Respondent 14
Our medical team had been supplied with Government Integrated Radio Network (GIRN) equipment. The GIRN equipment had indeed been distributed to all agencies involved in Directive No. 20, but they were also limited, as not all regions have them.

Respondent 15
We also had difficulty in getting reinforcements from other agencies. This was caused by communication problems, as we were unable to contact others to help us. At first, on the 25th and 26th of December, we lost our connection. Thus, we did not know what the victims in the disaster areas needed. We could not provide enough support, for we did not know what the situation was like over there.

Lack of Assets
The Department A representative stated that during the floods, they suffered due to a lack of assets. No donations and no special provisions were given that could be used to help in flood management. Therefore, they had to use assets that were meant for extra-curricular activities.

Respondent 15
(We used) assets meant for extra-curricular activities, such as kayaks, rafts, speedboats, and so on.

Department C also acknowledged that the assets were not enough to help the flood victims. Although they had made preparations, some of the assets provided could not be used during the floods, and in some cases, no provisions were given for the maintenance of these assets.

Transportation Issues
The representatives from departments C and D wrote about the transportation problems they had. Since communication with the flood-affected areas was lost, police and firefighters were unable to carry out their duties effectively. The poor state of the boats also did not allow them to continue their rescue efforts. Here are some of the problems they faced in relation to transportation problems:

Respondent 16
The need was already there but the process of delivery could not begin. We lost contact with the target area, and there was no helicopter landing pad. We had to drop the food down from the air.

Respondent 17
All agencies were helping each other during the floods but the boats were unable to go against the currents. There were also boats that were not suitable for the rescue. I think this needs to be emphasized. There should be specific boats for the rescue operation. This is very important because boats are necessary modes of transportation where roads are closed. Hovercrafts were also important in the 2014 floods.

The Absence of Food Supply
The representatives from departments D and B stated that the lack of food supply was one of the problems they faced during the floods. This problem occurred because KSWD, who had lost all contact with the target areas, could not supply the food and had no transport. As a result, the victims had to resort to rain water as they did not get any food supply for two days.

Respondent 18
Based on my experience as a flood victim, I think our main problem was the lack of food. At the place where I stayed, there was indeed a lack of food supply. We had to ration the food supply so that it would be enough for everyone. Food aid from outside did not reach the place where I stayed.

Other Constraints
Apart from the problems mentioned above, the police stated that they were not familiar with the route to the village. As a result, it took them some time to save the victims.

Respondent 19
We encountered many difficulties as we were not so familiar with the route to the village, and the water level was too high. We were unable to make correct estimations on how long it would take to get to our destination. The situation was very dangerous to the rescue teams. We were worried we would bump into houses, trees and electric poles. The journey was also time consuming because we had to go through many obstacles. We took a 4x4, then we had to board a truck. We also had to take a boat. Our connection to the target area was also disrupted.

Department D also stated that they had to deal with situations involving political discrimination. These situations made it difficult for them to manage food and clothes supplies for the victims.

3.3 Problems after the Floods
The following are the four major issues raised by representatives of the agencies interviewed:

Lack of Provisions
According the Department F, there was no provision of equipment available for future floods due to the fact that all provisions were used for restoration efforts that were to be carried out after the floods. The costs incurred were very high, amounting to millions of ringgit.

Respondent 20
Indeed, the cost of damages, that include broken fans, doors, toilets and clogged pipes, was very high. According to our estimations, the damages cost millions of ringgit.

Redevelopment
The biggest challenges for most agencies were rebuilding and repairing the damage caused by the floods. Departments F, A and D all agree.

Respondent 21
Repairing damages in the hospitals and clinics that were affected by the flood was a challenge for us. We also needed to repair broken equipment. Some clinics are still operating in tents because the new clinics are not completely ready. This is worrying, particularly if floods happen again in the near future.

Although large allocations were given to the redevelopment process, the lack of time and space has caused problems. The cleaning process was also plagued by problems due to the lack of water.

Respondent 22
Apart from the problems faced in reconstruction, there were also problems in the cleaning process, as the mud was very deep and we had no water to carry out cleaning activities.

Respondent 23
We faced problems when we had to clean the areas affected by the floods. At the time, there was no water, so the cleaning activities were delayed. Many came to help, and we had sufficient equipment, but there was no water. The FRD received many calls requesting water supply for cleaning purposes, and we had to commute here and there to give full cooperation to all parties.

Social Situations
Another issue that worried many people was the presence of opportunists in the areas affected by floods. Some traders increased the prices of goods while banks and other facilities in Kelantan were not operating. Robberies were also common.

Respondent 22
There were many implications. There were those who took advantage of the situation after the floods receded. Victims who needed to buy groceries were taken advantage of by grocers who raised the prices of their goods. For instance, one candle was priced at RM5, while a bottle of mineral water cost RM2.

Trauma
After the flood, many victims were under pressure due to trauma.

Respondent 23
Recently, eighty-seven percent of students in Kuala Krai were traumatized by the disaster. Most of them lost their homes and had to live in tents or huts while they waited for the completion of their proposed houses which took quite some time.

Improvement of Flood Management
To overcome the problems that were encountered, Department E suggested that awareness among students should be nurtured from childhood.

Respondent 24
There should be a study on awareness of disasters in schools and this awareness should be nurtured from childhood.

In addition, Department E suggested that the use of GIRN should be given more emphasis as it can be used even when electricity is unavailable.

Respondent 25
Our medical team had been supplied with GIRN equipment. GIRN equipment had indeed been distributed to all agencies involved in Directive No. 20, but they was also limited, as not all regions had them. We have already pointed out that the use of GIRN should be given more emphasis, as it can be used even if there is no electricity.

In addition, Department D recommended that adjustments are made to the distribution of aid supplies in order to facilitate the division of tasks, and so that all shortages can be detected.

Respondent 26
Items received from outside should be coordinated by one agency. There were places that only received clothing donations but not food, and there were places that received rice, but no kitchenware. This led to a lot of wastage, as we ended up with piles of unused donated items. By having one coordinating body, we would know what is needed, and the NGOs can help put a stop to wastage. We had piles of extra clothes, and we had to collect and deliver them to their proper places.

Department A took the initiative to help victims suffering from trauma by holding programs with them to help them cope.

Weakness of the current DRR framework

Many agencies and relevant stakeholders involved in the flood management are not familiar with nor understand what Directive No. 20 is. It is also known as an integrated disaster management system under the purview of the Prime Minister's Department. Agencies and stakeholders who are aware of such a directive at the national level appear to only have superficial knowledge of it. Their knowledge of the content of overall details of Directive No. 20 is alarmingly poor. In Malaysia, when floods occur, the relief and recovery processes are hugely dependent on Directive No. 20.

It must be mentioned that such a directive would not be fully effective as a tool in fulfilling the Sendai Framework if the different legislations that play different roles in disaster management are not invoked. A more flexible legal structure is needed in a modern community to keep up with socio-economic and technological advancements. As policies develop, and climate changes and new risks emerge, there is a need for a single legislation to keep abreast with flood risk management policies.

Victims also felt that the damaging effects of disasters can be reduced if they had more information about these disasters. Raman et al. (2010) claims that the lack of a universal information system for disasters contributes to the worsening condition of floods in Malaysia. Othman et al. (2014) stresses the need for improvement, particularly in the governance of information and information-related technology.

Research question 2: What is an alternative DRR framework to mitigate flood losses?

Based on the various discussions in the above paragraphs, it appears that Directive No. 20 is generally a broad guideline which describes the various types and forms of disasters, including natural disasters. In this regard, it is extremely important to note that there is an absence of a specific guideline or framework related especially to disaster risk reduction (DRR) for floods. Flood is a common problem faced annually in certain states in Malaysia.

To address this issue, the researchers feel that it is extremely important and timely for Malaysia to have such a DRR framework at the national level that would specifically address the risk of flooding. Due to its importance and urgency, the researchers suggest that the Malaysian government act now to establish a new and relatively easy-to-implement DRR framework for effective flood risk mitigation at the national scale. The new DRR framework would be the very first of its kind in Malaysia and perhaps the ASEAN region.

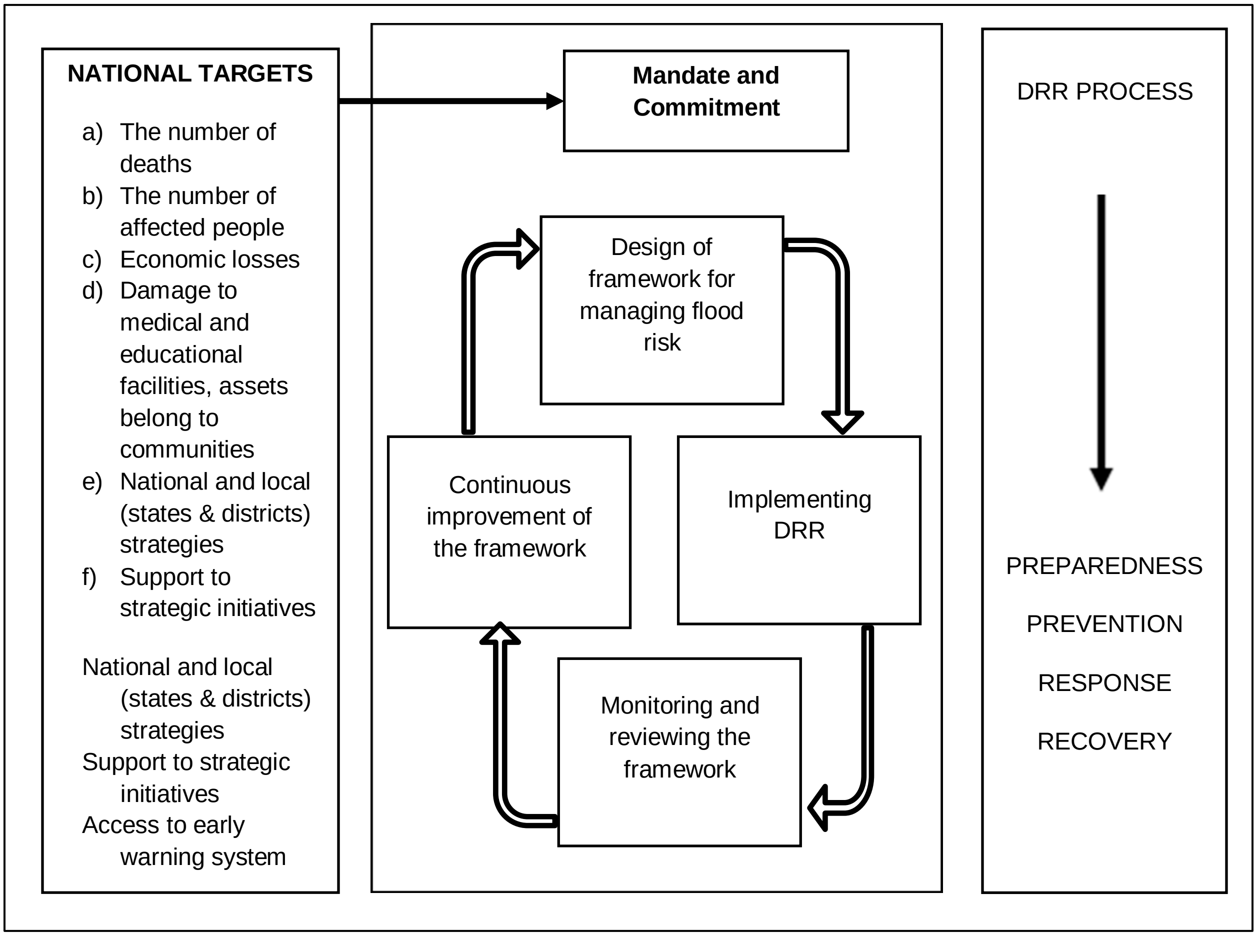

Diagram 1: Relationship between the seven (7) National Targets and Disaster Risk Reduction (DRR)

Framework to the four (4) stages of DRR Process for flood risk mitigation (Source: Researchers)
Diagram 1 above shows the relationship between the National Targets and DRR Framework in relation to the Stages of DRR Process for flood risk mitigation. The seven (7) National Targets are as follows:

1. Number of deaths
2. Number of affected people, parties and/or stakeholders
3. Economic loss incurred
4. Loss or damage to affected educational and medical facilities including various assets and resources belonging to the communities involved
5. Strategies at national/federal, state and district levels
6. Support from the Government of Malaysia at national/federal, state and district levels
7. Readily available access to early warning information at times needed and/or required

It is important to note that the above National Targets have a direct and positive relationship with the DRR Framework that involves five (5) equally important components, which are:

1. Mandate and commitment
2. Design of framework for managing flood risk
3. Implementing DRR
4. Monitoring and review of the framework
5. Continual improvement of the framework

In relation to item 3 of the DRR Framework, which is 'Implementing DRR', four (4) stages of the DRR Process are deemed essential. They are as follows:

1. Preparedness
2. Prevention
3. Response
4. Recovery

4.0 Conclusion

Despite the implementation of Directive No. 20, this study has uncovered several pertinent issues of primary concern that arose during the massive 2014 flood. Such issues of primary concern include the severe lack of coordination of resources, integration of systems and processes available, and communication between the various agencies and relevant stakeholders. One of the key findings of this national study is the apparent coordination of most agencies that operate in silos. The National Security Council (NSC), on the other hand, appear to have a rather serious staffing problem, with an inadequate number of staff assigned to handle routine activities and oversee matters of concern during the actual occurrence of flooding. In addition, findings show a gross lack of relevant training and required drill-activities among all agencies and relevant stakeholders involved. Also, there seems to be a lack of knowledge among personnel who were appointed and/or assigned to handle flood disasters at all the federal, state and district levels. It is also worth mentioning that there is indeed a lack of awareness programs involving the entire communities at the national level as a whole. Clearly, the existing Directive No. 20, which is the National Disaster Management (NDM) Framework is not being utilized to the advantage by all parties concerned, especially the agencies and relevant stakeholders who are directly involved with the business of managing flood risk on the national scale. It is the objective of this particular study to propose that a new DRR framework, specifically for flood risk mitigation, is established immediately at the national level. Such a framework will be the first of its kind in Malaysia. Since the framework is adapted from the World First Global Risk Management Standard (ISO-31000:2009), the implementation and execution of this newly established DRR framework will indeed be useful and effective in managing flood risk occurrences in the future.

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A DEVELOPMENT OF A STANDARD POLICY TO UTILIZE ONLINE FLOOD DATA MANAGEMENT SYSTEM

Project Information

Project Leader	: Dr Noreen Izza Arshad
University	: Universiti Teknologi Petronas
Address	: Block 02, CIS Department, 32610, Bandar Seri Iskandar, Perak
Contact number	: 017 350 1179
Email	: noreenizza@petronas.com.my
Project Members	: Ahmad Izuddin Bin Zainal Abidin, Nazleeni Samiha Binti Haron @ Baharon Mazuin Binti Jasamai, Mohamed Imran Bin Mohamed Ariff Azizi Bin Ahmad, Nur Afiqah Binti Marzuki Najibah Binti Shahbila

1.0 Introduction

Currently, flood is no longer a new issue in Malaysia. Our country has to deal with this natural disaster almost every year, especially in the East Coast region. It is found that most of the initiatives conducted for preparedness and flood disaster response plans are done manually without any automated and connected system to assist data sharing between related bodies. This has call for an online flood data management systems involving the related government and private bodies. Since the system will involve various authoritative bodies, a proper planning on who are responsible to which and what data is crucial. This is important as to ensure that the right data is uploaded and maintained by the responsible bodies and then be made available to only those eligible parties. From the interviews and discussion conducted with selected authoritative bodies, this study has planned three designs for the system that include, the (1) data mapping of information needed before, during and after disaster, (2) Standard Operating Procedure (SOP) that divide tasks according to the respective authority, and (3) policy to utilize the data management system. These three findings have been validated by the responsible parties. It is hoped that this research will lead to a better flood data management and communication among related parties.

2.0 Methodology

To materialize the policy in utilizing the online flood data management system, there are three important phases that needs to be completed in this research: (1) Analyze and assess the existing policies and guidelines, action plans and standard operating procedures that relates to flood, (2) Develop the policy to utilize online flood data management system, and (3) Solicit feedback from actual and potential users of the policy.

1. **Analyze and assess the existing policies and guidelines, action plans and standard operating procedures that relates to flood** - During this phase, it is important for researchers to get existing policies and guidelines, action plans and standard operating procedures that relates to flood developed by various agencies, industries and other bodies. These include the action plan prepared by the Ministry of Health Malaysia and Ministry of Education; the Mitigation plan prepared by the Water and Energy Consumer Association of Malaysia (WECAM) and many more.
2. **Develop the policy to utilize online flood data management system -** At this stage, authorized personnel who have involved during Stage 1 mentioned above involved in reviewing the policy to utilize the online flood data management system that we have created based on the information that we gathered from them previously. At this stage, it is crucial for participants to solve any shortcomings that include highlighting and solving ambiguity over data responsibility. At the end of this stage, a consolidated and verified policy to utilize the online flood data management system with three main measures which are flood mitigation plan, preparedness and flood disaster response plan and recovery and reconstruction plan is produced.
3. **Solicit feedback from actual and potential users of the policy** - At this stage, researchers solicited participation from various potential users who will actually be using and rolling out the policy when flood strikes. This will include getting representatives from humanitarian groups, public agencies (e.g. Jabatan Kebajikan Masyarakat, Jabatan Belia dan Sukan, etc.), private

bodies (e.g. MERCY Malaysia, IKRAM, etc.) and group of volunteers (e.g. Persatuan Bulan Sabit Merah). At this stage, a validated policy is produced.

3.0 Results and Discussion

After all the interviews with the organizations that involved in handling flood either directly or indirectly, we decided to cover around 16 organizations such as Pejabat Belia & Sukan, Jabatan Pengairan & Saliran, Majlis Daerah, Majlis Keselamatan Negara and others. Based on the interviews, we managed to figure out what are the crucial data needed by all those organizations, and what are the data that they will provide to others.

We converted all those information into a table that will show clearly the needs of each of the organizations. Based on this table, we check either there is any redundancy in providing data (two different organizations provide the same data to other organizations). The table also shows either the data will be uploaded before, during or after the flood happened. Such as example in Fig. 1, the list of the villagers and number of houses should be uploaded earlier before the flood season by the committee of the village.

No.	Agensi	Data yang dimuat turun (diperlukan)	Data yang dimuat naik (disumbangkan)		
			Sebelum	Semasa	Selepas
1	JKK Kampung	• Simulasi banjir	• Senarai AJK Kampung • Senarai penduduk • Bilangan rumah • Senarai kelengkapan		• Laporan kerosakan
2	Pejabat Pelajaran	• Senarai penduduk • Simulasi banjir	• Senarai sekolah • Keadaan fasiliti		• Keadaan fasiliti • Laporan kerosakan
3	Jabatan Kebajikan Masyarakat	• Senarai AJK kampung • Senarai penduduk • Bilangan rumah • Simulasi banjir	• Senarai pangkalan hadapan (Stok bekalan) • Senarai pusat penempatan	• Senarai mangsa banjir (keluar /masuk) • Senarai pusat penempatan (buka/ tutup)	• Senarai mangsa (untuk diberikan bantuan)

Figure 1 The list of organizations with the data that they need and the data that they will provide

Jabatan Kebajikan Masyarakat should upload the list of the flood victims in the relief center during the flood. After the flood, Pejabat Pelajaran should upload the list of damaged equipments or infrastructures and recovery costs that they need to bear after the flood. Based on this table, we came out with a data mapping to see the flow of the data from which organization to what organization. Since there are 16 different organizations involved, we assigned each organization with their own color to make it easier to differentiate between one another as shown in Figure 2.

	1) JKK Kampung
	2) Pejabat Pelajaran
	3) Jabatan Kebajikan Masyarakat
	4) Pejabat Daerah
	5) Majlis Keselamatan Negara
	6) Pasukan Penyelamat
	7) Orang awam
	8) Belia & Sukan
	9) Jabatan Pengairan & Saliran
	10) JKR
	11) NGOs & Badan Sukarelawan
	12) Tenaga Nasional Berhad
	13) Meteorologi
	14) Pejabat Kesihatan
	15) Syarikat Telekomunikasi
	16) Majlis Daerah

Figure 2 The list of organizations with their representative colors

The data mapping will be separated into three sections, which are the left side that shows the name of the organizations with the data that they will provide, the center of the data mapping that shows the flow of the data, and lastly the right side of it that shows the name of organizations with the data that they need. Such as example from Figure 3 and Figure 4, we can see that Pejabat Pelajaran will upload three data and receive two data. Jabatan Kebajikan Masyarakat will upload three data and receive four data. From the data mapping, it is easy to see who are the largest data provider and who are the largest data consumer.

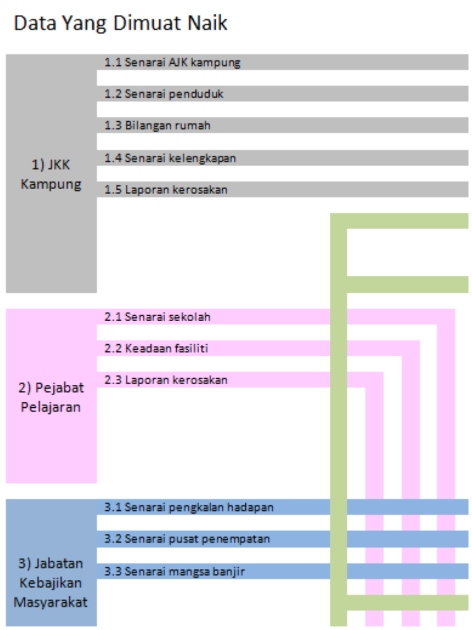

Figure 3 The list of organizations with the data that they will provide (on the left side of the data mapping)

Figure 4 The list of organizations with the data that they need (on the right side of the data mapping)

With the data mapping, it is easy to ensure that nobody will upload the data that are not under their responsibility since this might create redundancy and will affect the reliability of the data. Besides that, the data mapping also ensure that all the data being uploaded into the system will be used by other organizations. No data will be uploaded without exact purpose.

In the beginning, it takes quite a long time to really understand the flow of the data and how data are transferred and shared during the real flood occurrence. By interviewing all those organizations (e.g. Jabatan Kebajikan Masyarakat and Majlis Daerah) it was shown that each organization plays a different role in managing flood. However, by converting all the information that we get into the form of table and data mapping, it is much easier to understand how the transfer and sharing of data occurs inter-organizations.

4.0 Conclusion

4.1 Data Mapping – The data mapping is successfully created with less complexity in order to make it understandable by related organizations that involve in data transfer and sharing during flood events.

4.2 Standard Operating Procedure - that clearly divided all the tasks to the responsible and authorized people, for flood disaster countermeasures that include for flood mitigation, preparedness and flood disaster response and recovery and reconstruction plan.

4.3 Written policy to utilize the data management system that will fit the requirements needed by users to perform their tasks according to the standard operating procedures.

PEMBINAAN DAN PENGUJIAN MODUL PEMERKASAAN PIHAK BERKUASA (BOMBA,JPAM,RELA,POLIS DAN TENTERA), PEMIMPIN KOMUNITI, KETUA RUMAH DAN INDIVIDU DALAM TINDAKAN BERSEPADU MENGHADAPI BENCANA BANJIR DI MALAYSIA

Project Information

Project Leader	: Dr Fauziah Mohd Sa'ad
University	: Universiti Pendidikan Sultan Idris (UPSI)
Address	: Jabatan Psikologi dan Kaunseling, Fakulti Pendidikan dan Pembangunan Manusia , Universiti Pendidikan Sultan Idris. 35900 Tanjong Malim
Contact number	: 0192401650
Email	: fauziah_msaad@fppm.upsi.edu.my
Project Members	: Dr Nurul Ain Daud, En Ghazali Din En Mohd Noor Idris, Dr Hapsah Yusof En Che Anuar Che Abdullah, Cik Norazani Ahmad PM Dato' Dr Junaidi Abu Bakar, Wan Nurul Farhana Bt Wan Hassan

1.0 Pengenalan

Banjir merupakan suatu permasalahan yang serius kerana boleh memberikan impak kepada kehilangan tempat kediaman, kerosakan harta benda, aktiviti harian tergendala, malahan menyebabkan kemalangan atau kematian akibat lemas kerana banjir.Inilah yang sering berlaku di Malaysia apabila kejadian hujan yang sangat lebat terutamanya dalam musim tengkujuh.

Akibat kejadian banjir yang berlaku pada tahun lepas, terdapat ramai mangsa banjir yang kehilangan tempat tinggal, kemusnahan tempat tinggal secara menyeluruh akibat air yang sangat deras. Segala aktiviti harian juga turut tergendala. Mangsa yang terlibat terpaksa menyelamatkan diri sehelai sepinggang ke arah kawasan yang lebih tinggi seperti bukit, bangunan tinggi dan kawasan yang tidak mengalami banjir. Terdapat mangsa yang kelaparan akibat bantuan yang lambat sampai dan tidak mendapat makanan selama seminggu.

Pengendalian dan pengurusan bencana banjir sangat penting bagi sesebuah negara sepertimana yang telah berlaku pada tahun lepas. Menurut Mohd Hisham (2014) berkata, fenomena full moon iaitu kedudukan bulan berada lebih dekat dengan bumi telah menyebabkan air pasang lebih tinggi adalah antara faktor yang mencetuskan banjir luar biasa di kawasan Pantai Timur pada tahun ini (Kosmo 24 Disember 2014). Oleh itu, Majlis Keselamatan Negara (MKN) telah mengeluarkan Arahan MKN No.20: Dasar dan mekanisme Pengurusan Bencana Negara pada 30 Mac 2012 dan ianya masih relevan serta masih digunapakai pada hari ini. Arahan ini telah menggariskan satu dasar pengurusan dan bantuan bencana di darat secara menyeluruh berkenaan pengurusan bencana meliputi peringkat sebelum, semasa dan selepas.

Sehubungan dengan itu, tahap pengurusan dan pengendalian banjir di negeri- negeri terlibat perlulah dipertingkatkan bagi memastikan segala kesulitan yang wujud dalam kejadian banjir pada tahun 2014 dapat dikurangkan. Justeru, kajian ini dijalankan bagi mengkaji keberkesanan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia. Sememangnya keberkesanan modul ini penting untuk dititikberatkan demi mencapai objektif dan hasil yang berkualiti seperti yang diharapkan. Kajian ini juga dapat mengukuhkan objektif pembinaan modul disamping mengembangkan modul ini supaya ramai pihak akan memperoleh manfaat dan faedah daripadanya.

Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia menghuraikan secara terperinci dan sistematik modul serta aktiviti yang berasaskan Modul Pemerkasaan Pihak Berkuasa dalam Menangani Banjir di Malaysia. Secara khusus, modul ini terbahagi kepada sepuluh Sub-Modul dan Strategi iaitu Strategi 1: Suai Kenal dan Matlamat, Strategi 2: Pengenalan Tindakan Banjir, Strategi 3: Program Kesedaran dan Tindakan Persediaan Pra Banjir, Strategi 4: Bengkel Tindakan Persediaan Pra Banjir, Strategi 5: Tindakan Bersepadu Semasa Banjir, Strategi 6: Bengkel Menghadapi Bencana Banjir, Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir, Strategi 8: Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda), Strategi 9: Simulasi Persediaan Banjir dan Strategi 10: Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir.

2.0 Metodologi

Kajian ini berbentuk deskriptif atau rintis untuk menjawab persoalan-persoalan kajian. Reka bentuk kajian kuantitatif pendekatan deskriptif melibatkan analisis kesahan dan kebolehpercayaan. Kajian ini terbahagi kepada tiga peringkat kajian yang saling berkaitan iaitu Pembinaan, Kesahan, dan Kebolehpercayaan. Reka bentuk kajian yang pertama adalah pembinaan awal MPPBB berdasarkan kajian awal (premilinary study) berbentuk kajian kepustakaan untuk mengenalpasti dan menilai literatur, teori dan model terbaik dalam membentuk aktiviti-aktiviti yang terkandung dalam Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia.Dalam bahagian ini fokus utama kajian tertumpu kepada penulisan modul berkenaan.

Reka bentuk kajian kedua adalah berbentuk tinjauan untuk menguji kesahan kandungan modul dan kesesuaian sesi dan aktiviti yang dijalankan di dalam Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia.Dua pemboleh ubah utama dalam kajian ini adalah Nilai Kesahan dan Nilai Kesahan Kesesuaian Sesi dan Aktiviti mengikut Mohammad Aziz Shah (2010).Bagi tujuan kesahan kandungan dan kesesuaian sesi dan aktiviti modul tersebut, seramai 10 orang pakar penilai terlibat dalam kajian ini.Seterusnya proses pengujian kebolehpercayaan modul dilakukan keberkesanan penilaian terhadap objektif-objektif modul dengan memilih sekumpulan subjek kajian di beberapa agensi Pihak Berkuasa yang melibatkan PDRM, ATM, JBPM, JPAM dan RELA. Fokus utama dalam bahagian ini adalah untuk mendapatan nilai kebolehpercayaan melalui respon secara bertulis daripada sekumpulan subjek kajian yang terpilih dalam kalangan peserta yang terlibat.

Reka bentuk kajian bagi setiap bahagian dalam kajian ini adalah penting kerana ia merupakan kaedah pendekatan yang digunapakai oleh pengkaji dalam memandu arah kaedah kajian itu sendiri. Hal ini secara tidak langsung akan memudahkan pengkaji dalam menjana idea yang berkaitan apabila wujudnya reka bentuk kajian. Sehubungan dengan itu, reka bentuk kajian kuantitatif yang sesuai dijalankan untuk menjawab persoalan kajian ini. Pada peringkat kesahan kandungan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia, lokasi kajian ialah di Flamingo Hotel, Selangor, Universiti Pendidikan Sultan Idris (UPSI), Universiti Teknologi Malaysia (UTM), Universiti Kebangsaan Malaysia (UKM), dan Politeknik. Lokasi ini dipilih berdasarkan kepada kemudahan yang terdapat di sekitar kawasan tersebut. Dengan kemudahan yang sedia lengkap, proses untuk menjalankan aktiviti berdasarkan Modul Pemerkasaan Pihak Berkuasa dalam Menangani Banjir di Malaysia dapat dijalankan untuk membantu perkembangan kelompok dan setiap ahli peserta. Subjek kumpulan rawatan dapat hadir dengan mudah dan secara sukarela mengikut jadual yang telah ditetapkan.

Responden kajian ini terbahagi kepada dua peringkat iaitu kajian kesahan yang melibatkan 20 orang panel pakar penilai daripada pelbagai latar belakang dan kajian kebolehpercayaan yang melibatkan 50 orang responden yang terdiri daripada peserta yang mewakili setiap agensi masing-masing.Responden kebolehpercayaan kajian adalah terdiri daripada peseta-peserta yang melibatkanpegawai-pegawai daripada agensi-agensi pihak berkuasa seperti PDRM, ATM, JBPM, JPAM dan RELA. Jumlah responden adalah seramai 50 orang yang telah mengikuti modul pemerkasaan banjir untuk mendapatkan kebolehpercayaan terhadap modul ini. Kesemua responden yang dipilih adalah terdiri daripada pegawai di dalam agensi masing-masing yang dikategorikan sebagai demografi sederhana.

3.0 Dapatan dan Perbincangan

Objektif pertama adalah keputusan kajian kesahan kandungan berdasarkan Rusell (1974). Objektif kedua pula adalah keputusan kajian tentang nilai kesahan Modul Pemerkasaan Pihak Berkuasa dalam Menangani Banjir di Malaysia berdasarkan sesi dan aktiviti oleh Mohammad Aziz Shah (2010). Objektif ketiga pula adalah keputusan kajian tentang nilai kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia berdasarkan kepada respon yang dijalankan ke atas peserta.

3.1 Hasil Dapatan Nilai Kesahan Kandungan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia

Proses saringan awal nama-nama tokoh yang mempunyai pengetahuan yang luas dalam bidang ilmu kaunseling telah dilakukan. Berdasarkan proses saringan tersebut, beberapa orang pakar telah dikenalpasti yang dipilih sebagai panel pakar iaitu sejumlah 20 orang. Satu salinan lengkap secara terperinci perlaksanaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia telah dihantar kepada panel pakar bagi proses penilaian. Setiap panel pakar menilai dan memberi komen bagi tujuan penambahbaikan. Jadual di bawah menunjukkan hasil nilai kesahan kandungan berdasarkan penilaian bagi Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia dan setiap sub-modul yang terdapat di dalam Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia.

Jadual 3.1 Nilai Kesahan Kandungan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia Berdasarkan Penilaian Pakar Mengikut Rusell (1974) (n=20)

Pernyataan	Peratusan (%)	Pandangan Pakar
Kandungan modul ini menepati sasaran populasinya	80	Diterima
Kandungan modul ini boleh dilaksanakan dengan sempurna	80	Diterima
Kandungan modul ini bersesuaian dengan masa yang diperuntukkan	80	Diterima
Kandungan modul ini boleh memberi perubahan tingkahlaku kepada diri peserta program	80	Diterima
Kandungan modul ini boleh memberi keilmuan dan kemahiran baru tentang pengurusan banjir kepada peserta program	80	Diterima

Jadual 3.1 menunjukkan nilai kesahan kandungan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia berdasarkan penilaian pakar mengikut Rusell (1974). Nilai peratusan minimum ialah 77% bagi Strategi 10. Manakala peratusan maksimum adalah 89% bagi Strategi 1. Ini menunjukkan keseluruhan kandungan adalah tinggi bagi semua strategi yang dinilai. Justeru, berdasarkan analisis keseluruhan ini peratusan dalam semua strategi adalah melebihi 70%. Bagi peratusan minimum ialah 80% iaitu bagi pernyataan bahawa kandungan modul ini menepati sasaran populasinya, kandungan modul ini boleh dilaksanakan dengan sempurna dan kandungan modul ini bersesuaian dengan masa yang diperuntukkan.Manakala bagi peratusan maksimum ialah 83% bagi pernyataan kandungan modul ini boleh meningkatkan prestasi peserta. Secara keseluruhannya, syarat-syarat yang telah dikemukakan oleh Rusell (1974) telah dapat diikuti dengan baik oleh pengkaji. Hasil yang diperolehi juga menunjukkan bahawa modul ini mempunyai kesahan kandungan yang tinggi.

3.2 Hasil Dapatan Nilai Kesahan Kesesuaian Sesi dan Aktiviti Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia Modul Berdasarkan Mohammad Aziz Shah (2010)

Proses saringan awal nama-nama tokoh yang mempunyai pengetahuan yang luas dalam bidang psikologi dan kaunseling. Berdasarkan proses saringan tersebut, beberapa orang pakar telah dikenal pasti yang dipilih sebagai panel pakar iaitu sejumlah 20 orang. Satu salinan lengkap secara terperinci perlaksanaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia telah dihantar kepada panel pakar bagi proses penilaian. Setiap panel pakar akanmenilai dan memberi komen bagi tujuan penambahbaikan. Jadual di bawah menunjukkan hasil nilai kesahan sesi dan aktiviti berdasarkan penilaian keseluruhan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia dan strategi-strategi yang terdapat di dalam Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia mengikut Mohammad Aziz Shah (2010).

Jadual 3.2 Nilai Kesahan Kesesuaian Sesi dan Aktiviti Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia Berdasarkan Penilaian Pakar Mengikut Mohammad Aziz Shah (2010) (n=20)

Pernyataan Berkaitan Aktiviti/Sub Modul Yang Dinilai	Peratusan (%)	Pandangan Pakar
Strategi 1: Suai Kenal dan Matlamat	84	Diterima
Aktiviti 1: Suai Kenal dan Membina Jaringan	89	Diterima
Aktiviti 2: Membina Matlamat Bersama		
Aktiviti 3: Mengenali Agensi Pihak Berkuasa	79	Diterima
	86	Diterima
Strategi 2: Pengenalan Tindakan Banjir	82	Diterima
Aktiviti 1: Apa itu Bencana Banjir?	86	Diterima
Aktiviti 2: Hasil Post Mortem dan Pengalaman Agensi-agensi Menghadapi Bencana Banjir	86	Diterima
Aktiviti 3: Majlis Keselamatan Negara; Penyelarasan dan Pengendalia Bencana Banjir di Malaysia	80	Diterima
Strategi 3: Program Kesedaran dan Tindakan Persediaan Pra Banjir	83	Diterima
Aktiviti 1: Program Kesedaran dan Pengenalan Persediaan Pra Banjir	80	Diterima
Aktiviti 2: Penyelarasan MKN; Tugas Khusus Agensi Bertindak Persediaan Pra Banjir	80	Diterima
Aktiviti 3: Persediaan Umum Terhadap Risiko dan Isu-isu Tindakan Awal serta Panduan Penyelesaian	82	Diterima
Strategi 4: Bengkel Tindakan Persediaan Pra Banjir	82	Diterima
Aktiviti 1: Bengkel Tugas-tugas Khusus dan Risiko Dalam Persediaan Pra Banjir		
Aktiviti 2: Bengkel Persediaan Umum Terhadap Risiko dan Isu-isu Tindakan Awal serta Panduan Penyelesaian	81	Diterima
	80	Diterima
Strategi 5: Tindakan Bersepadu Semasa Banjir	82	Diterima
Aktiviti 1: Pengenalan Tindakan Bersepadu Semasa Banjir Oleh Agensi Pihak Berkuasa dan Pihak Sokongan	82	Diterima
Aktiviti 2: Penyelarasan MKN; Tugas Khusus Agensi Bertindak Semasa Banjir	77	Diterima
Aktiviti 3: Persediaan Umum Terhadap Risiko dan Isu-isu Semasa Banjir Oleh Agensi		
Aktitvi 4: Panduan Penyelesaian Isi-isu dan Risiko Semasa Banjir Oleh Agensi Pihak Berkuasa dan Agensi Sokongan	81	Diterima
	80	Diterima
Strategi 6: Bengkel Menghadapi Bencana Banjir	85	Diterima
Aktiviti 1: PengenalanBengkel Menghadapi Bencana Banjir di Malaysia Oleh Agensi	78	Diterima
Aktiviti 2: Penyelarasan Bengkel Menghadapi Bencana Banjir di Malaysia Oleh Agensi Pihak Berkuasa dan Agensi Sokongan	80	Diterima
Aktiviti 3: Persediaan Menghadapi Bencana Banjir di Malaysia		
	82	Diterima
Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	83	Diterima
Aktiviti 1: Pengenalan Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	78	Diterima

Aktiviti 2: Bengkel Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir		
Aktiviti 3: Persediaan Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	80	Diterima
	82	Diterima
Strategi 8: Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda)	83	Diterima
Aktiviti 1: Pengenalan Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda)	81	Diterima
Aktiviti 2: Bengkel Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda)		
Aktiviti 3: Persediaan Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda)	80	Diterima
	81	Diterima
Strategi 9: Simulasi Persediaan Banjir	85	Diterima
Aktiviti 1: Pengenalan Simulasi Persediaan Banjir	82	Diterima
Aktiviti 2: Simulasi Persediaan Banjir		
Aktiviti 3: Persediaan Menghadapi Banjir	83	Diterima
	81	Diterima
Strategi 10: Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir	79	Diterima
Aktiviti 1: Pengenalan Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir	77	Diterima
Aktiviti 2: Apakah Tahap Pengurusan Banjir Dalam Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir	76	Diterima
Jumlah Keseluruhan Nilai Kesahan Kesesusaian Sesi dan Aktiviti Modul Pemerkasaan Pihak Berkuasa Dalam Tindakan Bersepadu Menghadapi Bencana Banjir Di Malaysia	81	Diterima

Jadual 3.2 di atas menunjukkan pekali kesahan kesesuaian sesi dan aktiviti Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia yang diperoleh daripada panel pakar mengikut Mohammad Aziz Shah (2010). Peratusan keseluruhan kesahan kesesuaian sesi dan aktiviti MPPBB adalah sebanyak 81%. Nilai ini adalah tinggi, boleh dipercayai dan mempunyai tekalan yang baik. Ini menunjukkan bahawa semua sesi tersebut boleh dilaksanakan di dalam modul ini.

3.3 Hasil Dapatan Kajian Secara Analisis Dokumen

Dapatan kesahan kandungan modul turut dibincangkan secara analisis dokumen. Dapatan kajian secara analisis dokumen iaitu komen penambahbaikan yang telah diberikan oleh pakar penilai. Perincian pandangan dapat dilihat menerusi jadual 4.3 di bawah. Secara keseluruhannya, pandangan yang diberikan adalah positif dan banyak membantu dalam penambahbaikan modul.

Jadual 3.3 Cadangan Penambahbaikan Kesahan Kandungan Modul

Pakar	Pandangan Penambahbaikan
Pakar 1	Kandungan modul ini adalah bersesuaian dan boleh membantu peserta dalam aspek pengurusan banjir
Pakar 2	Kandungan modul ini mempunyai isi yang kurang padat dan harus diperbaiki lagi
Pakar 3	Kandungan modul ini amat teratur dan dilaksanakan dengan baik, menepati

		sasaran dan populasinya serta bersesuaian dengan situasi banjir yang kerap berlaku
Pakar 4	1	Menepati konsep kajian yang dilakukan
	2	Menggunakan teori yang sesuai dengan konsep modul
Pakar 5		Modul yang baik dan bagus
Pakar 6		-
Pakar 7		Modul ini dilihat bersesuaian dan memerlukan kerjasama dari semua pihak untuk menjayakannya
Pakar 8		Aktiviti yang dijalankan mungkin sesuai bagi pihak berkuasa namun perlu dititikberatkan juga kepada mangsa banjir
Pakar 9	1	Modul ini mungkin dapat diperhalusi lagi pada masa akan datang
	2	Modul ini memberikan panduan yang jelas untuk tugas serta tanggungjawab agensi yang terlibat
Pakar 10		Baik dan memuaskan
Pakar 11		-
Pakar 12		Keseluruhan adalah baik
Pakar 13		Modul ini sangat baik dan perlu sedikit penambahbaikkan
Pakar 14		-
Pakar 15		-
Pakar 16		Kandungan modul ringkas dan padat serta diharap dapat memberikan manfaat untuk pengurusan banjir di Malaysia
Pakar 17		Modul ini baik dan sesuai digunakan oleh semua pihak terlibat
Pakar 18		Kumpulan sasaran mestilah tepat dengan aktiviti
Pakar 19		-
Pakar 20		Taklimat kepada fasilitator adalah sangat penting kerana keberkesanan modul bergantung kepada mereka

3.4 Hasil Dapatan Nilai Kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia

Bahagian ini mengemukakan dapatan kajian kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia. Sidek (2005) menjelaskan bahawa terdapat dua kaedah untuk menguji kebolehpercayaan sesuatu modul iaitu melalui langkah-langkah dalam setiap aktiviti atau melalui objektif di dalam sesuatu modul. Oleh yang demikian, Sidek dan Jamaludin (2005) merumuskan, untuk menguji nilai pekali kebolehpercayaan sesuatu modul, kaedah mencipta soal selidik atau item-item soalan berdasarkan langkah- langkah aktiviti modul ataupun berdasarkan kepada objektif-objektif modul tersebut adalah merupakan cara terbaik. Dalam kajian ini, pengkaji telah menghasilkan satu soal selidik yang dapat menguji tahap kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia berdasarkan sepuluh strategi iaitu; Strategi 1: Suai Kenal dan Matlamat, Strategi 2:

Pengenalan Tindakan Banjir, Strategi 3: Program Kesedaran dan Tindakan Persediaan Pra Banjir, Strategi 4: Bengkel Tindakan Persediaan Pra Banjir, Strategi 5: Tindakan Bersepadu Semasa Banjir, Strategi 6: Bengkel Menghadapi Bencana Banjir, Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir, Strategi 8: Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda), Strategi 9: Simulasi Persediaan Banjir dan Strategi 10: Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir.

Bagi mendapatkan nilai kebolehpercayaan, soal selidik mengikut pecahan sub modul telah dibina bagi mendapatkan keputusan kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia. Nilai kebolehpercayaan yang diperoleh melalui kaedah ini juga dikenali sebagai nilai kebolehpercayaan *Alpha Cronbach* (Sidek, 2005). Sehubungan dengan itu, pengkaji telah membina soal selidik kebolehpercayaan mengikut pecahan sub-modul berdasarkan sejauh mana ahli kelompok mampu mengikuti aktiviti modul tersebut untuk mendapatkan nilai kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia ini. Hal ini kerana setiap langkah-langkah dalam aktiviti modul ini akan menentukan responden telah menguasai objektif modul tersebut. Soal selidik tersebut mengandungi 87 item soalan dan ditadbir ke atas 50 orang responden yang telah mengikuti modul selama dua hari berturut-turut. Dengan kebolehpercayaan modul dianalisis dengan berbantukan program *Statistical Packages for Social Sciences* (SPSS) versi 20.0 yang menggunakan nilai kebolehpercayaan

Alpha Cronbach. Dapatan kajian ditunjukkan pada jadual berikut:

Jadual 3.4 Nilai kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia: (n=50)

Modul	Nilai *Cronbach Alpha* (α)
Modul Pemerkasaan Pihak Berkuasa dalam Menangani Banjir di Malaysia	0.951

Aras Signifikan 0.5

Berdasarkan jadual 3.4 di atas, keputusan yang diperoleh melalui soal selidik yang telah dijalankan menunjukkan bahawa pekali kebolehpercayaan Alpha Cronbach bagi Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia adalah tinggi iaitu sebanyak 0.951. Mohd Majid (1990) menegaskan bahawa nilai Alpha Cronbach seharusnya melebihi 0.7, tetapi nilai 0.6 juga dikira baik dan masih boleh diterima pada aras signifikan 0.5. maka, ini membuktikan bahawa modul ini boleh digunakan di lapangan sebenar.

Jadual 3.5 Pekali Kebolehpercayaan sesi dan aktiviti Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia (n=50)

Aktiviti/Pengisian			Nilai Kebolehpercayaan *(Cronbach alpha)*	keputusan
Strategi 1	:	Suai Kenal dan Matlamat	0.951	Tinggi
Aktiviti 1	:	Suai Kenal dan Membina Jaringan	0.915	Tinggi
Aktiviti 2	:	Membina Matlamat Bersama	0.849	Tinggi
Aktiviti 3	:	Mengenali Agensi Pihak Berkuasa	0.883	Tinggi
Strategi 2	:	Pengenalan Tindakan Banjir	0.959	Tinggi
Aktiviti 1	:	Apa Itu Bencana Banjir	0.884	Tinggi
Aktiviti 2	:	Hasil Post Mortem dan Pengalaman Agensi-Agensi Menghadapi Bencana Banjir	0.929	Tinggi
Aktiviti 3	:	Majlis Keselamatan Negara; Penyelarasan dan Pengendalian Bencana Banjir di Malaysia	0.865	Tinggi
Strategi 3	:	Program Kesedaran dan Tindakan Persediaan Pra Banjir	0.956	Tinggi
Aktiviti 1	:	Program Kesedaran dan Pengenalan Persediaan Pra Banjir	0.887	Tinggi
Aktiviti 2	:	Penyelarasan MKN;Tugas Khusus Agensi Bertindak Persediaan Pra Banjir	0.863	Tinggi
Aktiviti 3	:	Persediaan Umum Terhadap Risiko dan Isu-isu Tindakan Awal serta Panduan Penyelesaian	0.898	Tinggi
Strategi 4	:	Bengkel Tindakan Persediaan Pra Banjir	0.936	Tinggi
Aktiviti 1	:	Bengkel Tugas-tugas Khusus dan Risiko Dalam Persediaan Banjir	0.891	Tinggi
Aktiviti 2	:	Bengkel Persediaan Umum Terhadap Risiko dan Isu-isu Tindakan Awal serta Panduan Penyelesaian	0.905	Tinggi
Strategi 5	:	Tindakan Bersepadu Semasa Banjir	0.960	Tinggi
Aktiviti 1	:	Pengenalan Tindakan Bersepadu Semasa Banjir Oleh Agensi Pihak Berkuasa dan Pihak Sokongan	0.835	Tinggi
Aktiviti 2	:	Penyelarasan MKN;Tugas Khusus Agensi Bertindak Semasa Banjir	0.917	Tinggi
Aktiviti 3	:	Persediaan Umum Terhadap Risiko	0.855	Tinggi

		Semasa Banjir Oleh Agensi		
Aktiviti 4	:	Panduan Penyelesaian Isu-isu dan Risiko Semasa Banjir Oleh Agensi Pihak Berkuasa dan Agensi Sokongan	0.918	Tinggi
Strategi 6	:	Bengkel Menghadapi Bencana Banjir	0.931	Tinggi
Aktiviti 1	:	Pengenalan Bengkel Menghadapi Bencana Banjir di Malaysia Oleh Agensi Pihak Berkuasa dan Agensi Sokongan	0.919	Tinggi
Aktiviti 2	:	Penyelarasan Bengkel Menghadapi Bencana Banjir di Malaysia Oleh Agensi Pihak Berkuasa dan Agensi Sokongan	0.902	Tinggi
Aktiviti 3	:	Persediaan Menghadapi Bencana Banjir di Malaysia	0.936	Tinggi
Strategi 7	:	Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	0.961	Tinggi
Aktiviti 1	:	Pengenalan Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	0.914	Tinggi
Aktiviti 2	:	Bengkel Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	0.930	Tinggi
Aktiviti 3	:	Persediaan Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir	0.941	Tinggi
Strategi 8	:	Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan, Material (Harta Benda)	0.941	Tinggi
Aktiviti 1	:	Pengenalan Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan (Semasa dan Selepas), dan Material (Harta Benda)	0.917	Tinggi
Aktiviti 2	:	Bengkel Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan (Semasa dan Selepas), dan Material (Harta Benda)	0.905	Tinggi
Aktiviti 3	:	Persediaan Tindakan Pasca Banjir, Pembersihan, Pemulihan Psikologi, Kesihatan (Semasa dan Selepas), dan Material (Harta Benda)	0.891	Tinggi
Strategi 9	:	Simulasi Persediaan Banjir	0.960	Tinggi
Aktiviti 1	:	Pengenalan Simulasi Persediaan Banjir	0.880	Tinggi
Aktiviti 2	:	Simulasi Persediaan Banjir	0.915	Tinggi
Aktiviti 3	:	Persediaan Menghadapi Banjir	0.925	Tinggi
Strategi 10	:	Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir	0.900	Tinggi
Aktiviti 1	:	Pengenalan Standard dan Penilaian Keberkesanan Tindakan Bencana Banjir	0.900	Tinggi
Aktiviti 2	:	Apakah Tahap Pengurusan Banjir dalam Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir	0.919	Tinggi

Aras Signifikan 0.5

Jika dibuat perbandingan antara kesemua aktiviti tersebut, keputusan analisis menunjukkan bahawa nilai pekali kebolehpercayaan yang paling tinggi ialah 0.941 bagi Aktiviti 3: Persediaan Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir yang terdapat dalam Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir, diikuti dengan Aktiviti 3: Persediaan Menghadapi Bencana Banjir di Malaysia yang mencatatkan nilai pekali sebanyak 0.936. Aktiviti tersebut adalah yang terdapat dalam Strategi 6: Bengkel Menghadapi Bencana Banjir di Malaysia. Nilai pekali yang ketiga tertinggi ialah 0.930 bagi Aktiviti 2: Bengkel Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir yang terdapat pada Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir.

Manakala pekali yang paling rendah ialah 0.835 untuk Aktiviti 1: Pengenalan Tindakan Bersepadu Semasa Banjir Oleh Agensi Pihak Berkuasa dan Agensi Sokongan yang terdapat pada Strategi 5: Tindakan Bersepadu Semasa Banjir dan diikuti oleh Aktiviti 2: Membina Matlamat Bersama yang terdapat pada Strategi 1: Suai Kenal dan Matlamat yang mempunyai pekali sebanyak 0.849. Secara ringkasnya, kedua-dua aktiviti ini mempunyai nilai kebolehpercayaan yang masih tinggi dan tidak kurang daripada 0.60.Hal ini menunjukkan bahawa kedua-dua aktiviti ini mempunyai tahap konsitensi yang agak baik.Namun begitu, kedua-dua aktiviti ini masih dapat diperbaiki dan diperkemaskan lagi dari aspek kebolehpercayaannya.

Kajian ini menggunakan reka bentuk kajian kuantitatif untuk mendapatkan pekali kesahan dan kebolehpercayaan modul. Peringkat pertama, kajian kepustakaan digunakan dalam pembinaan modul. Peringkat kedua, modul yang telah dibina diberikan kepada pakar yang dilantik untuk dinilai dari segi kesahan kandungan modul dan kesahan sesi dan aktiviti yang dijalankan di dalam modul tersebut. Seterusnya, modul ini diedarkan kepada peserta-peserta untuk mendapatkan hasil pekali kebolehpercayaan modul tersebut.

3.5 Kesahan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) Dalam Menangani Banjir Di Malaysia

Kesahan Kandungan Modul Mengikut Rusell (1974)

Kesahan kandungan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir Di Malaysia telah dinilai oleh sepuluh orang pakar penilai yang telah dipilih berdasarkan kepada kepakaran dalam bidang bimbingan, kaunseling dan agensi kerajaan yang berpengalaman dalam menghadapi bencana banjir. Pekali kesahan yang diperoleh daripada panel pakar adalah 0.961 manakala pekali kesahan kesesuaian sesi dan aktiviti Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia ialah 0.941. Selain itu, dapatan juga menunjukkan bahawa kesemua panel pakar memberi beberapa cadangan penambahbaikan secara bertulis bagi menambahbaik modul yang sedia ada.

Kesahan Kesesuaian Sesi dan Aktiviti Mengikut Mohammad Aziz Shah (2010)

Selain itu, nilai kesahan kesesuaian sesi dan aktiviti mengikut Mohammad Aziz Shah (2010) juga menunjukkan nilai yang tinggi iaitu melebihi 70%. Nilai kesahan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia adalah sebanyak 84% yang mana menunjukkan peratusan minimum ialah 77%. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti adalah tinggi bagi semua strategi yang dinilai. Nilai kesahan bagi Strategi 1: Suai Kenal dan Matlamat adalah sebanyak 83.8% bagi 3 aktiviti yang mana menunjukkan peratusan minimum ialah 79% iaitu bagi Aktiviti 2: Membina Matlamat Bersama. Manakala peratusan maksimum ialah 89% iaitu bagi Aktiviti 1: Suai Kenal dan Membina Jaringan. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur.

Nilai kesahan bagi Strategi 2: Pengenalan Tindakan Banjir adalah sebanyak 81.7% bagi 3 aktiviti yang mana menunjukkan peratusan minimum ialah 80% bagi Aktiviti 3: Majlis Keselamatan Negara; Penyelarasan dan pengendalian bencana banjir di Malaysia. Manakala peratusan maksimum ialah 88% bagi Aktiviti 1: Apa Itu Banjir? Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur. Nilai kesahan bagi Strategi 3: Program Kesedaran dan Tindakan Persediaan Pra Banjir adalah sebanyak 83.4% bagi 3 aktiviti yang mana menunjukkan peratusan minimum ialah 80% bagi Aktiviti 2: Penyelarasan Majlis Keselamatan Negara; Tugas Khusus Agensi Bertindak Persediaan Pra Banjir. Manakala peratusan maksimum ialah 82% bagi Aktiviti 3: Persediaan Umum Terhadap Risiko Dan Isu-Isu Tindakan Awal Serta Panduan Penyelesaian. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur.

Nilai kesahan bagi Strategi 4: Bengkel Tindakan Persediaan Pra Banjir adalah sebanyak 82% bagi 2 aktiviti yang mana menunjukkan peratusan minimum 80% bagi Aktiviti 2: Bengkel Persediaan Umum Terhadap Risiko Dan Isu-Isu Tindakan Awal Serta Panduan Penyelesaian. Manakala peratusan maksimum ialah 81% bagi Aktiviti 1: Bengkel Tugas-Tugas Khusus Dan Risiko Dalam Persediaan Pra Banjir. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur. Nilai kesahan bagi Strategi 5: Tindakan Bersepadu Semasa Banjir adalah sebanyak 82% bagi 4 aktiviti yang mana menunjukkan peratusan minimum 77% bagi Aktiviti 2: Penyelarasan Majlis Keselamatan Negara: Tugas Khusus Agensi Bertindak Semasa

Banjir. Manakala peratusan maksimum ialah 82% bagi Aktiviti 1: Pengenalan Tindakan Bersepadu Semasa Banjir Oleh Agensi Pihak Berkuasa Dan Pihak Sokongan. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur.

Nilai kesahan bagi Strategi 6: Bengkel Menghadapi Bencana Banjir di Malaysia adalah sebanyak 85% bagi 3 aktiviti yang mana menunjukkan peratusan minimum sebanyak 78% bagi Aktiviti 3: Persediaan Menghadapi Bencana Banjir di Malaysia. Manakala peratusan maksimum sebanyak 82% bagi Aktiviti 1: Pengenalan Menghadapi Bencana Banjir di Malaysia. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur. Nilai kesahan bagi Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir adalah sebanyak 83% bagi 3 aktiviti yang mana menunjukkan peratusan minimum sebanyak 78% bagi Aktiviti 1: Pengenalan Tindakan Pasca Banjir: Kebajikan Pemantauan Mangsa Banjir. Manakala peratusan maksimum sebanyak 82% bagi Aktiviti 3: Persediaan Tindakan Pasca Banjir: Kebajikan Pemantauan Mangsa Banjir. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur.

Nilai kesahan bagi Strategi 8: Tindakan Pasca Banjir: Pembersihan, Pemulihan, Psikologi, Kesihatan (Semasa dan Selepas) dan Material (Harta Benda) adalah sebanyak 83% bagi 3 aktiviti yang mana menunjukkan peratusan minimum sebanyak 80% bagi Aktiviti 2: Manakala peratusan maksimum sebanyak 82% bagi Aktiviti 3: Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur. Nilai kesahan bagi Strategi 9: Simulasi Persediaan Banjir adalah sebanyak 85% bagi 3 aktiviti yang mana menunjukkan peratusan minimum sebanyak 81% bagi Aktiviti 3: Persediaan Menghadapi Banjir. Manakala peratusan maksimum sebanyak 83% bagi Aktiviti 2: Simulasi Persediaan Banjir. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur.

Nilai kesahan bagi Strategi 10: Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir adalah sebanyak 79% bagi 2 aktiviti yang mana menunjukkan peratusan minimum sebanyak 76% bagi Aktiviti 1: Pengenalan Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir. Manakala peratusan maksimum sebanyak 77% bagi Aktiviti 2: Apakah Tahap Pengurusan Banjir Dalam Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir. Ini menunjukkan nilai kesahan kesesuaian sesi dan aktiviti mempunyai nilai ketekalan yang kuat iaitu dapat mengukur apa yang sepatutnya diukur. Berdasarkan analisis keseluruhan nilai peratusan dalam semua strategi-strategi adalah melebihi 70%. Dapatan kajian ini menunjukkan bahawa kaedah penentuan kesahan kesesuaian sesi dan aktiviti oleh Mohammad Aziz Shah (2010) adalah sesuai dan boleh dilaksanakan. Dapatan ini juga membuktikan bahawa modul ini mempunyai kesahan yang tinggi. Selain itu, penilaian panel pakar juga diambil melalui kaedah analisis dokumen. Dapatan juga menunjukkan bahawa kesemua panel pakar memberi beberapa cadangan penambahbaikan secara bertulis bagi menambahbaik modul yang sedia ada.

3.6 Perbincangan Kebolehpercayaan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM,JBPM, JPAM dan RELA) dalam Menangani Banjir Di Malaysia

Nilai kebolehpercayaan bagi Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir Di Malaysia dan strategi Modul Pemerkasaan Pihak Berkuasa dalam Menangani Banjir Di Malaysia keseluruhannya menunjukkan nilai yang tinggi iaitu melebihi .70. Mohd Majid (1990) menegaskan bahawa nilai Alpha Cronbach seharusnya melebihi 0.7, tetapi nilai 0.6 juga dikira baik dan masih boleh diterima pada aras signifikan 0.5. Maka, ini membuktikan bahawa modul ini boleh digunakan di lapangan sebenar. Nilai kebolehpercayaan bagi Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir Di Malaysia adalah tinggi iaitu .857 yang mana menunjukkan nilai kebolehpercayaan Alpha Cronbach (α) yang tertinggi adalah sebanyak .961 bagi Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir. Manakala, yang terendah ialah .931 bagi Strategi 6: Bengkel Menghadapi Bencana Banjir di Malaysia. Ini membuktikan bahawa modul ini boleh digunakan di lapangan sebenar.

Nilai kebolehpercayaan bagi Strategi 1: Suai Kenal dan Matlamat adalah tinggi iaitu .951 yang mana menunjukkan nilai Alpha Cronbach (α) yang yang tertinggi ialah sebanyak .915 bagi Aktiviti 1: Suai Kenal dan Membina Jaringan. Manakala nilai Alpha Cronbach (α) terendah ialah sebanyak .849 bagi Aktiviti 2: Membina Matlamat Bersama. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar. Nilai kebolehpercayaan bagi Startegi 2: Pengenalan Tindakan Banjir adalah tinggi iaitu .959

yang mana menunjukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .929 bagi Aktiviti 2: Hasil Post Mortem Dan Pengalaman Agensi-Agensi Menghadapi Bencana Banjir. Manakala nilai Alpha Cronbach (α) yang terendah .865 bagi Aktiviti 3: Majlis Keselamatan Negara; Penyelarasan Dan Pengendalian Bencana Banjir Di Malaysia. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar.

Nilai kebolehpercayaan bagi Strategi 3: Program Kesedaran dan Tindakan Persediaan Pra Banjir adalah tinggi iaitu .956 yang mana menunjukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .898 bagi Aktiviti 3: Persediaan Umum Terhadap Risiko dan Isu-Isu Tindakan Awal serta Panduan Penyelesaian. Manakala nilai Alpha Cronbach (α) yang terendah .863 bagi Aktiviti 2: Penyelarasan MKN; Tugas Khusus Agensi Bertindak Persediaan Pra Banjir. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar. Nilai kebolehpercayaan bagi Strategi 4: Bengkel Tindakan Persediaan Pra Banjir adalah tinggi iaitu .936 yang mana menunjukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .905 bagi Aktiviti 2: Bengkel Persediaan Umum Terhadap Risiko dan Isu-Isu Tindakan Awal serta Panduan Penyelesaian. Manakala nilai Alpha Cronbach (α) yang terendah iaitu .891 bagi Aktiviti 1: Bengkel Tugas-Tugas Khusus dan Risiko Dalam Persediaan Pra Banjir. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar.

Nilai kebolehpercayaan bagi Strategi 5: Tindakan Bersepadu Semasa Banjir adalah tinggi iaitu .960 yang mana menunjukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .918 bagi Aktiviti 4: Panduan Penyelesaian Isu-Isu dan Risiko Semasa Banjir Oleh Agensi Pihak Berkuasa dan Agensi Sokongan. Manakala nilai Alpha Cronbach (α) yang terendah iaitu .855 bagi Aktiviti 3: Persediaan Umum Terhadap Risiko dan Isu-Isu Semasa Banjir Oleh Agensi. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar. Nilai kebolehpercayaan bagi Strategi 6: Bengkel Menghadapi Bencana Banjir di Malaysia adalah tinggi iaitu .931 yang mana menunjukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .936 bagi Aktiviti 3: Persediaan Menghadapi Bencana Banjir di Malaysia. Manakala nilai Alpha Cronbach (α) yang terendah iaitu .919 bagi Aktiviti 1: Pengenalan Menghadapi Bencana Banjir di Malaysia. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar.

Nilai kebolehpercayaan bagi Strategi 7: Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir adalah tinggi iaitu .961 yang mana menunjukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .941 bagi Aktiviti 3: Persediaan Tindakan Pasca Banjir: Kebajikan Pemantauan Mangsa Banjir. Manakala nilai Alpha Cronbach (α) yang terendah iaitu .914 bagi Aktiviti 1: Pengenalan Tindakan Pasca Banjir; Kebajikan Pemantauan Mangsa Banjir. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar. Nilai kebolehpercayaan bagi Strategi 8: Tindakan Pasca Banjir; Pembersihan, Pemulihan, Psikologi, Kesihatan(Semasa dan Selepas) dan Material (Harta Benda) adalah tinggi iaitu .941 yang mana menujukkan nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .917 bagi Aktiviti 1: Pengenalan Tindakan Pasca Banjir, Pembersihan, Pemulihan, Psikologi, Kesihatan (Semasa & Selepas) Material (Harta Benda). Manakala nilai Alpha Cronbach yang terendah iaitu .891 bagi Aktiviti 3: Persediaan Tindakan Pasca Banjir, Pembersihan, Pemulihan, Psikologi, Kesihatan (Semasa & Selepas) Material (Harta Benda). Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar.

Nilai kebolehpercayaan bagi Strategi 9: Simulasi Persediaan Banjir adalah tinggi iaitu .960 yang mana nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .925 bagi Aktiviti 3: Persediaan Menghadapi Banjir. Manakala nilai Alpha Cronbach (α) yang terendah ialah .880 bagi Aktiviti 1: Pengenalan Simulasi Persediaan Banjir. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar. Nilai kebolehpercayaan bagi Strategi 10: Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir yang mana nilai Alpha Cronbach (α) yang tertinggi ialah sebanyak .919 bagi Aktiviti 2: Apakah Tahap Pengurusan Banjir Dalam Standard Pemantauan Dan Penilaian Keberkesanan Tindakan Bencana Banjir. Manakala nilai Alpha Cronbach (α) yang terendah ialah .900 bagi Aktiviti 1: Pengenalan Standard Pemantauan dan Penilaian Keberkesanan Tindakan Bencana Banjir. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar.

Analisis keseluruhan nilai kebolehpercayaan dalam semua strategi adalah melebihi 0.7. Ini membuktikan bahawa strategi ini boleh digunakan di lapangan sebenar. Berdasarkan dapatan kajian yang telah diperolehi, perbincangan dan implikasi kajian, maka terdapat beberapa cadangan yang dikemukakan. Disebabkan nilai kesahan Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia adalah tinggi, maka dicadangkan agar modul ini dijalankan kepada kaunselor dalam pelbagai bidang kerajaan atau pun swasta untuk menguji kebolepercayaaan. Selain itu ia boleh juga diuji kepada agensi bukan kerajaan.

Dicadangkan agar para penyelidik dan pembina modul yang baru menggunakan kaedah ini dalam menentukan kesahan dan kebolehpercayaan selain daripada menggunakan kaedah yang selalu digunakan iaitu mendapatkan pandangan dan penilaian daripada pakar. Bagi mendapatkan pandangan pakar dalam menentukan kesahan sesuatu modul, dicadangkan agar para penyelidik dan pembina modul yang baru menggunakan item-item kesahan kandungan dan kebolehpercayaan modul yang telah digunakan dalam kajian ini. Penyelidik juga mencadangkan kepada bakal penyelidik yang akan datang supaya menggunakan modul kesahan dan kebolehpercayaan yang sama sebagaimana yang digunakan dalam mengkaji kesahan dan kebolehpercayaan modul ini sekiranya ingin menentukan suatu kesahan dan kebolehpercayaan bagi sesuatu. Hal ini demikian kerana penyelidik berpendapat hasil daripada pengalaman dan pemerhatian yang diperolehi sepanjang kajian yang dijalankan menunjukkan bahawa kaedah modul ini berkesan.

Bagi memantapkan lagi hasil dapatan kajian untuk mendapatkan kesahan dan kebolehpercayaan yang baik dan benar-benar berkualiti, penyelidik menyarankan kepada penyelidik yang seterusnya untuk memilih panel pakar yang benar-benar mempunyai kepakaran yang tinggi dan mempunyai kredibiliti yang baik dalam bidang yang berkaitan dengan kajian. Selain itu, latar belakang pendidikan panel pakar penilai serta kronologi pencapaian panel pakar juga harus dititikberatkan. Hal ini mampu memberikan impak yang lebih berkualiti bagi nilai kesahan dan kebolehpercayaan yang bakal diperolehi oleh penyelidik. Selain itu, nilai keseluruhan peratus kesahan pakar yang tinggi hasil daripada kajian yang dijalankan oleh penyelidik membuktikan bahawa modul ini mempunyai tahap kesahan dan kebolehpercayaan yang tinggi sekaligus menjadi suatu sandaran yang kukuh untuk digunakan sebagai hujah untuk mempertahankan kesahan kandungan dan kebolehpercayaan ini kelak ketika diadaptasikan.

Penyelidik amat menggalakkan golongan pendidik terutamanya kaunselor dan pegawai psikologi tanpa mengira jenis organisasi untuk mengambil inisiatif melalui modul ini. Selain itu, penyelidik juga amat menggalakkan golongan profesional lain meliputi pegawai kerajaan dan swasta serta pegawai tinggi kerajaan dan swasta untuk melalui modul ini memandangkan faedah yang mampu diraih daripada modul ini benar-benar dapat membantu golongan ini dalam meningkatkan kelancaran dan kualiti kerja yang dilakukan.

4.0 Kesimpulan

Secara keseluruhannya, pengkaji telah membincangkan berkaitan beberapa perkara seperti rumusan kajian, perbincangan, implikasi kajian, dan cadangan kajian pada masa akan datang. Setelah meneliti daripada bab 1 hingga terakhir ini, pengkaji dapat menyatakan bahawa Modul Pemerkasaan Pihak Berkuasa (PDRM, ATM, JBPM, JPAM dan RELA) dalam Menangani Banjir di Malaysia adalah satu platform yang berkesan dalam membantu mengatasi pelbagai masalah kehidupan.

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SOCIO ECONOMIC WELL-BEING: A FRAMEWORK FOR ECONOMIC RECOVERY PLAN THROUGH INCOME GENERATING ACTIVITIES

Project Information

Project Leader	: Rohani Binti Mohd (Dr)
University	: University Teknologi MARA (UiTM)
Address	: Shah Alam, 40450, Selangor
Email	: intan@salam.uitm.edu.my
Project Members	: Nordin Bin Abu Bakar (Dr) Salwana Binti Hassan (Dr)

1.0 Introduction

The massive flood that hit Kelantan in 2014 has severely changed the socio-economic landscape of the affected community. The quality of life after the flood has changed for the Gua Musang residents, for example, due to the severity of the flood. It has changed for the worst. In order to help the community back on its feet, the loss must be analysed, empirically or qualitatively, and its socio economic well-being must be evaluated. The information, so far, is not available for more effective relief plan. The helps that have been handed out by many organizations may be effective in a short term but once the supply runs out they would be in need again. A comprehensive plan to recover the whole community from the disaster must be laid out as a long term aid to help them regain a normal quality of life. The standard of living that they used to have before the flood came. This recovery plan would also help the local authority as well as the government agencies to execute their disaster recovery plan effectively. If this study is not carried out, the needs and plans would be based on shallow outlook that may not be accurate to guarantee a positive outcome. Therefore, *the purpose of this research is to develop a framework for economic recovery plan through income generating activities*. The research questions would be: how can the quality of life of flood victims be improved? and how a socio-economic recovery plan can best be presented? Previous research on recovery plan for disasters focused more on short term recovery plan by government and non-profit organizations. The recovery plans were mostly identified to be focusing on how to improve the disaster impact area, temporarily stabilize the disaster conditions, improve the physical aspects and provide social and emotional support. In addition, researches in this area can be classified into two: 1) types of disasters and its impact to the quality of life of the victims; 2) recovery coping strategies which further be divided into temporary strategies, sustainable livelihood strategies and success strategies. Since this research focuses on economic recovery plan for the flood victims, the output will be a framework on long term recovery plan which include the formation process and the implementation of the economic activities.

2.0 Methodology

This research used qualitative method in assessing the needs and aids provided whereas the profile of the samples was acquired and analyzed empirically. For the purpose of this research, data has been gathered from 180 flood victims using convenient sampling methods: 150 from Kuala Krai and 30 from Gua Musang. For this reason, the victims were asked 17 questions on their perception of the types of aids that were impactful and still needed even after the flood. For a better result, Rasch analysis has been employed. Rasch analysis was employed because the different levels of perceptions on the impact of aids provided can be shown on a ruler produced from Rasch Analysis. Thus, which aids were more impactful can be identified easily. Therefore, the economic recovery coping strategies can be developed based on the needs-aids assessment.

3.0 Results and Discussion

3.1 Rasch Analysis

In order to answer those research questions, the needs-aids assessment should be determined first, so that the area of improvement can be identified and strategies can be developed. For this reason, the main output of rasch, a ruler measuring the need-aids impact level, was produced. Figure 1 shows the impact of each aids provided to the victims and its degree of importance. The ruler is meant to help identify the importance of each aids provided, its impact and its effective distribution to the victims. The needs-aids analysis shown in Figure 1 was summarized in Table 1. This is to provide a clear picture of miss-matched between what was needed with what was provided.

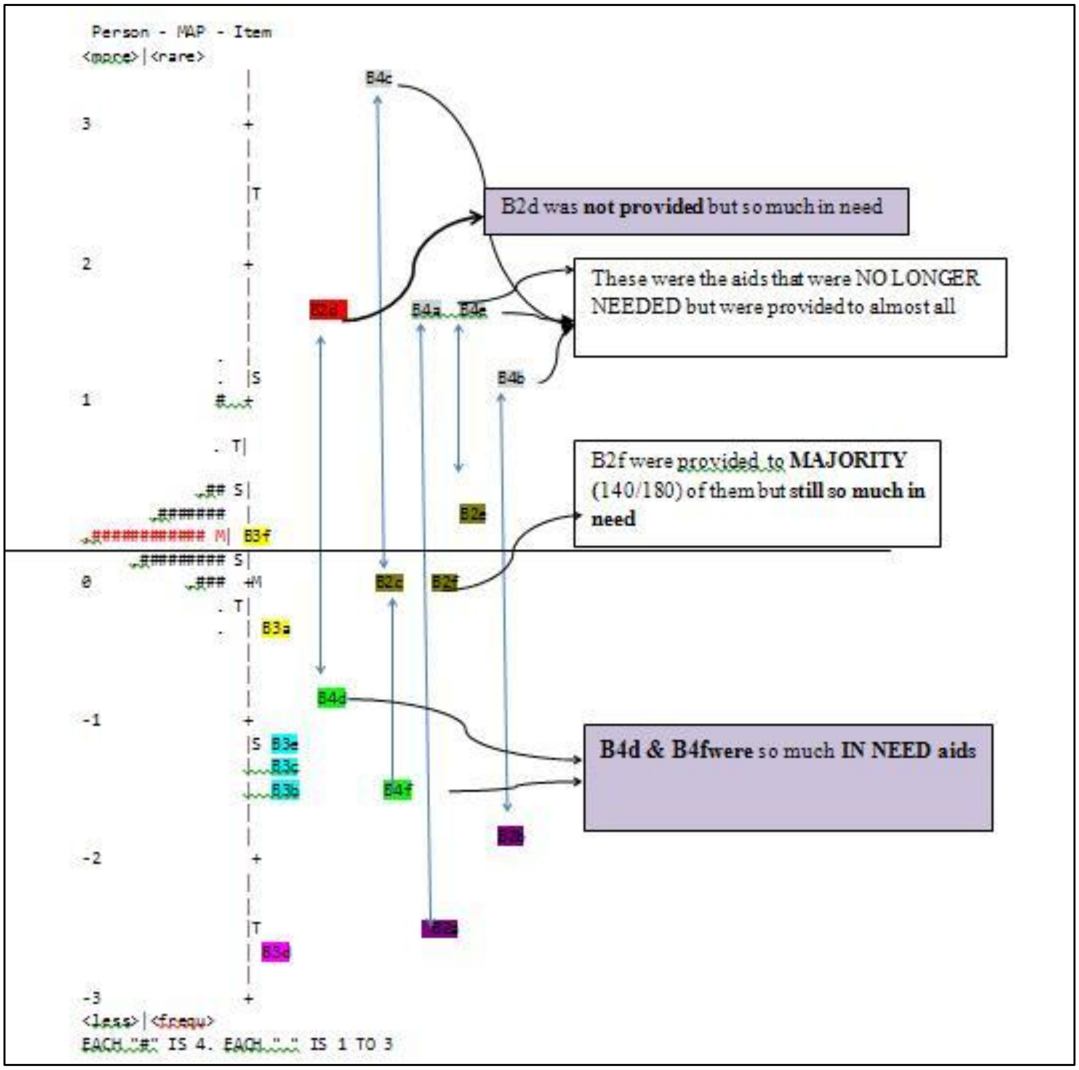

Figure 1: Person Item Map (A Ruler Of Effective Distribution Of Aids)

With reference to Figure 1, a ruler divides persons and items side by side. On the left side, the persons (respondents) represented by the symbol "#", while items (needs and aids) were placed on the right side. Items that are located above persons (#) were items that were not agreed/accepted by the person. The higher the item located against person, the higher the disagreement. On the opposite, items located below # were agreed or accepted by persons (respondents). Therefore, the lower the items located below #, the higher the level of agreement or acceptance. Items located at par with # indicating the decision on was indecisive. Item B2 and B4 represent the perception of the level of importance of the needs and aids to the respondents. B4 refers to the respondents' need for the aids, while B2 refers to the aids provided to them. B3 refers to the victims' perception on the impact of each aids to their life. The interpretation of the results is tabulated in Table 1.

Table 1: Item/Need-Aids analysis: Types of aids provided, its impact and its degree of importance

TYPES OF AIDS	IMPACT PERCIEVED	DEGREE OF IMPORTANCE	COVERAGE OF AIDS
a (basic needs) & f (financial aids)	Perceived short term impact	***a*** was Not more needed but ***f*** is still needed	Given to all

e (school aids), c (temporary house), b (kitchen utensils and stove)	Perceived moderate impact	not more needed	***b*** was given to all but ***c***&***e*** to some of them depending on their requirement
d (permanent house)	Perceived long term impact	So much in need	Was not given to all of them

4.0 Discussion and implication

From the need-aids analysis shown in Table 1, their quality of life was perceived to be improved temporarily mainly due to school aids, temporary houses, and kitchen utensils. This improvement is due to the fact that these items were perceived as having moderate impact. These aids were provided to all but it was no longer needed. This shows that these aids were important and effective but they were poorly allocated and distributed. This requires a good coordination between the head of villagers who monitors the villagers and the agencies that were involved in providing and distributing the aids. Item ***f*** which refers to financial aid ,even though was perceived as short term, was still in need. Financial aids will always be perceived as important but it was less effective because it was used unwisely to satisfy their needs in short term. This aid was much needed after the disaster to help them to start a new life. Since the impact of this aid is short term in nature, government should provide financial aids with some conditions so that its impact becomes long term. For this reason, the money should be provided for a small business start-up purposes. To whom and how much the aids are to be provided should depend on types of available resources (their skills, knowledge and property). In general, the aids provided were considered effective. The field observation conducted by the researchers showed thatmost victims under study were in better quality of life after the flood. For school aids and temporary houses, the aids were given to those in the state of a total lost only. School aids and temporary house were given only to some families due to 2 valid reasons: 1) family with no school children; 2) family whose house was still in good condition (not badly damage). However, the way aids were distributed were not efficient. From the observation and interview, some aids were given more to some families and less to some others. Some families received more than what they need. There should be a good system of distribution. The coordinator should identify the number of families in a village, and the list of names with the family head should be given to the distributor and coordinator.

With the strength of Gua Musang for its strategic location of its main road that connects Kota Bharu and Kuala Lumpur, the opportunity to be busy business centre is potentially higher. The new housing area in the middle of the town is also good market opportunity. With these strengths the community would have no problems to get the demand for the product sold. Based on these analyses, a business enterprise using an *umbrella business concept* which is proposed based on the SWOT analysis taking into consideration the attitudes of the villagers, the commitment for the businesses by each member in a project and the coordination activity. The umbrella business concept would protect the villagers from business failure as well as the fund provider from bogus borrowers. The potential businesses are agricultural-based as the land are plenty and the villagers already have the necessary skills. All economic activities will be registered under a cooperative enterprise. Each family in the community will be the members of the cooperative. This is because each family must run a micro business in which the capital (in the form of equipment and materials) is funded by the government and NGOs. These pooled financial resources will be given to those committed family which are identified through an interview and rigorous selection process. The business will be monitored by the collaborative efforts of newly developed special tasks teams that should come from any government agency that provide business advice and support. The framework of the strategies are as displayed in Figure 2.

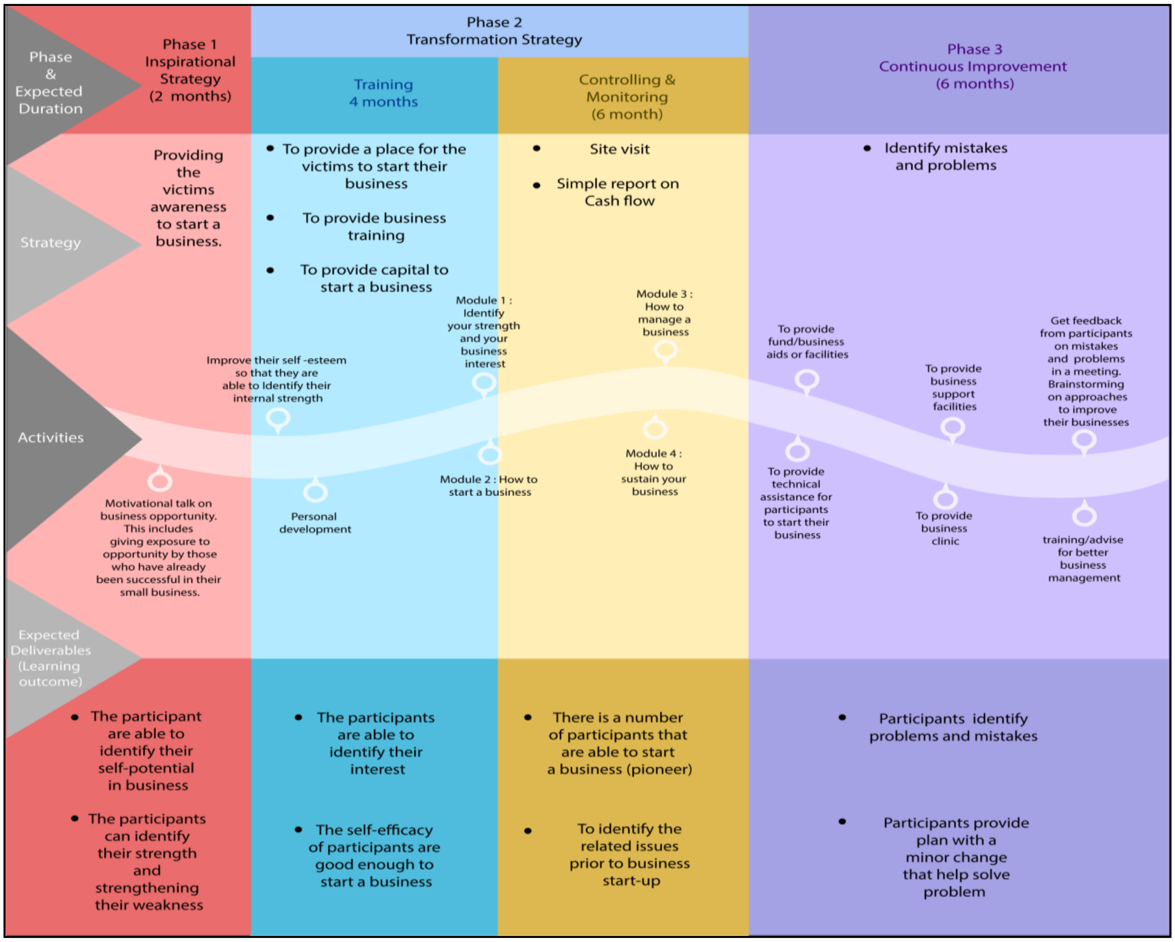

Figure 2: A framework for economic recovery plan through income generating activities

5.0 Conclusion

The victims were generally poor even before the disaster. The disaster has made their quality of life even worst. With the lack of ability and capability, their situation become even worst. Therefore, this victims should be assisted to develop their life after the flood. For the time being, the victims are still depending on government for their shelter and basic needs. This does not help them to improve. Therefore, the proposed economic recovery plan not only can help them to recover from flood but to assist them to develop their internal capabilities and survival. Since this research focuses on the economic recovery plan, the long term reconstruction impact can be gained through several activities. The most impactful yet manageable are business and economic development activities; and these sustainable developments would help the victims to regain or improve their quality of life.

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KEPERLUAN KIT/MODUL INTERVENSI TINDAK BALAS PSIKOLOGIKAL SERTA MERTA DAN SEPARUH PENGGAL (MID-TERM) PASCA BANJIR TERHADAP MANGSA BANJIR DI NEGERI SABAH DAN SARAWAK

Maklumat Projek

Ketua Projek	: Dr. Ferlis Bullare @ Hj. Bahari
Universiti	: Universiti Malaysia Sabah
Alamat	: Jalan UMS, 88400 Kota Kinabalu, Sabah.
No. Telefon	: 088-320 000 Ext: 8104/8105/8979
Email	: ferlis27@yahoo.com
Ahli Projek	: Prof. Dr. Rosnah Ismail, Prof. Madya Dr. Dahlan A. Malek, Jasmine Adela Mutang, Dr. Lailawati Madlan @ Endalan, Dr. Wan Anor Wan Sulaiman

1.0 Pengenalan

Kejadian banjir merupakan satu bencana alam yang boleh menyebabkan kesan buruk yang bersifat berpanjangan seperti gangguan stres yang melampau, trauma yang berpanjangan atau disebut sebagai Post Traumatic Stress Disorder (PTSD), kemurungan, kebimbangan untuk berpisah, ketakutan terhadap insiden yang spesifik, fobia dan gangguan tidur (Balaban *et al*., 2005). Gersons dan Olff (2005) menyatakan sehingga kini tiada kata sepakat yang dicapai yang menunjukkan bahawa terdapat intervensi yang berkesan untuk digunakan serta merta dalam keadaan trauma pasca dan pertengahan banjir. Di Malaysia, belum ada lagi modul intervensi yang memberi fokus kepada tindak balas serta merta dan separuh penggal pasca banjir dalam kalangan mangsa banjir yang terselamat walhal tempoh tersebut merupakan tempoh kritikal dan perlu diberi perhatian sebelum keadaan psikologi mangsa banjir akan alami distres yang teruk di fasa PTSD. Objektif umum kajian ini adalah untuk membentuk Kit/Modul Intervensi Psikologikal Tindak Balas Serta Merta dan Separuh Penggal dalam kalangan mangsa pasca banjir.

2.0 Metodologi

Kajian ini menggunakan reka bentuk *exploratory sequential design*, iaitu dimulakan dengan Fasa 1: Kajian kualitatif, disusuli dengan Fasa Interim: Proses pembentukan Modul PsikoSpiritual-Mangsa Banjir (MPS-MB) dan Fasa 2: Menguji kesahan kandungan Modul PsikoSpiritual-Mangsa Banjir. Seramai 147 mangsa banjir yang terselamat dijadikan sebagai responden kajian dalam kedua-dua kajian kualitatif dan kuantitatif. Pemilihan responden berdasarkan senarai mangsa banjir yang berdaftar di pusat pemindahan banjir. Lokasi kajian adalah di negeri Sabah (Kundasang, Ranau), Sarawak (Kuching) dan Kelantan (Gua Musang).

3.0 Keputusan Dan Perbincangan

Berdasarkan pendekatan kualitatif, beberapa tema dikenalpasti daripada analisis data dan dicirikan sebagai (1) memahami trauma, (2) strategi psikososial berdepan dengan trauma, (3) strategi harapan, (4) strategi spiritualiti/keagamaan dan (5) strategi terapi dan kaunseling. Daripada tema-tema ini, modul dibentuk dan melibatkan enam (6) unit termasuklah *ice breaking*, memahami trauma, strategi psikososial berdepan dengan trauma, strategi harapan, spiritualiti/keagamaan dan strategi terapi dan kaunseling.

3.1 Perkaitan Antara Tema

Kelima-lima tema yang telah dibincangkan di atas dilihat saling berkaitan. Secara umum, pengalaman traumatik memberi kesan kepada psikososial dan spiritual mereka. Justeru, intervensi psikososial dan spiritual adalah penting untuk diberikan kepada mereka. Sebagai tambahan, pegalaman traumatik juga memberi kesan yang kritikal kepada harapan mangsa banjir. Oleh itu, intervensi harapan dikenalpasti sebagai satu keperluan utama kepada mangsa banjir bagi membolehkan kehidupan mereka lebih bersemangat dan meneruskan hidup. Bagi sesetengah mangsa banjir khususnya golongan yang lebih muda, mereka cenderung mengalami tekanan-tekanan yang kritikal seperti gangguan tidur dan kejutan yang melampau serta daya tahan yang lemah. Terapi dan kaunseling dilihat sebagai penting bagi mangsa banjir khususnya mereka yang sukar untuk menerima dan berdaya tindak dengan tekanan-tekanan yang dialami.

3.2 Perkaitan Dapatan Utama Kepada Kajian-Kajian Lepas

Memahami Trauma

Kajian mengenal pasti bahawa terdapat mangsa banjir yang tidak dapat berbuat apa selepas berlakunya peristiwa traumatik. Kehilangan sumber-sumber penting khususnya keperluan hidup, terputus hubungan dengan orang lain dan gangguan emosi seperti sedih dan trauma memberi kesan kepada mereka. Hal ini mungkin disebabkan mangsa banjir tidak memahami pengalaman sedemikian, yang kemudiannya menyukarkan mereka untuk berdaya tindak dengan pengalaman tersebut. Justeru, pemahaman tentang trauma adalah satu keperluan bagi mangsa banjir atau mereka yang berpotensi menjadi mangsa banjir bagi membantu mereka menjaga diri sendiri dan menggalakkan pemulihan daripada pengalaman traumatik (www.psychology.org.au). Pemahaman tentang trauma adalah dalam pelbagai cara termasuklah memahami dan mengenalpasti definisi trauma, pengukuran trauma dan reaksi-reaksi trauma, daya tindak terhadap trauma serta faktor-faktor atau sumber-sumber trauma. Elemen-elemen ini merupakan asas penting yang perlu diberikan kepada mangsa agar mereka berupaya mengatasi trauma dengan lebih baik.

Intervensi Psikososial Berdepan Dengan Trauma

Sokongan psikososial kepada mangsa bencana adalah penting. Selepas berlakunya bencana, sokongan sosial serta-merta boleh diajukan oleh komuniti itu sendiri seperti mengumpulkan ahli-ahli komuniti dalam satu satu tempat yang selamat dan melakukan aktiviti bersama seperti berdoa ataupun memberi bantuan kepada ahli komuniti yang lebih memerlukan pertolongan. Berdasarkan kajian, mangsa banjir berkumpul bersama, cenderung meluahkan pengalaman melalui perbualan antara sesama dan orang luar serta berkongsi sumber yang dimiliki dengan orang lain. Hal ini menunjukkan bahawa mereka memerlukan sokongan sosial antara sesama dan orang lain termasuklah penyedia perkhidmatan. Justeru, strategi perlu dibentuk untuk meningkatkan keupayaan komuniti yang sudah terbina untuk membentuk sokongan psikososial serta-merta selepas bencana (*World Health Organization*).

Strategi Harapan

Bencana banjir yang teruk memberi kesan yang kritikal kepada kesejahteraan psikososial mangsa apabila ianya melibatkan kehilangan orang tersayang dan kehilangan atau kerosakan harta benda sehingga menyebabkan mereka berasa putus asa. Justeru, intervensi harapan merupakan elemen yang diperlukan oleh mangsa banjir bagi mengembalikan semula harapan mereka. Pelbagai tindakan boleh diberikan bagi memulihkan semula semangat mangsa banjir. Meluangkan masa dan mendengar merupakan satu cara mudah bagi mangsa banjir meluahkan harapan dan perasaan mereka. Mangsa banjir boleh meluahkan harapan mereka bagi keajaiban walaupun mereka pasti kehilangan dan kematian orang tersayang (Brymer *et al.,* 2006). Intervensi ini dapat membantu mangsa banjir khususnya mereka yang cenderung mudah berputus asa selepas bencana. Mangsa banjir boleh berasa bersemangat terhadap masa depan melalui pemikiran dan luahan bagaimana kehidupan harus diteruskan.

Spiritualiti/Keagamaan

Intervensi spiritual atau keagamaan merupakan aspek yang penting kepada mangsa bencana banjir memandangkan majoriti menyatakan bahawa apa yang berlaku ke atas mereka adalah di bawah kuasa Tuhan. Bagaimanapun, respon-respon tekanan yang tidak dapat diatasi kekal dalam tempoh yang lama dan mengganggu kehidupan harian mereka. Menurut Aten dan Boan (2013), Kepercayaan spiritual mempengaruhi bagaimana seseorang memahami dunia. Mangsa banjir mungkin cuba untuk mendapatkan keselesaan daripada kepercayaan mereka. Kepercayaan spiritual ini akan membantu mereka berdaya tindak dan berdaya tahan terhadap pengalaman traumatik. Pada masa yang sama, bencana boleh menggalakkan perjuangan rohani sebagaimana mangsa bencana berusaha mencari makna pengalaman bencana tersebut. Kajian juga mendapati bahawa perjuangan rohani dikaitkan kepada emosi-emosi negatif dan tanda-tanda kesihatan fizikal dalam kalangan mangsa bencana. Kebanyakan mangsa cuba mendapatkan sokongan rohani untuk membantu mereka dalam perjuangan rohani. Dalam satu kajian juga mendapati aktiviti keagamaan didapati mengurangkan kelemahan kanak-kanak mangsa banjir dan meningkatkan daya tahan mereka. Amalan budaya dan nilai-nilai yang digalakkan khusus untuk kanak-kanak membolehkan mereka bertindak dalam keupayaan mereka (Taylor & Peace, 2015).

Strategi Terapi dan Kaunseling

Berdasarkan kepada kesan daripada bencana, terbukti bahawa mangsa bencana mengalami pelbagai masalah psikologikal termasuklah PTSD, kebimbangan, tanda-tanda kemurungan dan kelemahan emosi dan fizikal (Dudley-Grant, Mendez & Zinn, 2000; Norris, Perilla & Murphy, 2001). Mungkin terdapat kesukaran-kesukaran dalam menumpukan dan menyempurnakan tugas-tugas dan berhadapan dengan permintaan-permintaan yang memerlukan usaha sendiri tanpa bantuan orang lain dan lebih kuat (Dudley-Grant *et al.,* 2000). Sesetengahnya mungkin juga berasa mereka tidak diberi perhatian atau diabaikan oleh media dan agensi-agensi persekutuan, yang mana mangsa berasa mereka tidak mendapat perhatian dan bantuan daripada pihak-pihak lain. Justeru, pada tahap ini mangsa memerlukan rawatan yang lebih mendalam bagi mengatasi pengalaman-pengalaman yang amat mengganggu mereka.

Satu cara yang mungkin dapat membantu mangsa adalah melalui pemulihan semula kognitif dan kaunseling secara berkelompok. Kaedah ini dilihat perlu kerana terdapat kecenderungan bagi seseorang individu berkumpul dengan orang lain bagi mencapai tujuan-tujuan bersama. Melalui kumpulan, seseorang individu mencapai matlamat dan berhubung dengan orang lain dengan cara yang inovatif dan produktif (McClure, 1990). Orang lain tidak akan hidup, apatah lagi berkembang maju, tanpa penglibatan dalam kumpulan. Oleh yang demikian, kumpulan merupakan elemen penting dalam kehidupan kita. Kaunseling kelompok merupakan satu intervensi yang boleh membantu mangsa bencana mengatasi masalah yang dihadapi.

Terapi kognitif juga boleh diberikan kepada mangsa banjir. Terapi kognitif merupakan psikoterapi berasaskan kepada model kognitif. Sifat utama kepada terapi kognitif adalah penekanan kepada pengaruh penyimpangan fikiran dan penilaian kognitif yang tidak realistik terhadap sesuatu peristiwa ke atas perasaan dan tingkah laku seseorang (Beck, Rush, Shaw & Emery, 1979). Kajian-kajian mendapati bahawa terapi kognitif berkesan dalam mengurangkan tanda-tanda, dengan atau tanpa perubatan, dalam pelbagai gangguan psikiatrik seperti kemurungan, gangguan kebimbangan dan fobia serta gangguan panik (Knapp & Beck, 2008). Justeru, terapi kognitif dalam kaunseling merupakan satu pendekatan yang berupaya mengurangkan tekanan peristiwa traumatik dalam kalangan mangsa bencana.

4.0 Kesimpulan

Secara kesimpulannya, terdapat beberapa hasil daripada kajian ini.

4.1 5 tema utama termasuklah memahami trauma, strategi psikososial berdepan dengan trauma, strategi harapan, spiritualiti/keagamaan dan strategi terapi dan kaunseling.

4.2 Terdapat 19 aktiviti intervensi yang mewakili kelima-lima tema utama .

4.3 Sebuah modul intervensi psikologikal khusus bagi mangsa banjir dibentuk, iaitu Modul PsikoSpiritual-Mangsa Banjir (MPS-MB).

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ENHANCING SUPPLY CHAIN MANAGEMENT SYSTEM TO SUPPORT EFFECTIVE FLOOD DISASTER RELIEF OPERATION

Project Information

Project Leader	: Wahidah Husain
University	: Universiti Sains Malaysia
Address	: School of Computer Sciences, Universiti Sains Malaysia, 11800 USM, Penang
Contact number	: 04-6533645
Email	: wahidah@usm.my
Project Members	: Nur'Aini Abdul Rashid, Zurinahni Zainol Sharifah Mashita Syed Mohamed, Meor Azli Ayub

1.0 Introduction

During flood disaster, there is always chaotic situation occurring in disaster relief operation centers and even at the evacuation centers. The well-intentioned people and organization start to donate what they think is needed versus what is actually required. Relief center becomes overloaded and clogged with non-critical items resulting in wastage and duplication. A supply chain management system is needed to manage the items donated by the mercy groups donate and to provide correct information on crucial items needed. The lack of proper inventory management system can cause huge delay in delivering humanitarian's aid to the flood victims (Michael H., 2009). The following are the problems that need to be solved so as to smoothen the flood disaster relief operations:

- Insufficient coordination of supply and demand management will cause chaotic process of delivering goods to the disaster victims.
- Wastage and duplication of donated goods caused by improper inventory management
- Matching of supply to the demands done manually can cause duplication of supply to the same group of victims while the other affected groups are left empty-handed.
- Lack of information visibility on supply and demand data will cause delay of decision making process in resolving immediate needs during critical situation.

2.0 System Objective

In order to solve the problems, a supply chain management system is proposed with the following objectives:

- To develop an inventory management system to keep track of all the supply and demands of goods before, during and after disaster.
- To develop best-fit algorithm to enhance supply and demand matching process.
- To integrate consumption trend analysis to support recommendation process.
- To provide better information visibility for quick reference by applying geographical-mapping and dashboard interfaces functionalities.

3.0 Proposed Solution

To support the flood disaster operations, a SCM system that manages and coordinates supply and demand, plus information is crucially in need. Based on the review of the current relevant literature and case study on flood disaster in 2014/2015 in Malaysia, we found some common problems in the handling of logistics operations. There are mainly lacks of logistic preparedness before disaster and the difficulty of coordination between disaster centres and evacuation centres. To solve the problems we propose a 3-Phase Supply Chain Management Model for disaster relief operations. The model can be applied in designing the framework for the SCM system.

The proposed 3-phase model will be handling the important phases during disaster which are pre-disaster (preparation), during disaster (response) and post-disaster (recovery). The model is proposed to provide a solution that can increase the efficiency in managing inventory and delivering goods to flood disaster victims. During pre-disaster, plans and measures are taken in advance to ensure effective response and early warning can be given. For example, preplanning logistics operations, stockpiling relief goods and establishing communication plans (Beamon, B. M. And Balcik, B., 2008). During disaster, action is taken to reduce the impact of flood disaster in order to prevent flood victims from getting further suffering. During post-disaster, effort is made to restore the affected areas to their previous original state by continuing to give the support in term of supply of goods. Fig. 1 shows the proposed 3-phase supply chain coordination model.

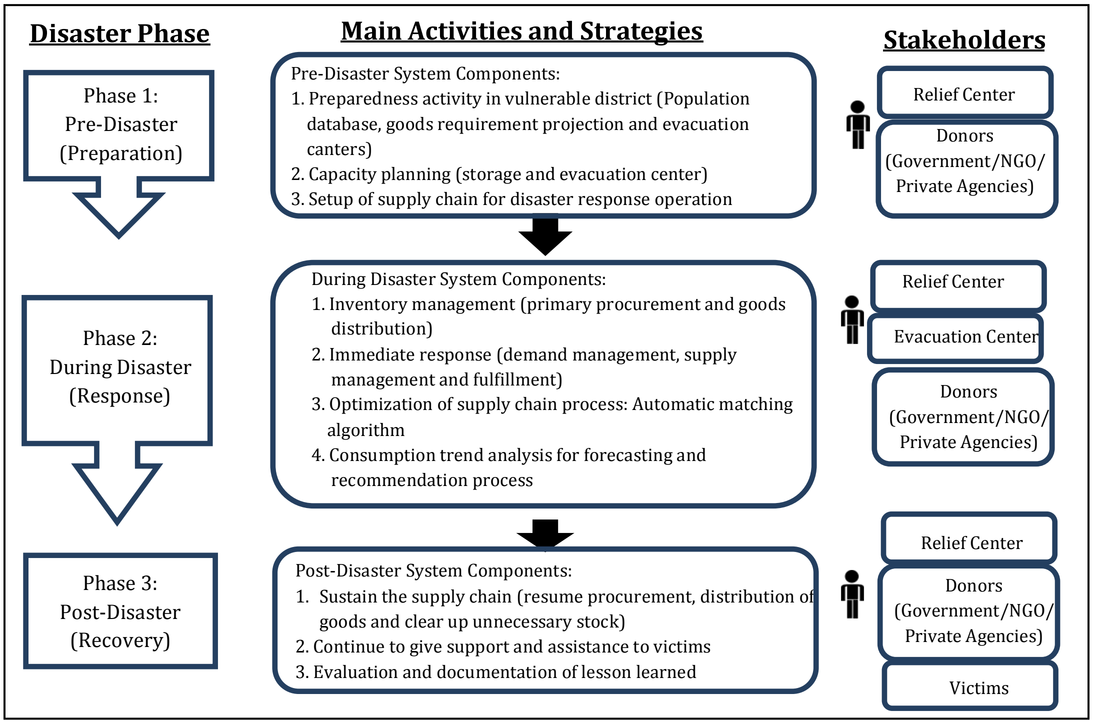

Figure1: 3-Phase Supply Chain Coordination Model for disaster relief operations

The first phase deals with strategic planning and coordination that involve team planning and data management. In strategic planning resources are identified that allow the organizations to be prepared for what must be done before the disaster. The main elements in this phase are collaboration and coordination among stakeholders of disaster relief operation (Dash S. et all, 2013). The next activity is to manage the database of the population on all possible flood affected areas and to generate the requirements of goods for the expected population. At the same time the inventory level should be monitored continuously especially on the critical item such as dried instant foods, drinking water and blankets. In the supply chain management, managing inventory level dynamically at the disaster operation centres is very crucial. The goods at the distribution centre need to be monitored and calculated. The precise amount of goods should be stored as a preparation before disaster. The system also continues to report the status of inventory and alert the relief centre worker. By displaying the status of inventory on-line, the donors will know what items are most needed and they can find the locations of the items most needed.

The second phase is response during disaster. Response is an action to be taken immediately during disaster and just after the disaster (Chandarprakaikul, W., 2010). The goals of the responders are to provide assistance in supplying critical goods to the victims as soon as possible, and at the right location and on the right quantity. Without access to the information the workers will not be able to effectively manage the goods and donations, and also to make important and critical decision during disaster. The information of inventory level should be made known to the donors, so they would know what items are needed and where mostly needed. Some relief center may already overflowed with certain items, but lacking of other items, and some centers may be left with nothing. During this phase, the comprehensive data should be shared among the relief centers, donors and also the workers at the evacuation centers. The location of the centers could be positioned on the map using GPS (Xuan S. et all, 2013). The level of goods at the distribution center is monitored and calculated continuously so that aid can be sent at any period of time. The system also should be able to calculate the optimum quantity of goods capacity in the inventory. Normally the relief centers will receive a flow of donation continuously. At this time the centres need to compare their stocks with victims' requirements at certain period of time i.e. every 24 hours (Cuervo, R., 2010). The center should always be prepared for request of goods from the evacuation centres. Level of goods will be presented all the time, and consumption trend graph could be plotted for better visibility. At this stage, the system also should be able to give recommendation to the relief centre based on the trend of goods consumption at certain period of time (Zhibo, Z. and Qinke P., 2015). By looking at the trend, the centre can make quick decision i.e. to restock shortage items to make sure enough supply for certain period of time for example within 24 hours. The system will also show the current amount of the goods on the dashboard. The dashboard shows the amount in the stock and the item that is still needed. According to Melville and Sindhwani (2010), in natural process of human decision making, a critical component is obtaining recommendations from trusted sources. Therefore, the systems are also equipped with system recommender. It will give suggestion and recommendation to the donators.

Post-disaster phase is actions that will be taken after the disaster, when urgent needs have to be met. A recovery action is designed to put the victims back to their original environment and to help them to recover their quality of life faster (http://www.aidmatrix). During post disaster, the system will continually respond to any goods requests from the victims and the relief centre will monitor the inventory level although it is not considered as in emergency or critical stage. As long as the donation is kept coming in, the relief centre at each district that were affected by flood will support and give assistant to the victims and distribute the available goods to the needy until the victims are able to settle down in their comfort homes. At the end of the post disaster activities, the system will produce reports that can later become as the lesson learnt documentation. The documentation can also be used as a guideline as a preparation for future flood disaster.

4.0 Conclusion

4.1 The proposed approach involves four major mechanisms: (1) demand forecasting (2) determination of distribution priority using matching supply and demand algorithm, (3) consumption trend analysis and (4) information visibility. Based on the proposed 3-phase supply chain coordination model, the frame work is designed to enhance the SCM to improve on supply and demand coordination.

4.2 Based on the proposed approach, 3-phase supply chain coordination model and the framework are designed to enhance the SCM to improve on supply and demand coordination.

Finally, the web-based system is implemented and the system is expected to give benefits not only for improving the performance of emergency logistics management, but also for clarifying the importance of the coordination among the disaster relief canters, the relief supply sources and the public.

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DEVELOPING EMERGENCY EVACUATION KITS IN RESPONSE TO FLOOD DISASTER BY APPLYING DPSIR FRAMEWORK

Project Information

Project Leader	: Dr. Shazwin Mat Taib
University	: Universiti Teknologi Malaysia (UTM)
Address	: Department of Environmental Engineering, Faculty of Civil Engineering, UTM
Contact number	: +6019-7090698
Email	: shazwin@utm.my
Project Members	: PM. Ir. Dr. Mohd Fadhil Md. Din, Dr. Aznah Nor Anuar Dr. Yong Ee Ling, Dr. Noorul Hassan Puan Nurfarhain Mohamed Rusli

1.0 Introduction

Malaysia is a country that prone to flood risks, mostly by nature of its physical as well as its human geography (Chan, 2012). In December 2014, East Coast area of Malaysia especially in Kelantan was stricken by the worst flood disaster in the history that suspected to have 100 return period. River levels of Kelantan in December 2014 exceeded those of recent flood records. According to the council's report, the water level of Sungai Kelantan at Tambatan DiRaja, which has a danger level of 25 metres, reached 34.17 metres on December 2014 compared to 29.70 metres in 2004 and 33.61 metres in 1967. The levels at Tangga Krai, which has a danger level of 5 metres, reached 7.03 metres compared to 6.70 metres in 2004 and 6.22 metres in 1967 (Azlee, 2015). The flood had resulted a shut-down of the traffic from outside which was delaying the rescue forces. Emergency aid has been experienced difficulties to reach the evacuation centres and victims were scattered trapped with low life support on water, food, energy and healthcare supplies. These had resulted significant losses and threatening the population when more than 4.82 million people across six states were sink flooded.

Vulnerability to flood among communities who live in flood-prone area needs to be access so that adaptation responses options can be prepared. The sensitivity might vary from community to community over the time and based on social development; while adaptive capacity depends on access to resources in responding to threats (Bizikova et al., 2009). The flood rescue infrastructures and the flood warning system may be damaged and submerged right at the start of the flood event. This will create additional dangers in the flood rescue operations, especially when both road transport and telecommunications are disrupted and rescue operations have to continue throughout the night without electricity supply. Therefore, an advanced and accurate flood warning information system that provided in a timely manner before and throughout the flood duration also can help to reduce the number of flood victim deaths, trauma and property damages. In order to reduce the risk of flood disaster, appropriate plans and methods must be developed. In this case, the Geographic Information System (GIS) application can be used to assist in flood management in response to disaster vulnerability for risk reduction among society who living with flood. With GIS application on vulnerability assessment of evacuation centre, flood hazard maps list of the nearest and safer evacuation centre was provided early and disseminated to the public beforehand to help and guide the flood victims to the evacuation centre in the fastest possible routes during flooding event.

Ang (2015) had made a comprehensive review on Monsoon Flood Disaster in Kota Bahru, Kelantan. Based on the review, monsoon floods cause destruction and changes in physical and mental characteristics of local residents. These had allowed them made some physical, (like house condition, high area for documents placing, emergency roof top, and flood warning system); and mental, (like daily need sources, evacuation centres, boats and buoys, and involvement of authorities) changes in characteristics to prepare for facing the monsoon flood. Digital elevation model (DEM) data, GPS data, Flood Model data and land use data were used in the production of flood risk vulnerability map for the study area. On the map, location of evacuation centres, which endorsed by Department of Society Welfare (JKM) were identified and plotted. Furthermore, the list of flood emergencies kit is proposed to reduce the risk to health and life and the damage caused by flooding that respond to the disaster vulnerability. Kuala Krai located is prone to flooding and has been chosen for case study analysis. All-inclusive participatory survey was carried out and blabbed into actions for producing guideline on emergency kit, both for home-based and centre-based. It is expected that this vulnerability map, evacuation aid plan and emergency pack-kit will be able to assist the responsible parties to communicate and give an option to those affected people to ensure the effectiveness of the emergency response assistance and aid to victims for better preparedness capability.

2.0 Methodology

2.1 Study Area

Kelantan River basin is one of the major basins in Malaysia. There are six sub-basins in Kelantan River basin namely Galas, Nenggiri, Pergau, Guillemard Bridge, Kuala Krai and Lebir. Kuala Krai contains the confluence of two major rivers, the Lebir and Galas, to form the Kelantan River, which receives high to moderate precipitation of 244.4mm/year and flood is a serious issue faced annually. In recent year, devastating floods have been occurred in Kuala Krai especially during monsoon season. This research will focus on the linkage among DPSIR elements and explore leverage points where appropriate responses can be exerted.

Kuala Krai is the largest district in Kelantan with the size of 222,500 hectare and has a total population of 103,200 people (Department of Statistic, 2010). The evacuation centre and villages along the Sungai Lebir (length 87km, width 125m) were chosen for case studies for which it was the sub-catchment for Sungai Kelantan as shown in Fig. 1. There are 108 evacuation centres had been endorsed by Department of Social Welfare where the field study in this study was expanded on coordinate checking with GPS handheld as major input for mapping purpose. Evacuation centres located on the river basin would be check together with the classification and population fit-in. Questionnaire survey was carried out at the villages along the Sungai Lebir where the impact and the community response towards the preparedness on flood disaster could be identified.

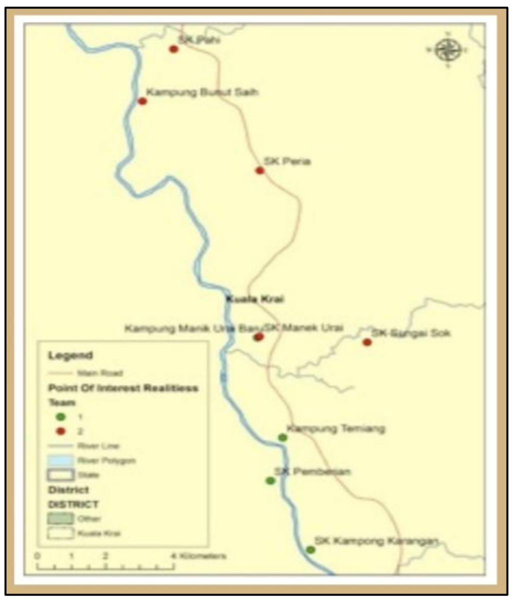

Fig. 1 Map of investigated location along the Sungai Lebir

2.2 Vulnerability Assessment on Evacuation Centre

Vulnerability on evacuation centre during the flood disaster will be assessed through a combination of social and environmental factors. Social vulnerability will consider human induced aspect while environmental vulnerability will consider both nature and human-induced. Based on preliminary field observations, few areas were identified as prone to flooding, including river flooding. These areas are sub-urbanized and sparsely populated. Field study was expanded on a coordinate checking with GPS handheld as a major input for mapping purpose to the existing data in which there are list of evacuation centre with many of missing on coordinate location. From the data collected and then put into a database integrated with information from the digital and manual data for producing flood risk maps. Analysis were performed using the GIS software ArcGIS 10.1 by using the tools in ArcToolbox such as Spatial Analyst that can be seen to play an important role in the information processing and in the production of flood risk maps. In this study, tools like Reclassification, Conversion Tools Polygon to Polyline, Raster to Feature, Symbology and clips are used for producing flood risk maps.

By referring to Department of Town and Country Planning, it classified the depth of flood hazard as shown in Table 1. It can be concluded that getting in a higher flood depth were exposed to the flood hazard. Classification of flood hazard can be viewed from a variety of factors such as the topography of the region, socio-economic and other factors. The classification raster analysis was made to classify the area according to the flood depth based on the flood hazard classification, which shows the flood hazard class based on the flash flood event at December 2014.

Table 1: Flood Hazard Classification

No	Depth (m)	Colour	Hazard Class
1	0.01 - 0.25	Green	Very low hazard
2	0.25 - 0.5	Yellow	Low hazard
3	0.5 - 0.8	Oren	Moderate
4	0.8 - 1.2	Dark green	High hazard
5	>1.2	Red	Very High hazard

The evacuation centre does not fall into any of the class flood level or must stay outside of the flood prone area to avoid centres sunk in the vicinity of the flood prone area in every degree by considering the capacity of the evacuation centre area. Hence, in ArcGIS, by using buffer analysis is the best way to implement this task. Using the 5 kilometres radius from the non-drowned centre, the evacuation centres that covered the area would be monitored. It also considers the capacity of evacuation centres, redundancy of radius and route to the evacuation centre aspects. To avoid the buffer overlapping, only 14 buffer out of 33 need be processed based on their capacity and range of the area that have more evacuation centre especially in Batu Mengkebang.

2.3 Perceptual Assessment

The design of the perceptual assessment was established based on the social characteristics of the communities. The method adopted here was the community participation method that stems from social inductive research and produces descriptive results. Questionnaire survey and in depth interviews were performed to obtain data related to community responses and adaptations toward flood disaster. The questionnaire survey and interviews were focused on the community responses toward the major flood events, particularly on that happened at December 2014, which caused severe impact in the studied area. Observations were made to identify the socio-environmental conditions of the research area. This method consists of identifying features along the path taken, followed by observing, listening, and asking questions of the local people. The areas investigated comprised Kuala Krai and on-site observations were conducted to the lowland areas located within Kuala Krai.

The questionnaire compound of 2 sections: Section A is the needs of help before and during the floods in evacuation centre; and Section B is the demography of respondents. The data collected were analysed using Statistical Packages for Social Science (SPSS) version 16.0. The questionnaire was designed to identify the impact and community response as well as preparedness towards flood disaster. There are 397 questionnaire surveys had been collected from the relevant respondents particularly flood victims at Kuala Krai. Kelantan state comprised of 1.6 million populations where the required sample size is 384 at the confidence level of 95% (The Research Advisors, 2006). Therefore, the total numbers of collected questionnaire surveys are 397 which is relevant to represent the population in Kelantan.

The information was gathered on the perceptions of the local community with regard to the active role of institutions/organizations in terms of flood response and identifying the needs of the community for immediate flood relief during their early stage of stays in the evacuation centre. The identification of the important series of events that occurred before and during the flooding allows the chronological events in the history of the community to be determined, such that improvements can be made. This is very helpful in anticipating an event that has not been considered before. Information on the perceptions of the local community that respond to the importance of institutions or organizations in terms of flood response can define the interaction of the local system and external link. Besides that, the perception on the important of developing an emergency kit would be proposed in order to provide a list of items that should be packed in a bag or kits for flood victims to reduce risk and immediate flood relief.

3.0 Results and Discussion

3.1 Vulnerability Assessment – mapping of evacuation centre

Based on the GIS mapping analysis, it showed that 33 evacuation centres (30.5%) did not submerge and have high possibility to survive in flood hazards. As a result, another analysis has been made to look into the radius of vulnerability and buffered on pre-determined radius of 5 km as shown in Fig. 3. Based on these 2 analyses, it is found that there was 14 out of 33 evacuation centre could be converged as buffer evacuation centres.

From this research study, it had proved that the use of geospatial technology which known as Geography Information System (GIS) is a good medium to carry out the studies that related to disaster management. The flood disaster should not be overlooked and actually could be controlled. Therefore, GIS approaches could be proposed to reduce the impact of disasters through better preparedness initiatives. This study had also become a starting point for the production of flood risk map which can be used as a reference for any related agencies as the preparedness towards the allocation of evacuation centre during flood disaster.

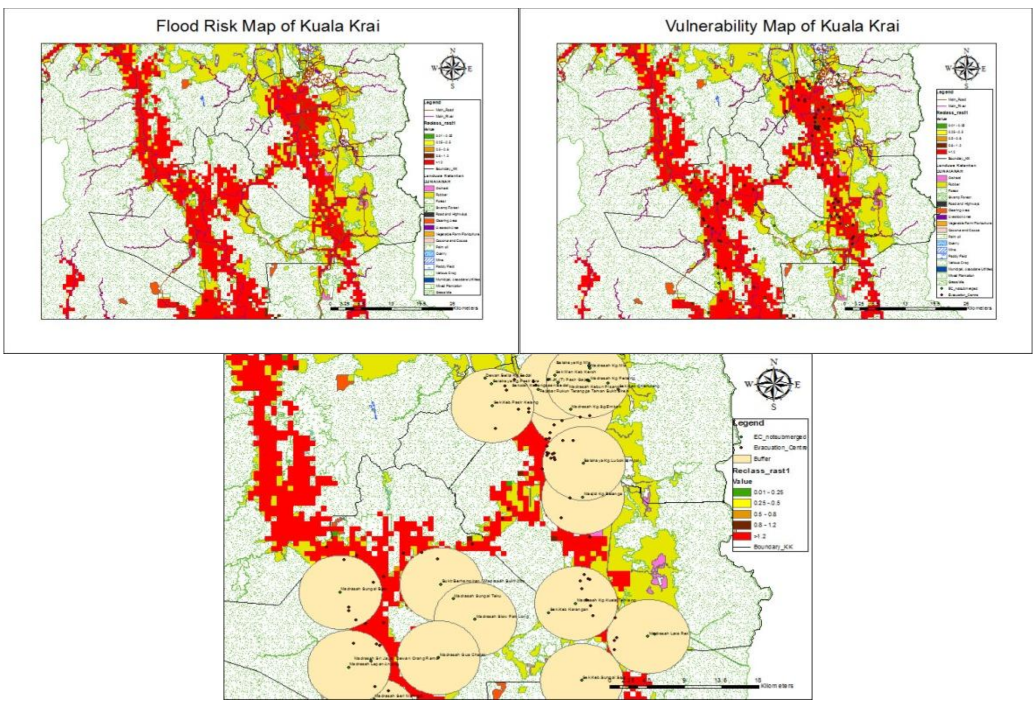

Fig. 2 Flood risk, vulnerability map and buffer area of study area

3.2 Demography of respondents

The questionnaire is distributed randomly to female (51.1%) and male (48.6%) respondents. According to analysis, majority of respondents are between the ages of 36 to 49 years old which consisted of 34% from the total. It followed by senior citizen that are 50 to 64 years old and teenagers from 26 to 35 years old with 27% and 17.1% from the total respectively. The occupations of respondent were randomly distributed across the listed options in the questionnaire. Most of them are working with government sectors (22.4%) and not working (20.7%). The household income for the respondents was low where 76.1% of them having the income lower than RM 2000 per family. The remaining 33.9% were randomly or almost equally distribute between RM2001 to RM5000. The majority numbers of household were between 4 to 6 person (49.9%) and then followed by 7 to 9 person (22.9%) and there were 18.4% of respondents obtained family member of less than 3 persons. The education background most of the respondents at SPM level (33.8%) and primary school (21.4%). There were 17.1% of them only able to have their education level at PMR/SRP. Besides that, there were 20.9% of respondents at more higher education level of diploma and degree level. Furthermore, Most of the respondent chose their residential area near to the flood-prone area because of the own family land and property where private property right (hak milik persendirian) consist of 33.2% and 26.2% was land/family heritage house. Some of the respondent responded to that their residential area were close to public infrastructure (15.1%) and workplace (10.6%).

3.3 Immediate needs before and during their stay in evacuation centre

This section attempts to identify the needs of the flood victim as well as their perception towards the immediate needs of emergency kits before and during their stay in the evacuation centre. The emergency kits and the immediate needs for the flood victims could be considered and prepared in the evacuation centre in order to ensure the safety and comfortless as well as immediate flood relief during their stays in the evacuation centre. During the past flood incident in Kuala Krai, Kelantan, most of the victims were arrange to stay in the evacuation centre for at least seven days. The facilities in the evacuation centre should be first been considered to ensure the safety and comfort level of the flood victims in it. The sufficiency towards the facilities and comfort level in evacuation centre may become the priority of concern that contributes to the flood victims' perceptions toward the needs in the evacuation centre.

In the questionnaire survey, the respondant have been asked on the items that will bring along when leaving the disaster area and the items that they needed to be provided in the evacuation centre as a disaster relief. The priority of the items for each of the category that needed to be provided in the evacuation centre are identified and discussed. From the results, it showed that the items that the victims can bring along during their transfer to the evacuation centre were less needed to be provided by the related agencies and volunteer in the centre, as they own the items. There were more than 90% of the victims able to bring along all their personal belongings such as identification documents, properties document, money, high value items as well as family and emergency phone numbers during their transfer to the evacuation centre. Hence, it may not necessary to be provided or prepared in the centre.

3.4 Perception on community assistance toward the flood victims

Table 2 showed the results of the parties that provide assistance to the flood victims in evacuation centre. Based on the results, the respondents received most aids from the volunteer with the percentage vote of 84.1%. It means that volunteer from the non-government organizations (NGO) play an important role in providing aids and assistance to the flood victims. It followed by the government sector, individual, family and relatives with the percentage of 58.7%, 39% and 35.5%, respectively. Some of them also received the aids from the private sector, statutory bodies and religious association with the value of 24.4%, 17.1% and 12.3% respectively. Based on the opinion from the flood victims, majority of them (72.5%) felt that the assistances received were in line with their needs during flood events. However, there were still a small percentage of victims does not agree with the assistances received from the parties in evacuation centre. There were some reasons that the victims does not feel like received the assistance where they felt that the distribution is unfair, assistance is not enough especially food and clothes, slow incoming help and no assistance received. All these lacks and insufficient must be overcame to fasten the distribution aids for immediate flood relief during their early stage of stays in the evacuation centre and when the victims return to their home.

Table 2: List of parties providing assistance to you while in evacuation centres

Parties providing assistance to you while in evacuation centres	Percentage [%]
Government	58.7
Private	24.4
Statutory bodies	17.1
Non-government organization (NGOs)	84.1
Religious associations	12.3
Individuals	39
Relatives	35.5

Based on the survey on ways of distribution of aids, most of the aids or consumer goods were distribute directly to the victims. There were 76.3% respondents received the aids directly through the related parties. Besides that, the distribution through Village Development and Security Committee (JKKK) also comprised of 57.4%, meaning that JKKK also play an important role in distribution of aids where it consisted of half from the total victims. Table 3 showed the crosstab between the parties that provided assistance and ways of distributed aids. The distribution through the NGO mostly distributed directly to the victims. NGO is a non-government organization where all the manpower's are mainly in the nature of volunteer. They are not bound with any organization; hence they act individually or in group to distribute the aids. The method directly to the victims is the most effective and convenient ways for the volunteer, but some of them also collected the donated items and distribute it through JKKK. Moreover, it was also found that most of the parties that provide assistance mostly distribute directly to the victims and then through the JKKK and government. All these aids should be distributed immediately after receiving from the related authority. The duration of receiving the donated items by the flood victims was depending on their needs and donations received from the public. The duration for collecting the donation may take some time before it can distribute to the flood victims.

Table 3: The crosstab between parties that provide assistance and ways of distribution

Parties that provide assistance	Frequency		
	Direct distribution to victims	Distribution through JKKK	Distribution through government
Government	185	144	70
Private	81	72	34
Statutory bodies	59	51	26
Non-government organization (NGOs)	261	202	77
Religious associations	42	42	19
Individuals	124	106	38
Relatives	115	97	46

3.5 Preparedness towards emergency kits

Majority of the respondents think that it is a need to have the emergency kit as the preparedness for the flood event. However, during the past flood events, there were 58.9% of the victims do not ever accepted the emergency kits before. There were only 36% of the flood victims received ever received the emergency kits in the evacuation and 5% of them receive the kits at home when preparing the flood event. It means that an emergency kit is still not yet a common thing to the victim in Kuala Krai areas. Since the flood victims thinks that it is a need to have the emergency kit, several approach should be proposed such as list of items in the kits and the price of the kits so that every victims can get the beneficial from the emergency kits for flood relief.

The emergency evacuation kit is useful by providing checklists, action sheets, consumer goods and information on evacuation precaution for flood to reduce risk among community and increase preparedness level. Even though this emergency kit is considered useful for the flood victim, they still will considered no necessary if there are payment been charged towards the kits. Based on the feedback, they not willing to own this kits because most of them come from low-income family where their family income is less than RM 2,000. There were still 27.5% of the victims willing to pay for owning the emergency kits. Among of them, they willing to pay less than RM50 for the kits. With the limited cost and bigger amount of items in the kit, the items must pre-selected carefully so that it fits the price and the amount item in it.

An appropriate party must be selected or chosen to distribute the kits. Head of the village (JKKK) is the most suitable person to distribute the emergency kits. Head of village knew what the villagers needs as he/she is in the same conditions with the villagers. Hence, they believe that the head of village can equally distribute the aids and emergency kits to the villagers according to their needs. Besides that, there were also 24.2% of the flood victims stated that NGO is the parties that should responsible for providing the kit as they mostly received the aids from the volunteers. The flood victims stated that the distribution of emergency kits should be provided immediately to the flood victims after the flood event in the evacuation centre. It means that the flood victims need more assistance and help immediately during their stay in the evacuation centre as most of their belongings are left at home and could not be issued during evacuation.

4.0 Conclusion

The effects of monsoon flood must be reduced by all parties involved to make better planning such as risk maps and emergency kits for reducing risk and flood relief. From analysis in the case studies of Kuala Krai District, it showed that 33 evacuation centres (30.5%) did not submerge and have high possibility to survive from flood hazard. Besides that, the radius of vulnerability had been check and found that it buffered on pre-determined radius of 5 km. As the result, there were 14 out of 33 that could be converged as buffer evacuation centre. This study is a starting point for the production of flood risk maps and can be used as a reference for future studies.

Furthermore, the victims along Lebir River recounted their experience with flood disaster occurred in December 2014 that inundated large area of Kuala Krai District, Kelantan. Victims' perceptions on immediate needs, information distribution, and emergency aid were assessed to improve disaster preparedness capability at community level especially during their stay in evacuation centre. The impact of the floods affecting the victims lives, particularly the destruction of homes and causing emotional distress to the victims. Assisting with relocation and the intense activities faced by disaster victims may involve emotional reactions. It is not perceived their difficulties during evacuation process. Due to the immediate needs of the flood victims by characterized types of assistance for immediate usage, there is a need for considering a proper emergency assistance in order to assist them before moving to the evacuation centre.

Based on the victim's perception on immediate needs before and during their stay in evacuation centre, the facilities and the list of items that need to be provided as well as the distribution ways in order to connect with the needs of preparing emergency kit for the flood victim in evacuation centre are reported and identified. Emergency kit here is still not yet a common thing to the victim in Kuala Krai areas; hence, it is a need to have the emergency kit. Therefore, several approaches had been proposed such as list of items in the kits and the price of the kits so that every victim can get the beneficial from the emergency kits for flood relief. The items that are not usually collected from the donors but actually needed by the victims in the evacuation centre must giving high attention prior to flood relief.

For preparedness capabilities prior to disaster; coordination efforts between all related agencies need to be improved by extending support networks, applying hazard resistant concept in flood prevention and preparedness for victims to be more alert and prepare in future. Maintaining disaster preparedness capabilities are integral components. An integrated system could be proposed to coordinate all the related agencies such as government parties, non-government organisation and individual for effectiveness of distribution of aids and delivery system so that all can achieve to those in need.

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ANALYSIS OF RIVER PLAN CHANGES FOR FLOOD IMPACT MAPPING AND DETERMINATION FOR FLOOD MANAGEMENT IN PAHANG RIVER, MALAYSIA

Project Information

Project Leader	: Dr. Mohd Khairul Amri Bin Kamarudin
University	: University Sultan Zainal Abidin
Address	: East Coast Environmental Research Institute (ESERI), University Sultan Zainal Abidin (UniSZA), 21300 Kuala Terengganu, Terengganu.
Contact number	: 012-9668303
Email	: mkhairulamri@unisza.edu.my
Project Members	: Prof Dr. Mohd Ekhwan Bin Toriman, Prof Dr. Muhammad Barzani Bin Gasim Prof Madya Dr. Hafizan Bin Juahir, Dr. Roslan Bin Umar

1.0 Introduction

Flood is the most common natural disaster that occurred in Malaysia. Approximately every year, flood event will occur in some places in Malaysia whether it is huge flood or only flash flood. According to the (Sulaiman,2010), the flood event is becoming an often disaster in Malaysia. The land use cover due to deforestation and massive development of the areas has become a perception to the researcher that it is the main reason that contribute to the increased of results in flood frequency and severity. Stream flow of rivers is basically can be studied to be used as an indicator for the flood event (Jusoh, 2005; Saher, 2012). Rainfall distribution is very important in study of flood disaster. According to (Hoybye, 2009), there are three main sources of flooding such as heavy local rainfall, extreme river discharge and sea wave from South China Sea. Rainfall form main water input to the river basin. It is influence the water storage and discharge of a river especially during heavy rainfall event. Therefore, the study on the impact of rainfall and run-off is very important in order to elaborate the cause of flood event (Obled, 1994). Besides that, rainfalls also play an important role during major flood event. In the case of rainfall distribution similar to the direction of the main stream, the flood peak is higher than when it is moving in the opposite area or direction (Ogden, 1993). Pahang Basin are one of the area that received highest total rainfall during north east monsoon period about 40% of the total rainfall annually (JMM, 2012; Gasim, 2013). According to (Adnan, 2008), climate change and weather play an important role in various fields such as hydrology, epidemiology and environment sustainability. That is directly referring to the monsoon season that hit the East Coast of Peninsular Malaysia about every year and the chances of being flooded are relatively high. Therefore, the river plan changes study at Pahang River is important in order to evaluate the impact of flood disaster upon the river.

2.0 Methodology

Pahang River is one of the largest river basins in peninsular Malaysia. Pahang River is located at longitude 101^0 30'E to 103^0 30' E and latitude 3^0 00' N to 4^0 45' N. Pahang River is the major river system in Pahang State that started from the Titiwangsa Mountain range to the South China Sea. GIS method is an effective method in geospatial data management which quantitative analysis of channel migration and meander evolution can be implemented effectively. The satellite imagery data will be process and digitization of the image will be done to establish the GIS. Using GIS method, the study also can be include the areas that been affected by flood with quite precise radius. Its adequate information and prediction capability is vital to evaluate alternative scenarios for flood mitigation policies and use as a tool in order to help in decision making process that associate with flood management (Kamarudin et al., 2015a).

In this study, Type of Lateral Change (TYLAT), Mean of Meander Movement (MOME), Sinuosity Index and Bathymetric analysis method will be used for the determination of river plan changes in the evaluation (Kamarudin et al., 2015b). Interpolation isohyet method is the method that uses to estimate the mean precipitation across an area. The method is by drawing lines of equal precipitation on a map. This method uses the topographic map and other hydrological data of Pahang River Basin to yield reliable estimates. Isohyets are contours of equal precipitation that analogous to contour lines on a topographic map. The station of rain gauges that available in Pahang River Basin are being mark on the topographic map to observed the area that deliver the highest equal precipitation. Statistical process control is a method use for quality control of the data sets. SPC is used in this research to conforming product or the data sets to ensure the data sets use is reliable and meet the specification needed for further analysis such as Isohyet and HACA. The data sets that been used for SPC analysis is rainfall and water level data. Statistical process control is a method use for quality control of the data sets. SPC is used in this research to conforming product or the data sets to ensure the data sets use is reliable and meet the specification needed for further analysis such as Isohyet and PCA.

3.0 Results and Discussion

3.1 First Objective: River Plan and Meander Changes of Pahang River

The section below emphasizes on the river plan change analysis in main stream of Pahang River. Pahang River was conducted based on two basic data that is satellite imagery from two time period on 2010 and 2015. The basic of the data was taken from the time period of pre flood event and post flood event of Major flood 2014. Overlay method have been used by GIS application software to conduct the analysis and assessment of Pahang River plan changes. Table 1 and 2 show the results of River plan changes results base on TYLAT and MOME method. The highest results is meander progression and extension where show more erosion event occur in upstream of Pahang River during 2014 flood event. The event will be affects the sedimentation process along the Pahang River.

Table 1: River plan changes results base on Type of Lateral Change (TYLAT) method

Sub-Plot	**Meander Progression**	**Increasing Amplitude**	**Progression and Cut-off**	**Irregular Erosion**	**Avulsion**	**Braiding**
upstream	**36**	10	2			
Middle stream	14			2		
Downstream	6	1				9

Table 2: River plan changes results base on Mean of Meander Movement (MOME) method

Sub-Plot	**Extension**	**Translation**	**Rotation**	**Enlargement**	**Lateral Movement**	**Complex Changes**
upstream	**23**	14	4	5		
Middle stream	11	10	1	5		
downstream	2	3		4		

In average, the evolutions of river meander occur at 15.51% for 5 years. Figure 1 show the trend and percentage of Sinuosity Index differences for 5 years. The results obtained from the analysis show clear changes of Sinuosity Index at the upstream area. The highest percentage of meander changes was recorded at sub-plot 9 at 45.1%, sub-plot 8 at 29.1%, sub-plot 13 at 26.6%, sub-plot 7 at 25.4% and the sub-plot 35 at 24%. Moreover, according to the (Rosgen,2007), the measurement for sinuosity index stability for Pahang river downstream channel was stable with the majority of the sub-plots show the sinuosity index was less than 1.2. However, there are several sub-plots that being identified to be unstable such as 71, 72 and 74 for year 2015 that indicates the index values about 1.26, 3.43 and 1.34. Sub-plot 71 and 74 been identified as unstable sinuous.

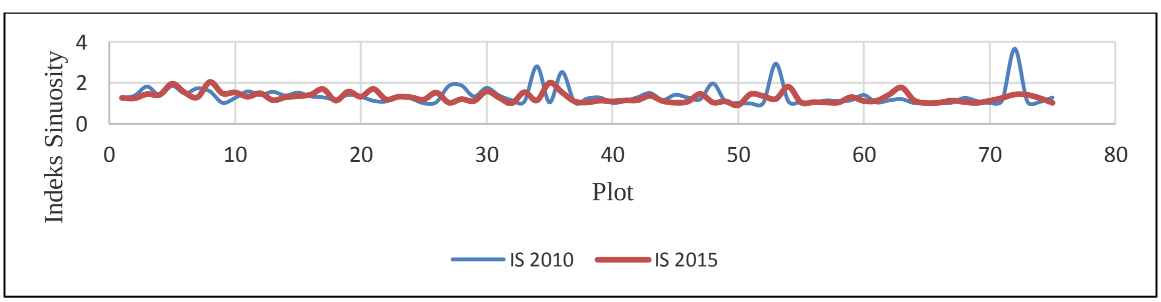

Figure 1: Sinuosity Index trend graph

Bathymetric data (in figure 2) indicate that the depth of Chenor station was decreasing and shallower in 2015 after the flood event compared to 2013 bathymetric data. Bathymetric data of Jerantut Peri station indicates that the depth of the river was shallower after the flood in 2014. From figure 3 and 4, Jerantut Peri station show that its group changes to very shallow depth (VSD) to High Depth (HD). The results also indicate that JPS Tembeling station class was changes from Middle Depth (MD) to Very Shallow Depth (VSD). This may be due to surface run-off that brought the sediment and sand into the river that resulted the river bed to become shallower and will lead to future flood. Other station also indicates the changes in depth cluster due to major flood event in Pahang December 2014 but the differences between pre-flood 2013 and post-flood 2015 do not leave significant differences between the depths of the river.

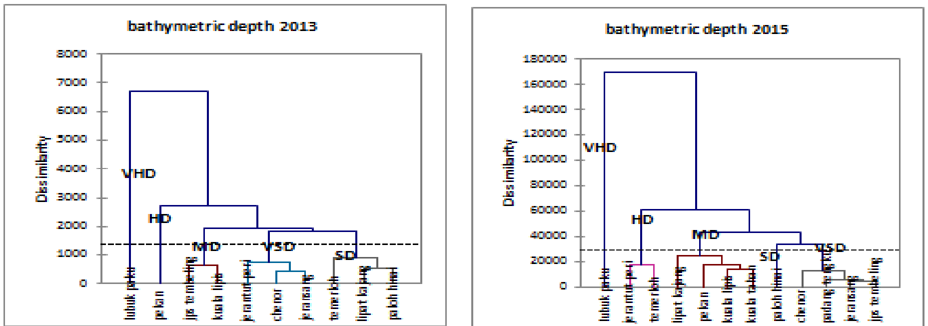

Figure 2: Bathymetric data classification

3.2 Second Objective: Local climate change of Pahang River Basin

Figure 3 show the rainfall intensity of Pahang River Basin in November 2014 - January 2015. According to (JKR Pahang, 2014; Utusan Online, 2014), during mid- November 2014, the heavy rainfall that hit Pahang especially in Pahang River Basin caused a flash flood in several places includes Pekan, Chini, Jerantut and Kuala Tahan in National Park. The river basin nearby Pahang River Basin is Kuantan River Basin. Besides that, at the border of Perak, Kelantan and Pahang located at highland such as Brinchang and Cameron highland, the intensity of rainfall increased dramatically at the range of 1600mm to 1700mm. The border of Terengganu, Kelantan and Pahang at Gagau Mount also affected by heavy rainfall at the range of 700mm to 1200mm.

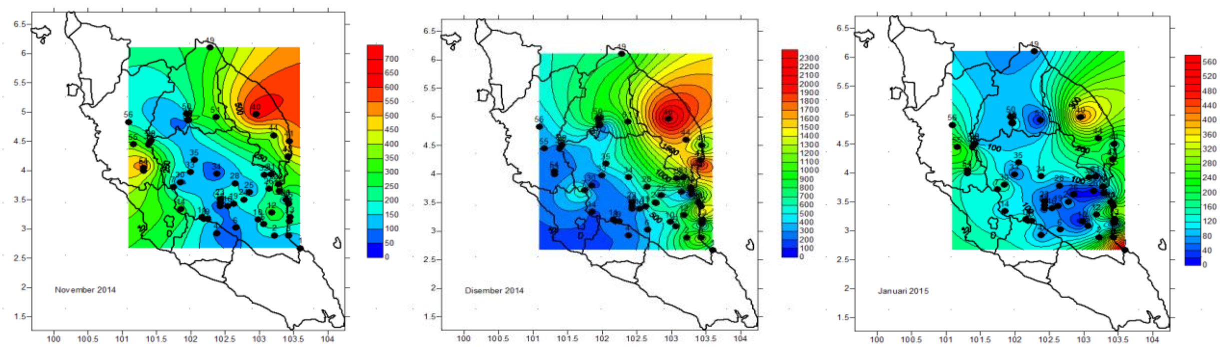

Figure 3: Cumulative Rainfall distribution of Pahang River Basin from (a) November 2014 (b) December 2014 and (c) January 2015

According to (JPS Pahang, 2014), the rainfall intensity increased in December 2014 especially during mid-December and several areas such as Jerantut, Maran, and Temerloh are started to flood. Based on the isohyetal map, high rainfall intensity in December 2014 was focused at the Terengganu and Kelantan border with the range of rainfall intensity was 2300mm to 1600mm. Temerloh, Jerantut and national park also obtained a high intensity of rain at the range of 1400mm to 1200mm. Other areas such as at the downstream of Pahang River show quite high rainfall intensity at the range of 800mm to 300mm especially in Chini, Pekan and Kuantan.

During January 2015, the rainfall intensity in Pahang state focused in Pekan located in Pahang river basin. However, the rainfall cumulative intensity still pouring down in few area that heavily effected by flood such as National Park, Jerantut, Temerloh, Cameron highland especially in Brinchang and Chini in capacity range about 120mm to 60m. Based on the isohyet map in January 2015, high intensity if rain was poured at Kuala Rompin area at the range of 800mm to 700mm. Other places such as central area of Pahang state and upstream area of Pahang River, the rainfall intensity has dropped to the range of 120mm to 40mm in the blue area.

3.3 Third Objective: Suggestion for Integrated Management Plan of Pahang River

This research has come into decision that the water storage pool system is very important in order to control the flood water and overflow from upstream and middle Stream of Pahang River as it will influence directly the water level of Pahang River in the downstream (base on objective 2 results). The options for the suggestion were is Chini and Bera Lake and other swamp areas that have been identified suitable to be modified as flood water storage as it is alongside the Pahang River Stream (for example see Figure 4).

Figure 4: Natural water storage areas suggested

The mitigation barrier plan was good suggestion to prevent the erosion process of Pahang River bank due to the stream flow (base on objective 1 result). The suggestion is to extend the plan of mitigation barrier to middle stream and upstream to increase the efficiency of the barrier. The study also suggest one system for integrated river management and everlasting environment that will completely working on to ensure the sustainability of the river and persistent basic behavior in Pahang River Basin.

4.0 Conclusion

Summarized all the important findings of the project in point form.

4.1 The analysis on river plan changes of Pahang River after major flood in 2014 show that the changes of meander progression of the river bank and extension of river meander that increase in sinuosity. The bathymetric analysis of Pahang River in selected location also shows significant changes at upstream and downstream of the river.

4.2 The local climate changes of Pahang River Basin were show that the rainfall intensity in November, December and January was high due to the monsoon season. The rainfall intensity was high in upstream of Pahang River such as in Brinchang, and Jerantut. Heavy rainfall that reported by department of drainage and irrigation was shown high on mid-November to early January. The range of cumulative rainfall intensity was about 1800mm to 750mm per day.

4.3 The management of Pahang River Basin for flood disaster was resulted in proposes of natural water storage area in Chini and Bera Lake and other swamp areas. The mitigation barriers for Pahang River bank in selected area also need to be conducted to prevent flood water overflow during rainy season.

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NEW CRITERIA FOR DISASTER PREPAREDNESS MANAGEMENT BASED ON HUMAN DIVERSITY FACTORS USING CROWD SOURCES INFORMATION PLATFORM

Project Information

Project Leader	: Dr Nur Sabahiah Abdul Sukor
University	: Universiti Sains Malaysia
Address	: School of Civil Engineering, Universiti Sains Malaysia.
Contact number	: 045996250
Email	: cesabahiah@usm.my
Project Members	: Dr Mohd Ashraf Mohamad Ismail, Prof Madya Dr Taksiah Majid Prof Dr Ahmad Farhan Mohd Sadullah

1.0 Introduction

As Malaysia is increasingly developed, the demand for social systems based on residents' diversity rises. This trend appears not only at normal times but also during emergencies such as disaster. Promoting and maintaining household disaster preparedness is essential. Disaster preparation reduces the risk of injury and damage within a household and facilitates a capability for coping with the temporary disruption associated with hazard activity. Given the infrequent nature of hazard activity, the maintenance of preparedness over time is essential to sustaining individual resilience (Paton,2000). It is often assumed that providing the public with information on hazards and how to mitigate the consequences to the public will encourage preparation (Smith, 2013). However, despite the substantial efforts and expenditure on public hazard education, the level of preparedness remain low (Lindell and Whitney, 2000; Paton et al, 2000). Additional complications are also introduced by differences in perceived vulnerability to hazard effects (Paton and Johnston, 2001). One of the reasons for the low level of preparedness is the lack offocus on diversity factors such as race, language and culture resulting in different responses to disaster (Andrulis , 2007). Diversity of residents means the coexistence of people with various characteristics and values such as aged, people with disabilities and chronic diseases, the number of woman and infants and the percentage of expecting mothers. Thus special countermeasure can be provided to protect, evacuate and sheltering the people in needs during the disaster response phase. A questionnaire surveys together with interview session will be carried out to know the predictive resilient capacity of the community based on several human diversity factors as indicators. In addition, the standard level of care of the residents for Malaysian can be developed based on the Japanese standard care of level used during the disaster response stage such as tsunami and earthquake. The main human diversity indicators together with the standard level of care developed will be used in the mobile application using crowd sourcing platform. The outcomes of this study can be used to strategize the disaster preparedness and response phases management by turning to crowd sourcing to collect information quickly and the very people who need assistance an important tool in helping to coordinate all government agencies response.

2.0 Methodology

The research methodology that adopted in this study consists of 3 main stages namely i) Criteria determination ii) Application of the criteria to the selected case study iii) Evaluation and verification of the proposed study. Several schools that played role as relief centers were selected to gain the respondents (the flood victims) for this project. The school children were asked to give the questionnaire form to their guardian in order to fulfill the objective for the first stage in this study.

2.1 Criteria determination

This phase consist of data collection by using the survey questionnaire method. Several schools that played role as relief centers were selected to recruit the respondents (the flood victims) for this project. The school children were asked to give the questionnaire form to their guardian in order to fulfill the objective for the first stage in this study.

2.2 Application to case study

A prototype of mobile devices platform was developed based on the newly determined criteria. This prototype of mobile devices platform was designed to allow the representative from the authority/ head village to collect the specified information via their mobile phone and tablets during the disaster preparedness phase where all the utility are function normally. The developed platform will process the input data and categorize the standard level of care for every respondent in each locality. The results produced will be presented via spatial map where different colours indicate different level of care needed and the diversified human factor for the disaster for the studied area.

2.3 Evaluation and verification

The crowd sourced information is suggested to be processed and verified with the results from the questionnaire surveys in order to assess the reliability and effectiveness of the developed platform.

3.0 Results and Discussion

3.1 Descriptive Analysis

The descriptive analysis of the data obtained in this research is shown in Table 3. There were 4447respondents data that used for the analysis. The age range for the respondents was between 7 to 100 years old. From the data, there were 4.8% of the respondents were below than 12 years old. However, we assume that those questionnaires were filled by the help of their parent. Moreover, 0.1% of the respondents were above 80 years old, which also assumed helped by their own family members to fill the questionnaire. In terms of gender, the result shows that the male respondents were more than half of the total number, which is more than female respondents. From the survey, self-employed was the highest percentage among the other occupation which was 39.2%. It was followed by not working, working in government sector and non-government sector as 32.1%, 22.4% and 6.3% respectively. Most of the respondents were finished their SPM but only 18.3%, 15.2% and 1.6% were diploma, degree and master/PhD holder respectively. As the survey conducted in rural areas, more than 2/3 of the respondents earned less than RM3000 per month with only 1.8% of the respondents who earned more than RM10,000 per month. More than half of the total respondents were concerning about the location of flood when bought the current house. 78.3% of the respondents live in their house for at least 5 years. Regarding the flood issues, nearly half of the total respondents live in the areas that prone to the annual flood event. The minimum and maximum losses that caused by the flood were RM10 and RM2,000,000 respectively. The highest losses amount was reported at range of RM900 to RM5000. In addition, most of the respondents did not have insurance coverage for their house as lack of information about flood's insurances. 81.5% of respondents in the survey reported that they did not have family member that have health problems or special needs. Thus only 18.5% of them reported to have family member that needed special care, which most of them dominated as the elderly and diabetes. Only 27.2% of the special needs register to government agencies.

About half of the respondents move to the temporary shelter and most of them move by their own transport while some helps by BOMBA and family's or relative's transport. Others did not move as they claimed that their houses were still safe to live and most not effected by the flood. Schools and mosques were reported as the most favourable for temporary shelter for the respondents. 55% of the respondents that moved to the temporary shelter inform that however, the shelters were mostly lack of facilities which achieved only 55.1% of satisfactory. Meanwhile 97.6% of respondents agreed that it is important to identify the special needs victims in order to facilitate the shelters with appropriate emergency equipment. Majority of the respondents recognized that their headmen, while only 26% confirmed that the headmen had the record of his residents status. Out of 4447 respondents, only 4.9% of them were not willing to give the information about their family to the local authority before the flood event due to the privacy of the information. Most of them answered that it is more suitable to have questionnaire or official census that go from house to house to get the residential data. Although majority were agreed to distribute the information via mobile application, the minority feel disagreed as the several rural areas were lack of internet access. 3568 respondents claimed that they know the location of the nearest shelters. While only 42.9% of respondents acknowledged the types of facilities and capacity of the shelters. Department of Fire and Resque, Department of Civil Defence and headmen were voted as 3 top agencies that providing the ample information about flood. Most of respondents claimed that they received the information about flood disaster via media such as radio and television.

3.2 The Special Needs

Figure 1 shows the relevant data for the special needs group (Group A) with the catagories of their vulnerability. It shows that elderly was the highest percentage of the special needs, followed by the diabetes peoples, disabled peoples, pregnant ladies, chronic illness, eyesight or hearing illness and other categories. However, one vulnerable individu maybe listed in more than one categories. For example one elderly might be categorized as elderly, but also may has heart disease or athsma. Therefore this data is showing the percentages of illness categories, not representing the percentage of the individuals. For special needs in Group A, 435 illness or special needs categories were identified.

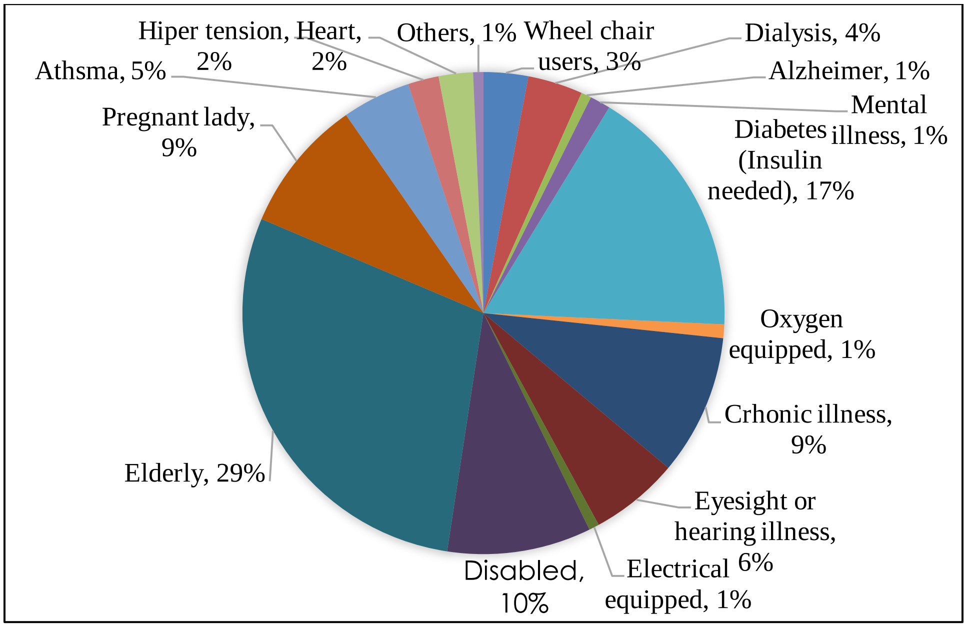

Figure 1 Category of vulnerabilities for the special needs people and moved to the evacuation shelters. (Total respondents = 340; Total diseases = 435)

Figure 2 shows how the respondents with the special needs family member evacuated to the shelters. The result shows that most of them had evacuated by using their own vehicles including boats. It is followed by help from fire and rescue department, their neighbours and friends, NGOs, public transport such as taxis or rental vehicles and others. Meanwhile, Group B in the result representing the special needs groups that not move to the shelters during the emergency event either they were refused to move or they were stranded away from the evacuation process.

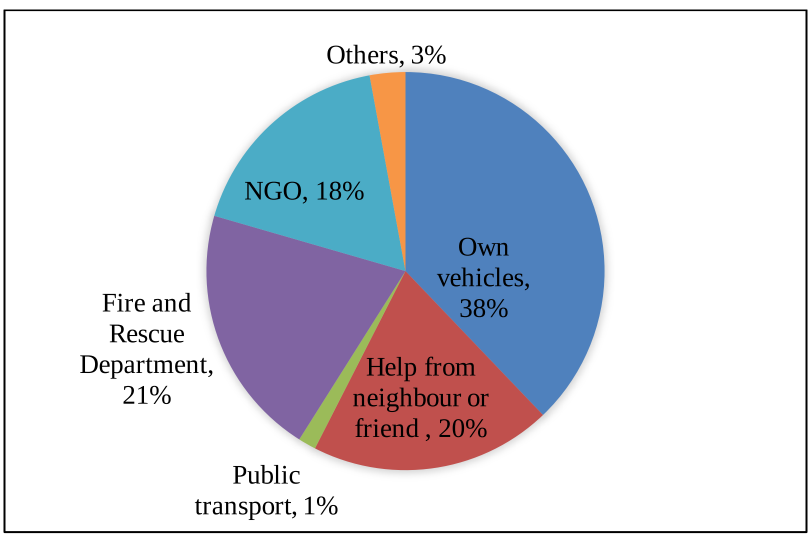

Figure 2 Method used by the special needs people to evacuate to the shelters

3.3 Standard of Care Levels for the Vulnerable Populations

Based on the interviews, outcomes from the questionnaires and discussions between the related agencies, this study come out with the standard of care levels in Table 1 below. The purpose of the standard of care levels are to assist in prioritizing the person or groups that need to be the rescued. However, the rescue teams or relief agencies need to be provided with the database of the vulnerable populations first. This study also come out with the categories for evacuation center in order to equipped the vulnerable populations and to assure that they were sent to the appropriate relief centers with their standard of care level (Table 1)

Table 1: Proposed standard of care level

Category	Standard level of supports / needs required (Mobility of the Person)	Priority in evacuation and sheltering
Level 1	The person can operate basic activities of daily living almost independently and only require short term support for the associated health conditions	Low priority
Level 2	The person needs a low level of support for daily living and cannot be left alone for long time. Required short to middle term support for the associated health conditions	Low Intermediate priority
Level 3	The person cannot stand up or walk firmly but can still can go do their daily living almost independently. Required short to middle term support for the associated health conditions	Intermediate priority
Level 4	The person cannot stand up or walk without helps and needs full support for toilet activities, bathing and changing clothes Required middle to long term support for the associated health conditions	High level priority
Level 5	The person activities for daily living is totally deteriorated and needs full support for daily activities and needs long term of support for the associated health conditions.	Very high level priority

Table 2 Proposed new category for evacuation center

Category of Evacuation Center	Characterictics of evacuation center
EC1	Normal evacuation center with basic facilities
EC2	Evacuation center with barrier free living environment
EC3	Evacuation center with basic nursing care
EC4	Evacuation center with special medical support
EC5	Evacuation center with electricity for life supporting medical equipment

EC6	Evacuation center with observation by a health professional / hospital

4.0 Conclusion

The flood disaster that hitted Kelantan in 2014 was a tragedy that beyonds anyone expectation. It was also claimed as small tsunami that caused devastation to the properties and agricultures. In addition, the impact from the lack of strategy and preparation in evacuating the vulnerable populations had cause the problematical circumstances including at the relief centers. This situation can be overcome if the vulnerable populations can be identified earlier especially in terms of their at-risk diversity. The diversity factors also includes the location where they are staying, their mobility level, the type of disease and the type of disabilities.Through this information, the responsible and rescue bodies can formulate the strategic plans to manage these populations in the disaster preparedness. Moreover, flood is an annual incident in Kelantan that needs the proper preparation and mitigation plans. With the appropriate plans and management, the special needs groups will not be spared from the rescue plan. In addition, these groups actually need the relief centers that can accommodate their health needs. Usually, during the flood seasons the vulnerable peoplse with chronic diseases would likely to stay at home due to their difficulties to evacuate with carrying their medical equipments or their bunch of medicines . This condition can be tackled if these groups were sent to the relief centers that equipped with their necessary medical facilities. As a conclusion, the results of this study are expected to benifit the responsible bodies to come out with a proper strategic plan for disaster preparedness by taking into account the needs of the vulnurable populations.

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INTERVENTION GUIDELINES AND MODEL PROGRAM FOR STRENGTHENING FAMILY COMMUNITY RESILIENCE IN TRAUMATIC LOSS AND MAJOR DISASTERS

Project Information

Project Leader	: Professor Dr. Rosnah Ismail
University	: Universiti Malaysia Perlis
Address	: Kangar, Perlis
Contact number	: 0138880770
Email	: rosnah@unimap.edu.my
Project Members	: Ferlis Bullare @ Hj. Bahari (Dr), Puan Jasmine Adela Mutang Shuhairimi Abdullah, Mohd Kasturi Nor Abd Aziz Adila Ismail, Siti Zaleha Ismail

1.0 Introduction

In post major flood disasters management besides assessing psychological impact for survivors, strengthening family and community resilience from traumatic loss after such catastrophic events is important for optimal recovery. With traumatic experiences, the body, mind, spirit and relationships with others can be wounded. The predominant therapeutic models used for treating trauma and survivors of major disaster have been individually focused and pathology based, centred on identifying and reducing symptoms of posttraumatic stress disorder (PTSD), categorized as a mental disorder. A bio-psycho-social understanding of trauma, its treatment, and prevention, including attention to variables that influence vulnerability, resilience, and the course of posttraumatic recovery are deemed necessary. Attention to family and community impact of major flood trauma is essential. Intervention guidelines and model programs assessing disaster resilience and vulnerability among families and communities is a necessary components of effective flood management planning. The aim of the study is to assess the psychological impact of traumatic loss situation, and to develop and implement intervention guidelines and model programs to foster family and community resilience.

2.0 Methodology

Ethical Approval to conduct a study was obtained from the Ethics Committee of the Research Management Center, Universiti Malaysia Perlis.

The study involves phases below:

Phase 1: Initial visit and Pilot study

Initial visit and pilot study were done in selected areas in Kelantan (Manek Urai and Kuala Krai) where 26 families affected by flood disasters were interviewed. Observations look into details on facilities, infrastructures, operations, and procedures; while interviews focussed on experiences towards disaster, and their traumatic experiences.

Phase 2: Quantitative Survey

This phase involved Face-to-face interviews using questionnaire developed from findings of pilot study, and the Resilience Scale™ 14 item by Gail Wagnild & Young, H.M. (1991). 129 respondents in Gua Musang, Kelantan and 116 respondents in Temerloh, Pahang comprising of families, community leaders, and NGOs were interviewed by trained enumerators to investigate the resilience level of the flood disaster victims. Data was analysed using QSRNVivo. From results of the RS-14 survey, the mean ranking score of respondents' resilience level was then categorised by high, moderate and low resilience level.

Phase 3: Focus Groups Discussion (FGD) and In-Depth Interviews

This qualitative research in data collection consists of semi-structured questions designed from output of quantitative survey, personal observation, key informant (community leaders) discussions and public meetings. Participatory approach was used as much as possible to gather insights from different groups of affected communities. A FGD and in-depth interviews was done to 22 selected respondents in Gua Musang, Kelantan, and 25 selected respondents in Temerloh, Pahang who have high, medium and low resilience level.

The qualitative data collected was analysed and coordinated by using computer software QSRNVivo. The data collected using questionnaires was analyzed using SPSS.

3.0 Results and Discussion

Phase 1: Initial Visit and Pilot Study

Through observations we found that resources are limited in the wake of emergency, and recognized that communities need to be on their own after an emergency before help arrives. Thus, they need to build resilience before and after disasters. Following disaster, survivors experiencing grief, guilt and fear. Some of the survivors revealed below:

> S1: “It is the worst trauma I have seen in my 30 years of experience.
> S2: “We are in despair; lost everything and can see no future; we are losing the will to live”
> S3: “I am suffering from nightmares and flashbacks of the wave. I feel guilty of surviving when others did not”.

The psychological impact of the flood disaster was immense for many survivors. Several main reasons for this, namely the loss of family members and friends, loss of homes and material possessions, loss of means for earning a livelihood, dislocation and temporary resettlement in army camps, and the profound uncertainty and loss of a predictable and secure future. As families and communities affected by the flood assess the devastation, try to come to terms with the loss, and begin to rebuild their lives, attention must turn to the future and the inevitable question: how can families and communities recover after such a disaster? Thus, assessing disaster resilience is a necessary component.

Phase 2: Quantitative Survey

Resilience level of respondents in Gua Musang, Kelantan is shown in Figure1.

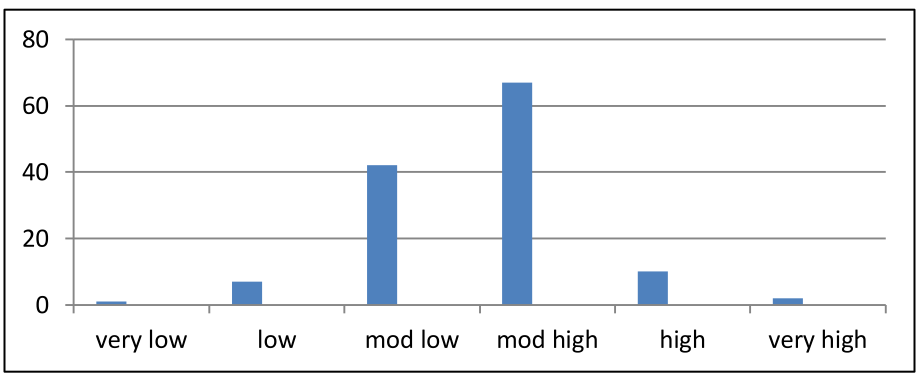

Figure 1**.** Resilience Scale-14 Result-Gua Musang, Kelantan

Figure 1 above shows majority of respondents (84.60%) are between moderate low and moderate high level of resilience, whereas 6.18 percent are very low and low level of resilience, and only 9.30 percent in a very high and high level of resilience.

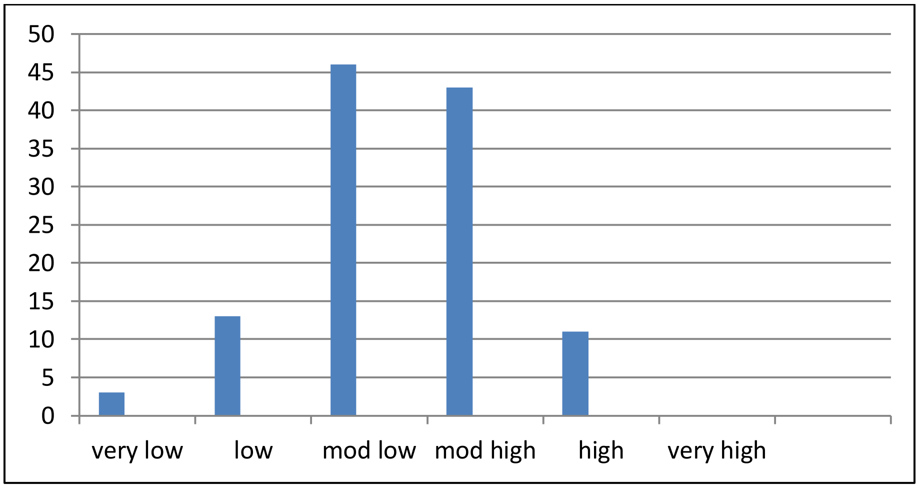

Figure 2. Resilience Scale-14 Result Temerloh, Pahang

Figure 2 above shows majority of respondents (77.0%) are between moderate low and moderate high level of resilience, whereas 13.50 percent are very low and low level of resilience, and only 9.50 percent in a very high and high level of resilience.

Phase 3: Focus Groups Discussion (FGD) and In-Depth Interviews
Findings from FGD and In-Depth Interviews revealed that following disaster, families felt stunned, disoriented, and unable to integrate distressing information. Common themes and responses were:

A) Emotions, Feelings, Behaviour & Thoughts
Victims felt intense or unpredictable feelings such as anxious, fear, overwhelmed or grief–stricken. Repeated and vivid memories of the event were also mentioned. These memories occurred for no apparent reason and difficult to concentrate or make decisions. As one man despaired that he had been unable to hold onto his disabled wife as they fled their home in raising floodwaters. When asked what helps him keep going, he replied, “It’s her inspiration. Her last words to me were ‘Take care of the kids and grandkids.’ It’s hard every minute, every day, but I can do it; her voice and her spirit give me the courage and determination.” Results from the study also found that each survivor’s experience is unique in sources of suffering and resilience depending on level of resilience (low, moderate or high) as some responses gathered below:

> S4: “Feel unsafe; threatened…rain for a longer period as well as loss of human life.” (low resilience)
> S5: “Become strong…continue to live because of children!” (high resilience).

B) Sensitivity to environmental factors
Continuous rains, sirens loud noises or other environmental sensations that stimulate memories of the disaster creating heightened anxiety. These “triggers” may be accompanied by fears that the “stressful event will be repeated.” One of the survivors said:

> S7: “If heavy rain falls continuously, I feel scared, can’t sleep and worry ... now December is coming!”

On infrastructures, facilities and social supports, majority responded during the early disaster phase, the urgent needs are clean water, good, safety and shelter. But in the post disaster phase, the most important is a new build own house and land besides psychological well-being and resilience.

C) Spirituality & Belief System

It is crucial to understand each family and communities belief system, rooted in cultural and spiritual traditions, which influences survivors' perceptions and coping responses to traumatic experiences. After a flood destroyed his home, a father in one family recounted to a researcher:

> S8 : "At first we were in a state of shock and disoriented, at a total loss about what to do...then we dusted ourselves off, took stock of our predicament, and took charge to clear out the debris and figure out options. We just believe in *Allah* and His will! We just kept hugging each other and taking it step by step..." (high resilience).

Other survivors said below:

> S9: "Accepted disasters due to God's willing (*Berserah kepada Allah*), and a test from God… Have strong religion and belief in God." (high and low resilience).

D) Communication

Families and communities need clear, consistent information and circumstances of traumatic events. Traumatic loss triggered a wide range of intense feelings, rage, fear, sorrow, guilt among survivors, with ripple effects throughout kin and community networks. When painful or unacceptable feelings can't be expressed and supported, or when differences are viewed as disloyal or threatening, there is a higher risk of somatic and emotional disturbance, and destructive behaviour. One of survivors revealed below:

> S10:" ...the urgent needs including provision of accurate and timely information, communication and reuniting family members who have been separated..." (high resilience)

High resilience survivors express their feeling whatever ways felt comfortable to them-such as talking with family or close friends. Whereas low resilience survivor became withdrawn, isolated or disengaged from communication with others and from usual social activities. A woman told the researcher:

> S11: "I secluded myself from others...grief, fear, helplessness, anxiety, anger! I don't want to meet my family...I don't want to talk to them..." (low resilience)

E) Social Support and Interaction

Social support is a key component to disaster recovery and resilience. Family and friends can be an important resource. As one of survivors reported:

> S12: "I find support from those who've also survived the flood disaster!" (high resilience).

Support groups are available for survivors. Through group discussions helped the survivors realized that they are not alone in their reactions and emotions. In general, a person or group with low resilience has a high vulnerability as revealed in this study areas, which are poor with limited resources to meet essential needs, indigenous groups who may be socially marginalized; poor socially isolated who may lack support physically and emotionally and large families.

4.0 Conclusion

Based on study, we found that fostering recovery from major traumatic events is gradual process overtime. Therefore, it is essential to facilitate healing and resilience by encouraging individuals, families, and communities to actively engage in the process below:

A) Spirituality Belief Systems
B) Organizational Patterns
C) Communication/ Problem Solving

This research has shown that a number of individual/personal, community and institutional attributes can be used as indicators of resilience. A Model has been developed as shown below:

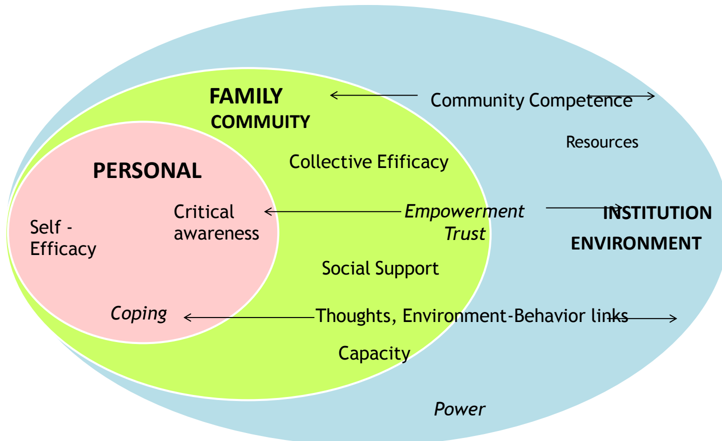

Figure 1. Model Family/Community Resilience after Flood Disaster

The resilience of a families or communities can be assessed on the basis of the following attributes:

A) Elements that support Resilience at an Individual/Personal Level
1. Self-Efficacy-
2. Coping
3. Critical awareness
4. Personal and community support
5. Involvemen

B) Elements that support Resilience at Community Level
1. Community Competence
2. Empowerment
3. Trust
4. Social Support
5. Resources and Skills
6. Environment & shared values

The significant output of this project is Intervention Guidelines and Model Program that has been prepared to foster recovery and strengthen family and community resilience in traumatic loss and major flood disasters.

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KELANTAN VS NEW ORLEANS. A TIME TO LEARN FROM A DEVELOPED NATION

Project Information

Project Leader	: Norafidah Binti Ismail
University	: Universiti Utara Malaysia
Address	: School Of International Studies, College Of Law, Government And International Studies
Contact number	: 04 9288555
Email	: norafidah@uum.edu.my
Project Members	: Nazariah Osman, Mohammad Zaki Ahmad Muhammad Fuad Osman, Mohamed Mustafa Ishak Mohamad Hanapi Mohamad

1.0 Introduction

A post flood disaster management in Malaysia has seen some challenges especially these few months. As threats in this manner are classified as non-traditional security, Malaysia is not fully ready to manage such a crisis when it occurs. The most common disaster crisis that reoccurs are floods and the events that took place in Cameron Highlands and Kuala Krai and some other parts of Malaysia has rung the alarm bells that Malaysia needs to have a workable and effective crisis management policy. Although the government does have such policy in such crisis, for example the Directive No. 20 (Arahan 20 MKN) which basically deals with reactions towards disasters, evidently from what happened in Kuala Krai, the government crisis management machineries were impotent for the first two days of the crisis. Policies concerning the security of public places and government agencies assets were glaringly absence that left vital government buildings such as hospitals, police stations, schools and public halls gone flooded. The research has assessed the reasons for the flaws of existing policies related to post-flood disaster management; and examined whether the existing government's policies tailored to post-disaster recovery management of the developed countries. This research has proposed constructive suggestions and policy recommendations to the government and relevant agencies on how to restore not only services and order but also public confidence to the government when it comes to post-disaster management in the country. Comparison is also made with similar disaster management practices for example from New Orleans, United States incidents.

This research has provided local and international experience and knowledge of post-disaster recovery management. By having such experience and knowledge, the governments, government agencies and public are expected to be more prepared to manage post-flood challenges of repeating flood disaster. Also these experience and knowledge would reduce the risk and catastrophe caused by flood disaster. To meet the research objectives, the researchers have adopted qualitative research method. Enough information concerning individuals, social settings and events have been obtained through the use of a case study research (one of the qualitative approaches). For a data collection, the researchers have benefited both the primary and secondary sources. For a data analysis, the researchers have adopted qualitative coding, identified patterns and compared the cases.

2.0 Methodology

This section begins with a discussion of the key importance of qualitative research method to the study. It will then deal with a case study research that has served as a practical qualitative approach to research post-disaster recovery management.

2.1 Qualitative Research Method

The qualitative research method is the most convenient way to understand specific events, particularly post-disaster recovery management of flood hazards in Kelantan and Hurricane Katrina in New Orleans which is addressed in this research. The qualitative research method has helped the researcher to study human behaviour and the interactions among the people's beliefs, attitudes, and perceptions. It has also assisted the researcher to give answers to the research questions "…by examining various social settings and the individuals who inhabit these setting" (Berg, 2001, p.6).

A Case Study Research (A Qualitative Approach)
One of the qualitative approaches that has been deployed in this research is "a case study research". The purpose of using this approach is 'to retain the holistic and meaningful characteristics of real-life events' (Yin, 2009, p. 4). This approach has also encouraged the researcher to get into a systematic way of obtaining "enough information" concerning a specific individual, group, social setting and event. As suggested by this approach, the researcher has given a strong focus on a particular issue or several issues. (Berg 2001, p.229) Examples of the issues are the two comparative incidents that have been mentioned before: flood in Kelantan and New Orleans. The researcher has chosen the intrinsic case studies. The reason for this selection is to have "a better understand[ing] of a particular case" (Berg 2001, p.229). Also, the case is interesting to study because of its "uniqueness or ordinariness" (Berg 2001, p.229).

2.2 Data collection

Primary Sources
The researchers have adopted an interview as an instrument for a data collection of primary sources. Some leaders, politicians, governments' officials and NGOs workers who have involved heavily in post-disaster recovery management are interviewed. Semi structured interview or in-depth interview have been used in exploring the research topic. This type of interview have encouraged the interviewees to use their own words in delivering ideas and insights. The researchers have learned from the interviewees' perspectives on the mechanism to restore and reconstruct the flood affected zones. During the data collection period, the researcher conducted more than fifteen interview sessions with different background of interviewees.

- *Agensi Pengurusan Bencana Negara (APBN)*
- *Lembaga Kemajuan Wilayah Kelantan Selatan (KESEDAR)*
- *Unit Perancangan Ekonomi Negeri (UPEN)*
- *Perbadanan Menteri Besar Kelantan*
- *Exco Kebajikan Negeri Kelantan*
- *Jabatan Pengairan dan Saliran Negeri Kelantan*
- *Jabatan Kebajikan Masyarakat Negeri Kelantan*
- *Jabatan Kerja Raya Negeri Kelantan*
- *Pejabat Air Kelantan*
- *Tenaga Nasional Berhad*
- *Majlis Daerah Kuala Krai*
- *Yayasan Darul Hijrah (Badan Bukan Kerajaan)*
- *Gabungan Bantuan Banijir NGO (BBNGO)*
- *Some local people of affected areas*

With regard to the numbers of interviews, the researcher believes in a saturation of information: no interview have been conducted should there is a repetition of information. Ellsberg and Heise (2005), argue "…the selection of respondents usually continues until the point of redundancy (saturation). This means that when new interviews no longer yield new information and all potential sources of variation have been adequately explored, sampling may stop" (p.105).

Secondary Sources
Apart from the primary data that will be mostly accessed through the interviews, the researcher have attempted to deal with the secondary data. This includes sources from books, journals, newspapers, conference articles, dissertations, electronic texts and websites.

3.0 Results and Discussion

The section has divided and analyzed the post-flood disaster management in five areas: politics; economy; legal, institution and policy; home rebuilding; and non-governmental organizations (NGOs). Each area has paid much attention on the implications of 2014 mega flood in Kelantan. It also offers some recommendations which could address the difficulties laid in the flood aftermath.

3.1 Political Concerns During and Post Kelantan Flood

Politics and political considerations in the affairs of the public have always given effects to the lives of ordinary people. More over if the state government is not of the same political party as the federal, thus making it more difficult to synchronize and manage political decisions and actions. This symptom was evidence enough during the Kelantan mega floods of 2014 and at times to the detriment of the people. Everything in Kelantan is divided into two systemic level, one of the state government and the other is of the federal government.

The 2014 Kelantan flood was a natural catastrophe, yet it had not been anticipated by any. Although flood and flash flood were rather common to the Kelantanese, the magnitude of the 2014 flood had taken everybody by surprise. However, the political divide between the two forces of state and federal government remained even in the face of the biggest natural disaster that the Kelantanese people faced. From our investigations, we found both parties did manage to coordinate their efforts. However, at times, there were still political considerations preceded the well- being of the *rakyat*. Some observations that the researchers have identified:

1. Lack of coordination between the state and the federal government in accessing the devastation on the ground. Due to the rapid rise of flood levels and the vast affected areas, better coordination between the two parties would have made rescue and post flood activities more synchronized.
2. Lack of communication between the two parties made rescue and post-flood activities either redundant or left behind. For example supplies to the affected areas sometimes only reached the target in the second week of the disaster rather than earlier.
3. The existence of separate entities between the two parties has dichotomized post-flood efforts. This for example was visible in listing the names of eligible victims in receiving post-flood assistance especially in regards to rebuilding and newly build houses which was being based to two separate lists, one by the state government and the other one by the federal agencies. This has created an unbalanced situation and loss of opportunities to both sides and affected post-floods efforts.

The state government claimed that the federal government had not been enough in assisting them especially as events of natural disasters were under the responsibility of the federal government. The federal government, on the other hand, claimed that they were exhausted all necessary means within their ability in assisting flood victims. The lack of coordinated efforts and resources between the two has resulted missed opportunities on both sides. Although some coordinating meetings were held but the efforts and implementation wise were not up to the expected levels especially in dealing with such a big disaster.

3.2 Legal, Institutional and Policy Reforms for the Recovery and Reconstruction of Kelantan's Post-Mega Flood Disaster of 2014

Avoiding the Trap of Sectoral Post-Disaster Reconstruction Approach

Overlapping jurisdictions and responsibilities in planning and executing reconstruction programs and projects among the federal, state and local government have delayed immediate implementation of disaster risk reduction management programs and post-disaster rebuilding efforts in New Orleans. According to Kates et al. (2006):

> The planning efforts and the actions taken to reconstruct New Orleans [one year after Katrina] clearly reflect the pattern of conflicting reconstruction goals. Planning for reconstruction is divided between city, state, and federal government, each assisted by outside advisors and contractors, with distinctive but often overlapping responsibilities and intentions [emphasis added].

For example, conflicts between local and federal authorities over the finalized version of hurricane protection system greatly delayed the system completion and exposed everyone to heightened risk of natural disaster (Kates et al. 2006: p. 14654). In the context of Malaysia, both federal and state government must reach some forms of consensus or agreement to expedite recovery and rebuilding process immediately after the disaster. An effective post-flood disaster management and disaster risks reduction regime is largely premised on coordination mechanisms within and across sectors and with relevant stakeholders at all levels. This would allow an efficient mobilization of assets and men power to implement rescue and relief activities and rebuilding initiative after the flood. The recent establishment of National Disaster Management Agency (or in Malay language, *Agensi Pengurusan Bencana Negara* (APBN)) in September 2015 is a positive step forward by the Malaysian government to have a central federal agency to plan, manage and coordinate the mobilization of assets and human resources during and after the natural disaster.

While the enabling, guiding and coordinating role of federal government remain essential, a prerequisite element for a successful and effective disaster risk reduction and post-reconstruction programs is the engagement and partnership of all stakeholders at different levels, including local indigenous community (Art. 19(d), Sendai Framework for Disaster Risk Reduction 2015–203). It is also necessary to empower local authorities and communities to reduce disaster risk in the aftermath of flood disaster, including through resources, incentives and decision-making responsibilities. To ensure mutual outreach, partnership, complementarity in roles and accountability, federal or state government can provide a clear articulation of responsibilities across public and private stakeholders, including academia and business communities (Art. 19(e), Sendai Framework for Disaster Risk Reduction 2015–2030).

Pursuing Institutional reform for Disaster Management and Disaster Risk Reduction

There was a need for urgent institutional reform for the main federal agency for disaster response - FEMA, after Hurricane Katrina stuck New Orleans. Following the findings made by the Congress and the White House, FEMA failed to learn from the previous natural disasters (e.g. Hurricane Andrew in 1992) and slow to response to the emergency needs of victims in New Orleans and the surrounding areas.

Among the factors contributed to FEMA's response failure during the Hurricane Katrina premised on the fact that the agency lack of clearly, defined leadership roles, outdated or inadequate response plans and inexperienced or under-trained staff. In addition, within the agency's command and control system, there is an absent of an effective communication system capable of sharing information from the ground-up and coordination procedure with onsite disaster responders, resulting the FEMA failed to obtain or track distribution of much-needed supplies like food, water and ice to victims (NBC, 2006).

Hence, it is imperative or the Malaysian government to have the political will in introducing not only a central agency dedicated for flood disaster management and risk reduction, but also an agency with a developed flood response systems. The functional scopes of the system – similar to the one recommend to FEMA, encompass, among other, better tracking of supplies, registering victims, approving debris removal contracts and creating disaster teams to give the agency a real-time picture of unfolding emergencies (NBC, 2006).

3.3 Economic Impacts of Mega Flood

Economic crises and natural disasters have been a recurrent phenomenon in developing countries. Droughts, floods, hurricanes, tropical storms, landslides, earthquakes, volcanic eruption and El Nino episodes are peculiar examples of these type of grievance shocks. Among them were 1995 and 2002 financial crisis in Argentina, the effects of El Nino on Philippines and Indonesia, the 1998 currency crisis of East Asia, and the more recent cases of earthquakes in Iran, China and 2011 mega flood in Thailand. Apart from these multitudes, the frequency and severity of these events seems to be on the rise (Von Braun et al, 2002). The Centre for Research on the Epidemiology of Disasters reported a clear increase in the number of natural disasters were probably due to changes in global climate. The aftermath of a natural disaster poses a monumental challenges to local officials. Homeless citizens need replacement housing. Water, sewer and other public services and utilities must be restored to maintain public health and to support other recovery activities. Local businesses need to be established to restore the local economy. The same general trend seems to be presence for the end of 2014 mega flood in Kelantan.

In order to obtain a better perspective on how economic crisis and natural disasters may affect household welfare, a series of field visits were conducted to obtain information on the crises. Natural disasters such as floods, drought, earthquakes, and other weather related phenomena can affect household welfare through the destruction of physical and human capital stock. The 2014 mega flood of Kelantan brought in several magnitudes. There was over 140,000 residents given temporary shelters in schools, mosques and community halls. It was reported that 1823 houses were totally damaged while 8375 houses required major repairs. It was also reported that apart from residential houses, the other premises affected were schools, community centers, mosques, government offices, shops and commercial premises. It was estimated that over RM120 million is required for repair works of government premises.

In addition the flood also brought damages to infrastructure facilities. For instance there were 384 roads and bridges were damaged with an estimated repair cost of over RM28 million. The train services from Kuala Lumpur to Tumpat were temporarily closed due to severe destruction of one of the bridge in

Dabong. The areas that were heavily affected by this flood were the low lying areas along the main Kelantan river basin. It was estimated that the accumulated losses from this mega flood was over RM1.0 billion (UPEN Kelantan, 2015)

Before we moved into the analysis of the impact of the mega flood to the State of Kelantan, it is proper to look into her economy. Traditionally, Kelantan main source of economic activities were in agriculture, trade, manufacturing and services. Prior to the mega flood, Kelantan managed to register positive growth in her gross domestic product at the rate of 3.5 % annually since 2000. The GDP for Kelantan was RM 13963 for 2014 (Department of Statistics 2015, Malaysia). Though the rate of growth in GDP is lesser compare to the national average, the dimensions of growth is some sectors were remarkable. The notion that Kelantan folks are fond in small business enterprises are fully demonstrated in their trading activities. The growth in trading such as wholesaling, retailing, hospitality was fairly significant. These activities contribute almost 50% to the service sector of her economy. The overall service sector registered RM 8592 million which was 61 % of her in state GDP. Similarly, agriculture sector was another backbone of the state economy accounting to RM 4983 million which is about 35 % to her total GDP of Kelantan which was somewhat far better to some other states. The other sectors notably construction and mining were fairly small with the exception of manufacturing, utility, transport, storage and communication. The latter sectors accumulated RM 2706 million to the overall GDP in 2014.

A distinguishing future that can be noticed from the present crisis was the inadequacy of flood mitigation programs. The state of Kelantan received heavy seasonal monsoon rain during the end of the year. The nature of the rain can become extremely heavy in certain years and become vulnerable to floods. The case of mega flood in Kelantan was also caused by heavy torrential rain that fall continuously for 48 hours in the southern part of Kelantan. In spite of regular monsoon season occurs in Kelantan they were a minimal efforts to face floods of any levels. Ironically, they were minimal flood preventive and recovery programs. In was noted that the number of rescue boats were very few in every district. Also they were a marked absent of proper mitigation such as reservoir, water catchment and artificial river channels.

Another noticeable feature of current crisis is that it may create a slowdown in economic activity that usually translates to a decrease in demand for labor services, a decrease in the probability of finding new employment, an increase in unemployment rate and a decrease in the level of earnings of individuals already employed. The other probability is the likelihood to have changes in relative prices or the removal of subsidies for staple food such as rice or the changes of value of assets. The other distinguishing feature of the present crisis is that they may affect many households simultaneously. For example, when aggregate demand and employment falls, being member of an occupational group can be of little help when most of the members of the same occupation are also affected negatively by the crisis. Along similar lines, natural disaster affecting whole villagers or even region may put significant strains on local government or local authorities. Another alarming cases were people of poorer household who are typically less equip to deal with crisis such as who have serious limitation to cope with crisis. In the absent of in affective public measures to deal with crisis such as nature disasters, poorer household may ultimately not be able to escape from poverty. Given this level of uncertainty, the incidence of poverty among the households become increasing visible.

A community with a high degree of interdependent has a tightly knit social network among local organization. The community is a true system of interdependent parts. It is viable with locally based problem solving entity. These scenario is quite invisible in the case of Kelantan where the issues of national crisis is in the prerogative of the federal government. This inherent differences create difficulties and may cause the implementation of some of the policies become a fairly fragile.

Communities need to initiate collective action soon after the impact in order to facilitate the timely equitable distribution of aid and to prevent the loss of significant opportunities. A key set of action involve local redevelopment planning. In the case of recovery actions, there appear a clear manifestation of hopes. Natural disasters such as mega floods may provide clearer opportunity for government development agencies. These opportunities offer local government to strengthen organization capacity to facilitate economic, social and physical development. While during the implementation periods, the various agencies is able to examine the multiple benefits that arise during the developmental recovery period.

One of the important dimension in the recovery program is the opportunity to alter physical development patterns to reduce future hazard vulnerability. Support for hazard mitigation is typically strongest immediately following disasters. With appropriate construction, repair, and land use standard, a rebuilt community can be at lower risk to future disasters, compact to pre-disaster condition. Moreover, long standing community problem can be resolved through reconstruction. For example, increasing the affordable housing for the poor, improving traffic circulation, expanding open space for park and recreation, modernizing public facilities and stimulating the local economy.

3.4 House reconstruction requires a coherent strategy

A lengthy and confusing registration process for new homes

It was slightly confusing at the beginning of registration process for those who entitled to get new permanent homes. The list of names for registration that compiled by JPP Village Headman (*Ketua Kampung JPP*) was different to that of the list of names recorded by State's Village Headman (*Ketua Kampung Negeri*). Also, some registered names constituted in the two lists were the same people. The two lists were then assessed and a new list of names was drawn up. This list was agreed by the two Village Headmen and Chief of State. It was also gained a consent from the State Government.

The Land Office sent the list to the Malaysian National Security Council (NSC) [*Majlis Keselamatan Negara (MKN)*] which was responsible for approving the proposed owners for new homes. When the National Security Council (NSC) endorsed the list, the Rural and Regional Development Ministry was responsible to identify the contractors who would engage in the restoration of damaged houses. Applications for new permanent homes continued even after a year of flood disaster. One common reason was the missing names from the existing list. This situation would not happen if the registration process at sheltering centres was made only for a specific duration, for instance, one or two weeks. (Syafiq 2016)

Changing on home project schedule

Home projects failed to complete on time. The deadline, for instance, has been extended from end of 2015 to March 2016. (Syafiq 2016) Building home was behind its schedule due to several reasons: insufficient documents and information related land ownership and a difficulty to access the settlement of disaster residence. There was a limited route to reach the settlement and the cost of transporting man power and construction materials by boat was high.

Works Minister, Fadillah Yusof, seemed to be outraged by the delay in completing the construction of permanent houses. To him, issues of land availability hindered the State Government from locating land that had been acquired by the Work Ministry to build 814 new houses. The Minister highlighted the initiatives taken by the Federal Government to resolve these issues. He stressed that the Federal Government had purchased private land and used the federal land in Kelantan which had not been utilized for any development. (Babulal 22.8.2015) Abdul Fatah Mahmood, the Chairman of State Local Government, Housing, Environment, Youth and Sports Committee responded to the statement made by the Work Minister. He called any rising issues should be discussed at Post-flood Development Joint Committee which represented by Ahmad Yakob (Kelantan's Chief Minister) and Mustapa Mohamed (Kelantan UMNO Liaison Committee).

National Disaster Housing Strategy (NDHS)

The commitment given by the Congress enhanced FEMA's authority and ability to tackle housing issues. The Congress released an enactment, Post-Katrina Emergency Management Reform Act, P.L. 109-295, in October 2006. It called FEMA to set up a National Disaster Housing Strategy. NDHS has two general objectives. Firstly, it reveals the way American nation providing home to disaster victims. Secondly, it explains further steps to improve the nation's efforts of addressing the needs of disaster communities. NDHS has six goals:

1. Support individuals, households, and communities in returning to self-sufficiency as quickly as possible.
2. Affirm and fulfil fundamental disaster housing responsibilities and roles.
3. Increase our collective understanding and ability to meet the needs of disaster victims and affected communities.
4. Build capabilities to provide a broad range of flexible housing options, including sheltering, interim housing, and permanent housing.
5. Better integrate disaster housing assistance with related community support services and long-term recovery efforts.

6. Improve disaster housing planning to better recover from disasters, including catastrophic events. (National Disaster Housing Strategy, 2009)

Cooperation among those who involve in housing effort is crucial. This could ease the disaster victims (individuals, households and communities) to address their housing needs and become self-sufficiency at the quickest possible. All organizations involved must comprehend and accomplish their responsibilities and roles of housing efforts. Their role in housing activities should be consistent with the National Response Framework and the National Strategy for Homeland Security which focuses on the basic response of disaster and recovery responsibilities. The organizations must understand and fulfil the needs of disaster victims, for example, disabled persons who need medical equipment and assistive technologies for survival. These needs could determine housing choices and housing assistance. The organization should develop their capabilities in housing efforts. For examples, they need to have "toolkits, planning templates, and grant funding". (National Disaster Housing Strategy, 2009)

3.5 The Roles and Contributions of the Non-Governmental Organisations (NGOs) in the Post-2014 Kelantan Flood Disaster

The post-flood aftermath or locally known as "*bah kuning*" witnessed a massive NGOs' engagement in assisting the flood victims in most affected areas, namely in Kuala Krai, Gua Musang, Kota Bharu, Pasir Mas, Tanah Merah, Tumpat and Machang . Among those NGOs involved in restoring and rebuilding the affected zones were MERCY or Medical Relief Society Malaysia, IKRAM Malaysia, Islamic Relief, DarulHijrah, *Khazanah Yayasan* (linked to *Khazanah Nasional*), *Pertubuhan Bantuan Bencana* (BBNGO) and few other international NGOs. Kelantan received a high volume of relief and assistance in the forms of food, cloth, shelters, cash donation, volunteers, experts, local and international donors including multinational corporations (MNCs) and individual countries (government-to-government relations) which includes Thailand, Indonesia, Japan, China United Kingdom etc. Yet, criticism arose on matters related to the distributing process of flood relief and assistance: uneven distribution of aid to the victims. One of the many reason was a lack of coordination among those NGOs which actively involved helping the flood victims to lessen the impacts of flood disaster. The NGOs worked independently without a proper order and guideline in distributing aid to the victims. There were incidents where victims had claimed that in some areas goods and aid were distributed abundantly whereas in other places these assistances had been delayed. Indeed, the late receiving of critical goods, such as food and clothing, was due to a handicapped delivery of information between the NGOs and government agencies. Another factor was a sudden increase of water level which led to road closure. This situation made it impossible for the rescue teams and NGOs to reach those flooded locations. In this manner, the researchers would strongly recommend for all NGOs to work hand-in-hand with both state and federal governments should this worst flood ever struck in the future.

Considering the above problem, having an updated database is essential in ensuring a smooth running of post flood relief work. Therefore, it is a high time for NGOs and relevant government agencies, in particular the Malaysian National Security Council to seat down and works seriously in establishing a reliable management system or database to address the above-mentioned problem (i.e a lack of coordination between the two parties). No doubt, a minimal interaction and cooperation did exist between NGOs and other parties (government agencies and state and federal governments) throughout the flood period but also aftermath the flood disaster. No doubt all parties did not expect such a big scale flood will struck Kelantan badly and it is believed to be the worst flood ever to hit the state in comparison with the previous big floods which hit Kelantan in 1926; 1967 and 2004.

Besides that, one of the major challenges identified by the local NGOs is the bureaucratic rules especially in dealing with the *Pihak Berkuasa Tempatan (PBT)*/ Local Municipal Council related to those victims who lost their land grants during the flood disaster which delayed the process of rebuilding new houses for the victims with total lost. The Local Municipal Council failed to treat this kind of flood victims' cases as something that needs to be dealt with urgently. For instance those victims were treated like any other ordinary client who lost or misplaced their land grants. As a result, few numbers of NGOs who were willing to finance rebuilding some houses for the victims had walked away due to complicated rules and regulations imposed by the Local Municipal Council. However, a lesson learnt from this severe disaster has urged some NGOs to produce a manual that can become a useful source of reference not only for the victims but also for those who will be involved in flood rescue operations (i.e search and rescue teams as well as volunteers). Finally, as the roles and contributions of NGOs and volunteers in the last Kelantan flood disaster is undeniably significant, it is crucial for the authority (the federal and state governments) to initiate a comprehensive training which involved the “pre, during and post” flood disaster rescue operations for these groups to uplift and enhance their efficiency and performances in case if such a huge magnitude of flood ever occurred in the future, not only in Kelantan but also in the other part of the country.

4.0 Conclusion

4.1 The federal and state governments relatively managed to coordinate the relief efforts. At some occasions, however, political considerations and interests preceded the well- being of *rakyat*.

4.2 The flood victims were facing with the worst natural disaster, yet the political divide between the federal and state governments significantly remained.

4.3 Both federal and state governments must reach some forms of consensus or agreement to expedite recovery and rebuilding process immediately after the disaster. An effective post-flood disaster management and disaster risks reduction regime are largely premised on coordination mechanisms within and across sectors and with relevant stakeholders at all levels.

4.4 The recent establishment of National Disaster Management Agency (*Agensi Pengurusan Bencana Negara* (APBN)) in September 2015 is a positive step forward by the Malaysian government to have a central federal agency to plan, manage and coordinate the mobilization of assets and human resources during and after the natural disaster.

4.5 The 2014 mega flood of Kelantan brought in several magnitudes. It was reported that 1823 houses were totally damaged while 8375 houses required major repairs. It was also reported that apart from residential houses, the other premises affected were schools, community centers, mosques, government offices, shops and commercial premises. It was estimated that over RM120 million is required for repair works of government premises. In addition the flood also brought damages to infrastructure facilities. For instance there were 384 roads and bridges were damaged with an estimated repair cost of over RM28 million. The train services from Kuala Lumpur to Tumpat were temporarily closed due to severe destruction of one of the bridge in Dabong. The areas that were heavily affected by this flood were the low lying areas along the main Kelantan river basin. It was estimated that the accumulated losses from this mega flood was over RM1.0 billion (UPEN Kelantan, 2015)

4.6 Another noticeable feature of current crisis is that it may create a slowdown in economic activity that usually translates to a decrease in demand for labor services, a decrease in the probability of finding new employment, an increase in unemployment rate and a decrease in the level of earnings of individuals already employed.

4.7 Natural disasters such as mega floods may provide clearer opportunity for government development agencies. These opportunities offer local government to strengthen organization capacity to facilitate economic, social and physical development.

4.8 Home rebuilding in the post-flood disaster in Kelantan has undergone a number of serious challenges. A slight confusion has occurred at the beginning of registration process for those who are entitled to get new permanent homes. Another challenge is a failure of home projects to complete on time. A deeper understanding on National Disaster Housing Strategy (NDHS) which has been introduced in the United States is expected to overcome these challenges.

4.9 It is a high time for NGOs and relevant government agencies, in particular the Malaysian National Security Council to seat down and works seriously in establishing a reliable management system or database to address the problem of lack coordination between them. No doubt, a minimal interaction and cooperation did exist between NGOs and other parties (government agencies and state and federal governments) throughout the flood period but also aftermath the flood disaster.

INTEGRATED GOVERNANCE APPROACHES TO FLOOD DISASTER MANAGEMENT IN MALAYSIA USING RISK REDUCTION TOOLS LEADING TO SUSTAINABLE DEVELOPMENT

Project Information

Project Leader	: Dr Mohd Sayuti Hassan
University	: Universiti Sains Malaysia
Address	: Centre for Global Sustainability Studies, Univrsiti Sains Malaysia, 11800, Pulau Pinang
Contact number	: 019-4491122
Email	: sayuti@usm.my
Project Members	: Profesor Dr Kamarulazizi Ibrahim, Profesor Dr Kanayathu Chacko Koshy Dr Suzyrman Sibly, Dr Ng Theam Foo Dr Noor Adelyna Mohammed Akib

1.0 Introduction

Disaster risk reduction depends on well-coordinated governance mechanisms across sectors and at all levels. Without good governance, a disaster will increase people's standard of vulnerability and will make disaster risks more powerful and frequent. According to the UNDP report entitled Reducing Disaster Risk: A Challenge for Development, "appropriate governance" is fundamental to reducing disaster risks. Therefore,monitoring and evaluating the effectiveness of governance systems in reducing disaster risk require data on the state of the society, the environment, and human actions are needed. In addition, these activities require the development of benchmarks and measures such as indicators or composite indicators.

As for the case of Malaysia, an assessment is crucial to ensure the effectiveness of current policies and proxies in reducing disaster risks, to identify best practices and gaps in its implementation, and to explore data and resource availability for continuous risk reduction efforts. In methodological terms, this assessment is important to direct the thinking on the analysis of the disaster risk governance issues such as the main lessons learned from recent experiences with regard to flood disaster governance, and the necessary requirements needed to deliver a sustainable development-DRM system.

Using the Kelantan flood of 2014 as case in point, generally, this research project determined the effectiveness of current policies and praxis are, identify best practices, gaps in implementation, and explore data and resource availability for continuous risk reduction.There are two specific aims are focused in this case study; (i) Investigate the sectoral and non-sectoral management of flood disaster with a view to assessing their coherence in terms of coverage and implementation of disaster risk management in Malaysia, especially in the floods which affected the Kelantan state at the end of 2014, and (ii) Assess the knowledge and practice on flood disaster preparedness and response among communities in Kelatan. This study will look into many issues, one of which is the issue of flood disasters as being viewed more in the context of emergency responses rather than in the context of preplanned response or preparedness measures.

2.0 Methodology

The theory construction of this study is guided by the methodology of the case study of Kelantan flood disaster in the end 2014, which involves standard social science methods, namely document analysis, interviews and questionnaire survey. The specific research design of the this study is outlined as follows: *Objective 1:* Through document analysis, data and relevant information on governance and various initiatives undertaken by the government and private agencies in their effort to manage the flood disaster risk reduction in Malaysia were gathered. Meanwhile, in-depth interviews were conducted with major stakeholders involved in the disaster risk management on flood disaster in Kelantan. These interviews intended to examine the existing strategies and action plans, practices, gaps in implementation, resource availability and to explore prospects for strengthening institutions to manage flood disaster and improve socio-economic conditions in Kelantan. Besides, the interviews investigated the effectiveness of current policies and practices when faced with flood disaster, with the focus placed on the issue of governance. The survey included 300 villagers (Fifty respondents from each village) as the study sample using a structured questionnaire in order to assess the current level of knowledge and practice on disaster preparedness and response. The questionnaire consisted of 24 questions on demography, respondents' knowledge, and practice on flood preparedness, prevention, response, and recovery. The scope of the study was limited to getting information about their knowledge, practice, flood preparedness, and flood response. The area of the study consisted of six villages.

3.0 Results and Discussion

3.1 Objective 1

Several critical issues, challenges and strategic plans have been identified through the interview surveys conducted among government agencies and departments involved in disaster risk management as follows;

- The Forestry Department of Malaysia is often blamed whenever flood occurs. However, the fault also lies on state government for allowing forest exploration for farming, which constitutes an anthropogenic factor (man-made factor) that can cause flood occurrence. Other main factors that contribute to flood disaster are climate change and high rainfall. Notably, from the data observation by Department of Irrigation and Drainage, high rainfall was identified as the main contributing factor to the unpredictably massive flood that occurred, especially in Kelantan. Research findings through modelling method by the National Hydraulic Research Institute of Malaysia (NAHRIM), on the other hand, found that compared with the Red Flood (*Bah Merah*) that occurred in 1970, no significant difference in the amount of rainfall were seen in both floods. This means that flood incidents will still occur, regardless of whether land exploration was carried out or not in Kelantan. Local residents ignored early flood warning released by the authorities, thinking that the flood would not be worse off than what they expected or what they have experienced in past floods. This situation mimics the tsunami tragedy in 2004 when locals did not expect such a big wave would hit them after the sea water receded suddenly. However, in that case, local residents learn from past experiences and act earlier in case they receive warning signs.

- Following the recent flood disaster, still there was no proposal to relocate the affected agricultural areas to less risky areas. Even if there is such a proposal, the challenge is too huge, especially when it involves agricultural areas of private land ownership (inheritance) and state land. However, the proposal could be examined from the point of practicality. The Ministry of Agriculture and Agro-based industry has opened four granary areas in Pekan, Rompin, Batang Lupar, and Kota Belud to increase the level of self-sufficiency and to ensure the continuity of the country's food supply. To achieve that goal, various aspects such as the suitability of the land, the introduction of new agricultural technologies and climate change need to be considered. The development of infrastructures in the new agricultural areas will also involve high investment which may cost hundreds of million ringgit.

- In Malaysia, government procurement is limited to natural resources and assessment payments. Since infrastructure is the responsibility of the federal government, the allocation for infrastructure repairs is distributed through grants. Another allocation of RM800 million was approved for the rehabilitation and reconstruction of houses that are damaged or destroyed. Nevertheless, the disaster victims complained that the process of compensation was too slow. This could occur due to a weakness in the structure and system of aid distribution between departments of the federal and state governments, non-governmental organizations and certain companies that wished to extend their help. In addition, social issues such as attitudes of the people and land tenure issues are likely to contribute to this problem. Therefore, a good coordination system is very important.

- From time to time, the JPAM also conduct research on highly risked areas for the possibility of disaster threat occurring in the areas. Besides that, collaboration with other departments involved in structural measurements such as the Meteorological Department and the Department of Drainage and Irrigation are held to facilitate collection of empirical data; through such collaborations, more accurate and objective assessment or prediction can be made.

- Restoration of public utilities such as water supply is one of the main issues to be addressed urgently in a disaster. Thus, collaboration with the state government and local authority is crucial. In terms of helping the local residents to recover economically, JPAM provides help depending on request from any responsible departments, for instance, a request from a farming area for technical help in cleanup services. The Department of Agriculture and Agro-based Industries should conduct a meeting with rescue agencies about co-ordinating requests for assistance. In the aspect of natural environment recovery and care, the particular department should also make a request if they need to use the services available at JPAM.

- It is only recently that KEMAS's Kindergarten (TABIKA, acronym for Taman Bimbingan Kanak-Kanak) has received a Standard Operational Procedure (SOP) with regard to measures to be taken in case of flood. The SOP specifies that kindergartens located at low areas prone to floods must be ready to be evacuated to higher and safer grounds together with their valuable assets. The procedure was developed as a result of lessons learned from previous floods that have forced the department to incur massive losses. Besides that, the SOP regarding their budget has been planned and continuously improved year by year. KEMAS Department's special rule regarding natural disaster is always improved and the main focus given is on the maintenance and protection of TABIKA buildings. During the recent disaster, the existing SOP has been used to apply for allocation and to collect fund. The collected fund was later distributed. Allocation for recovery, on the other hand, takes up a significant amount of time to be channelled to flood victims.

- For repair works, priority is given to main roads and areas badly damaged by the flood. For repairs of underground utility systems such as electricity and water supplies, companies involved in repair works should obtain permission or special permit from the Public Works Department (JKR). The Ministry of Works (KKR) has appointed a few concession companies for maintenance work and federal road repairs. Advice for commencement of work will be issued directly to these companies. Submission of tenders for quotation is not needed in this process. Hence, bureaucracy is avoided and implementation process would be much faster. However, execution period depends on the level of damage suffered by the infrastructure. Other ministries need to apply for their own allocations to repair their damaged buildings. However, their applications have to be channelled through KKR for approval.

- In the Ministry of Agriculture and Agro-based industry, flood prevention measures are still lacking or weak. Nevertheless, the Ministry is in the process of discussing on their efforts to provide an appropriate SOP. There was a proposal that the Ministry to emulate the procedures that have been adopted by the Chukai and Kemaman district in Terengganu. However, they need to adapt and modify those procedures from the highest administrative level, up to the implementation level so that they are appropriate to the various sectors of the Ministry. This is because the SOP used in the two districts has been characterized as excellent and holistic

From the experience of the Kelantan's worst flood in 2014, the Malaysia government has made improvements to its disaster management system. Lessons learned from the problems faced in managing this flood have caused the government to plan short- and long-term measures to handle future flood situations. Discussions were held among all relevant stakeholders. In these discussions, a number of urgent issues were identified and solved, especially those needing urgent attention. The aim was to strengthen Disaster Risk Management in Malaysia, particularly in Kelantan. Thus, the government should needs to learn from the situation. For the future, the government should prepare a proper plan parallel to the global sustainability plans and disaster framework actions. Clear guidelines are already specified in the MKN's Directive No. 20. A disaster control centre has to be established based on the criteria and assessment made by the responsible officers in the disaster committee. In terms of planning and logistics, every rescue agency relies on the directive from Malaysian National Security Council. During a disaster, all directives are to be given by MKN. In discussions before the occurrence of a disaster, delimitation of areas of responsibility has been determined by MKN and district or state disaster committees. These responsibilities were determined after considering the ability from rescue agencies in terms of logistics and workforce as well as the density of the local population involved.

3.2 Objectives 2

The overall second objective of this study is to assess the knowledge and practice on flood disaster preparedness and response among local communities. In term of flood knowledge, 44.67% of the respondents knew about flooding. Flood is an annual event for them, but the 2014 flood was none like previous floods. Furthermore, 29.67% of respondents answered they were not sure with their knowledge on flood, 9.67% said they have a good knowledge, 9.00% had few knowledge and the remaining 6.67% had no knowledge about flood. Tthe result of the questionnaire on the residents' agreement to the statement "Possess knowledge on the importance of cooperating with each other to solve flood issue." On this response, 48.7% of them said they agree with the statement, 28.0% respondents were not sure, 11.30% did not agree, 9.7% strongly agreed and the remaining 2.3% strongly disagreed. In the context of preparation to face flood, the resulst shows that 18.33% respondents stored enough food before flood occurred, 16.00% focused on keeping important documents at a secure place, 12.67% said they stayed cautious during heavy rainfall and 10.00% of them said they keep their belongings and vehicles at a safe place or location as a preparation to face flood. Meanwhile, when the flood occurs, 25.33% of the respondents said they would move to a safe place, 11.33% said they would ensure the safety of the family and their own self, 8.67% listened and followed orders from the authority, 8.00% took care of the safety and health, and lastly, 6.67% said they would save family members first.

Preparedness includes suggestions to providing updated database information to staff, providing training to encounter flood disaster, ensuring equipment needed for disaster to be in a ready-to-use condition, allocating annual fund for encountering disaster, expanding Government Integrated Radio Networking (GRIN), ensuring power bank stock for mobile phones to exist at locations frequently affected by flood, building electrical substations at suitable locations with wider coverage by Telco, improving and revising the specifications and capacity of equipment that can withstand disaster, determining the adequate number and capacity of stand-alone generator to generate electricity at appropriate locations and build all plant utilities at higher locations. On the other hand, response includes suggestions of limiting the number of flood victims at every evacuation center, ensuring the safety of flood victims as well the rescuers (for example, safety from dangerous animal threat and electrocution), establishing better information sharing system between agencies involved, conducting regular media briefing to the public through various media channels during the occurrence of a disaster, executing a system of "Freeze Leaves" to all responsible agencies, providing mobile tankers, static tanks, having a treated water drinking system and supplying mineral water, giving the authority and power to State Operation Room Health Director to determine and decide on critical victims for evacuation process, monitoring the safety of premises and properties, providing space and partition wall to separate every family and gender at evacuation centers, and using electricity wisely at all evacuation center

4.0 Conclusion

4.1 The findings of this study will provide significant ideas and contributions for the Malaysian government in the following contexts: (a) substantial reduction of disaster losses, in terms of lives and in terms social, economic, and environmental assets of persons, and communities, (b) progressive creation of disaster risk prevention and the reduction of the existing disaster risk through economic, social, cultural, environmental legislative measures which address exposure and vulnerability, and thus strengthen resilience, (c) regulatory and financial empowerment of local action and leadership in disaster prone areas by local authorities, institutions, volunteer groups, communities, and indigenous people, and (d) active engagement in the global and regional platforms for DRR, and effective multi-stakeholder mechanisms to forge partnerships

4.2 This study suggests that proper and suitable actions taken in facing flood disaster can reduce the risk of losing lives and destruction of properties. This study also finds that the knowledge and practices of the communities in relation to disaster preparedness and response are inadequate. To improve this knowledge and awareness the communities prone to flooding must be given exposure to flood disaster management. This will then help them to develop interest in the issue in the future.

4.3 With regard to the flood situation in Malaysia, the nation is in need of more programs such as the Community Disaster Preparedness Programmes and Community Disaster Response Programmes. Malaysia needs to train the community, especially those living in flood areas. According to Lechat (1990), the basic aim of the International Decade for Natural Disaster Reduction (IDNDR) is to further encourage the recent trend in disaster management. There is a need to change the planners' perspectives from implementing a reactive strategy of postdisaster improvisation, which relies heavily on relief aid, to a more proactive strategy of predisaster planning and preparedness.

4.4 Sentiments and attitudes of communities toward government and national disaster management are critical element needs to be concern. There is a general reluctance among the flood victims to accept that tragedies may occur any time due to a flood disaster. Unfortunately, flood disasters are seen more in the context of emergency responses rather than as measures taken in preparedness. Disaster preparedness and responses provide a platform for designing effective, realistic, and coordinated planning, and reducing duplication of efforts as well as increasing the overall effectiveness of community disaster preparedness and response efforts of national societies and households. Hence, knowledge about flood disaster preparedness and response is essential for all flood victims.

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APLIKASI MODUL RAWATAN ACT DALAM PROSES TOLONG BANTU MANGSA TRAUMA PASCA BENCANA

Project Information

Project Leader	: Prof. Madya Dr. Faizah Bte Abd. Ghani
University	: Universiti Teknologi Malaysia
Address	: Fakulti Pendidikan, UTM
Contact number	: 019-7710249
Email	: faizah-ag@utm.my
Project Members	: Prof. Madya Dr. Farahwahida Yusof, Prof. Madya Dr. Hamdan Said Dr. Megat Aman Megat Zakaria, Dr. Shaharudin Dr. Mastura Mahfar, Faizah Hayati Haron Normaliyawana Sulaiman

1.0 Introduction / Pengenalan

Kesan bencana boleh mempengaruhi kehidupan seseorang dari aspek mental dalam menghadapi cabaran kehidupan. Latihan model ACT dijalankan bagi membantu mangsa-mangsa banjir yang mengalami PTSD. Ia merupakan satu bentuk latihan dalam membantu mangsa pasca trauma bencana yang trauma. Model ini dianggap sesuai kerana perlaksanaan rawatan yang diberikan mengambil kira aspek kehidupan merangkumi pemikiran, tingkahlaku, emosi, spiritual dan sosial (Roberts, 2005). Latihan model ACT memerlukan tiga sesi bimbingan kelompok yang mengandungi 17 aktiviti. Ia dijalankan selama 4 hari. Tiga sub modul telah dibina iaitu modul

Assessment, Connecting With Others dan Treatment. *Assessment* merangkumi penilaian dari aspek keperluan perubatan segera, ancaman keselamatan awam, kerosakan harta benda dan aspek yang paling penting iaitu kesan psikologi ke atas mangsa pasca bencana. *Connecting with others* adalah proses dimana menghubungkan mangsa pasca bencana kepada kumpulan-kumpulan tertentu apabila mangsa terpisah contohnya ahli keluarga, pihak bantuan bencana dan sokongan sosial serta melaksanakan *Critical Incident Stress Debriefing* (CISD). *Treatment* iaitu pengendalian kesan kesihatan mental selepas bencana. Antara rawatan yang berkesan ialah rawatan menggunakan kaedah Rational Emotive Behavior Theraphy (REBT), Cognitive Behavior Theraphy (CBT), Self Report and Sharing (SRS), Spiritual Emotional Freedom Technique (SEFT), relaksasi dan kaedah rawatan kelompok. Sehubungan dengan itu, kajian ini direalisasikan bagi menghasilkan satu aplikasi modul Rawatan ACT dalam Proses Tolong Bantu Mangsa Trauma Pasca Bencana.

2.0 Methodology / Metodologi

Kajian yang dijalankan ini merupakan gabungan kajian kuantitatif dan kualitatif. Ia melibatkan kajian secara deskriptif dan kajian kes. Menurut Gay, Mills dan Airasian (2009) gabungan kedua-dua jenis kajian ini boleh membentuk kekuatan dan kuasa di antara kaedah kualitatif dan kuantitatif untuk memahami keseluruhan fenomena berbanding dengan hanya menggunakan mana-mana satu kaedah sahaja. Soal selidik telah digunakan sebagai instrumen kajian di mana soal selidik *Depression Anxiety Stress Scales (DASS) 21* yang dibina oleh Lovibond (1995) digunakan bagi mengukur samada responden mengalami *depression, anxiety dan stress* atau sebaliknya, manakala soal selidik *Posttraumatic Stress Disorder (PTSD)* yang dibina oleh penyelidik digunakan bagi mengukur samada responden mengalami *Posttraumatic Stress Disorder (PTSD)* atau sebaliknya. Soalan semi struktur dan terbuka menerusi temubual kepada responden juga digunakan bagi mengenalpasti bentuk sokongan yang diperlukan oleh responden. Kajian rintis telah dijalankan kepada 110 responden di kawasan yang pernah terlibat banjir di kawasan Kota Tinggi, Johor Bahru dan Segamat. Kesahan pakar dilakukan bagi menentukan sama ada kandungan soal selidik benar-benar boleh diuji berdasarkan konstruk yang hendak diukur. Bagi soal selidik ini, kepakaran dari bidang psikologi, pakar bimbingan dan kaunseling dan pakar penilaian dan pengukuran diambilkira sebagai pakar yang layak dalam membuat penilaian kesahan soal selidik. Nilai kesahan bagi soal selidik *Posttraumatic Stress Disorder (PTSD)* yang diperolehi daripada pakar ialah 0.7, ini menunjukkan pandangan pakar mengenai kesahan kandungan soal selidik ini adalah tinggi.

Seramai 262 responden akan terlibat sebagai sampel kajian yang dipilih berdasarkan teknik pensampelan rawak mudah. Bagi daerah Gua Musang, terdapat empat lokasi tempat kajian iaitu Kem Bandar Utama, Kem Pusat Latihan Khidmat Negara (PLKN) Taman Etnobotani , Kampung Kerinting dan

Kampung Kolam Emas. Manakala lokasi kajian di daerah Kuala Krai adalah, penempatan sementara atau khemah Desa Sakinah, penempatan sementara atau khemah Desa Rahmah, Rumah Transit MERCY, Kampung Guchil, Kampung Pahi dan Manek Urai Lama. Berikut adalah demografi responden yang mendiami lembah banjir di kawasan Gua Musang dan Kuala Krai, Kelantan dari aspek umur, kaum, agama, jantina, status pekerjaan, pendapatan, latar belakang pendidikan dan status perkahwinan.

Bagi pembangunan Modul ACT melibatkan 2 peringkat iaitu peringkat merekabentuk dan pembinaan. Peringkat merekabentuk ialah proses mengumpul bahan kajian samada dari aspek kandungan, metodologi, sampel dan kepentingan kajian. Seterusnya, Jadual spesifikasi Kandungan Instrumen dilakarkan khusus untuk membina konsep, konstruk dan definisi operasi instrumen. Meta data analasis terhadap rujukan-rujukan utama juga dilakukan. Seterusnya, penulisan item berdasarkan dapatan kajian perpustakaan dibina.

3.0 Results and Discussion / Keputusan dan Perbincangan

Modul telah dibentuk iaitu modul *Handling the Trauma* dan dijalankan oleh penyelidik berdasarkan kepada Model ACT iaitu *Assessment*, *Connecting With Others* dan *Treatment*. Latihan ini telah dijalankan pada 14 hingga 17 Oktober 2015 selama empat hari di Hotel Perdana Kota Bharu. Seramai 10 orang terdiri daripada mangsa pasca banjir yang trauma telah diberi latihan berasaskan model ACT yang terdiri daripada 3 submodul, iaitu submodul *Assessment* yang mengandungi 4 aktiviti, *Connecting With Others* 8 aktiviti dan 5 aktiviti di dalam submodul *Treatment*. Berdasarkan kebolehpercayaan menunjukkan nilai kebolehpercayaan item ialah .80 dan nilai kebolehpercayaan individu ialah .95 dengan menggunakan model pengukuran *Rasch*. Analisis *principle component* juga menunjukkan nilai varians yang boleh diukur adalah mencapai 40%.

Analisis kebolehpercayaan Modul ACT telah dianalisis menggunakan Model Pengukuran *Rasch*. Kebolehpercayaan yang dilaporkan melibatkan kebolehpercayaan item dan individu. Nilai kebolehpercayaan item adalah tinggi iaitu 0.94 (Bouton, 2007 dan Azrilah & Saidfudin, 2008). Kebolehpercayaan item merujuk kepada setiap item dapat diterangkan dengan baik mengikut tahap kesukaran. Ini bermakna bagi setiap tahap kesukaran item, terdapat responden yang mencukupi untuk menjawab item tersebut mengikut kebolehan mereka. Kebolehpercayaan individu menunjukkan item adalah mencukupi di sepanjang kontinum tahap persetujuan responden. Nilai pengasingan item dan individu juga menepati syarat iaitu melebihi 2 (Ellis, 2010 dan Hambleton,1996). Rajah di bawah menunjukkan nilai individu dan item bagi setiap submodul. Rajah 3.1 menunjukkan nilai kebolehpercayaan individu bagi submodul *Assessment* adalah tinggi iaitu.80

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SUMMARY OF 9 MEASURED PERSON
-------------------------------------------------------------------------------
|          TOTAL                         MODEL         INFIT        OUTFIT    |
|          SCORE     COUNT   MEASURE     ERROR      MNSQ   ZSTD   MNSQ  ZSTD |
|-----------------------------------------------------------------------------|
| MEAN      61.3      18.0       .97       .36       .90    -.4   1.06   -.2 |
| S.D.       7.2        .0       .88       .02       .47    1.2    .78   1.5 |
| MAX.      72.0      18.0      2.30       .39      1.98    2.1   3.14   3.4 |
| MIN.      51.0      18.0      -.31       .34       .48   -1.8    .54  -1.7 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .39 TRUE SD   .79  SEPARATION 2.02  PERSON RELIABILITY .80 |
|MODEL RMSE    .36 TRUE SD   .80  SEPARATION 2.23  PERSON RELIABILITY .83 |
| S.E. OF PERSON MEAN = .31                                                   |
-------------------------------------------------------------------------------
PERSON RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .83
```

Rajah 3.1 : Nilai kebolehpercayaan individu bagi *Assessment*

Rajah 3.2 menunjukkan nilai kebolehpercayaan item bagi submodul Assessment adalah tinggi iaitu.94

```
                         SUMMARY OF 18 MEASURED ITEM
-------------------------------------------------------------------------------
|           TOTAL                         MODEL         INFIT        OUTFIT    |
|           SCORE      COUNT     MEASURE  ERROR      MNSQ   ZSTD   MNSQ  ZSTD |
|-----------------------------------------------------------------------------|
| MEAN       30.7        9.0         .00    .54        .94    -.1   1.06    .1 |
| S.D.       10.1         .0        2.38    .12        .38     .9    .67   1.1 |
| MAX.       43.0        9.0        3.24    .82       2.06    1.9   3.51   3.3 |
| MIN.       16.0        9.0       -3.55    .42        .36   -1.9    .37  -1.8 |
|-----------------------------------------------------------------------------|
| REAL RMSE      .59 TRUE SD   2.30  SEPARATION 3.88  ITEM   RELIABILITY .94 |
|MODEL RMSE      .55 TRUE SD   2.31  SEPARATION 4.18  ITEM   RELIABILITY .95 |
| S.E. OF ITEM MEAN = .58                                                     |
-------------------------------------------------------------------------------
```

Rajah 3.2 : Nilai kebolehpercayaan item bagi *Assessment*

Rajah 3.3 menunjukkan nilai kebolehpercayaan individu bagi submodul *Connecting with Others*. Nilai kebolehpercayaan individu ialah .92

```
                         SUMMARY OF 22 MEASURED ITEM
-------------------------------------------------------------------------------
|           TOTAL                          MODEL         INFIT      OUTFIT     |
|           SCORE    COUNT     MEASURE     ERROR       MNSQ   ZSTD  MNSQ   ZSTD |
|------------------------------------------------------------------------------|
| MEAN       31.7    9.0               .00  .61         .92   -.2   1.48   .1   |
| S.D.       11.1     .0              2.51  .20         .57   1.0   1.82   1.2  |
| MAX.       44.0    9.0              2.98 1.06        2.82   2.1   8.23   3.0  |
| MIN.       18.0    9.0       -3.40         .40        .27   -1.9  .33    -1.7 |
|------------------------------------------------------------------------------|
| REAL RMSE .72 TRUE SD     2.40  SEPARATION   3.33  ITEM RELIABILITY    .92   |
|MODEL RMSE .65 TRUE SD     2.42  SEPARATION   3.75 ITEM   RELIABILITY    .93   |
| S.E. OF ITEM MEAN = .55                                                      |
-------------------------------------------------------------------------------
```

Rajah 3.3 : Nilai kebolehpercayaan individu bagi *Connecting with Others*

Rajah 3.4 menunjukkan nilai kebolehpercayaan item bagi submodul *Connecting with Others*. Nilai kebolehpercayaan individu ialah .92

```
                         SUMMARY OF 22 MEASURED ITEM
-------------------------------------------------------------------------------
|           TOTAL                         MODEL         INFIT        OUTFIT    |
|           SCORE      COUNT     MEASURE  ERROR      MNSQ   ZSTD   MNSQ  ZSTD |
|-----------------------------------------------------------------------------|
| MEAN       31.7        9.0         .00    .61        .92    -.2   1.48    .1 |
| S.D.       11.1         .0        2.51    .20        .57    1.0   1.82   1.2 |
| MAX.       44.0        9.0        2.98   1.06       2.82    2.1   8.23   3.0 |
| MIN.       18.0        9.0       -3.40    .40        .27   -1.9    .33  -1.7 |
|-----------------------------------------------------------------------------|
| REAL RMSE      .72 TRUE SD   2.40  SEPARATION 3.33  ITEM   RELIABILITY .92 |
|MODEL RMSE      .65 TRUE SD   2.42  SEPARATION 3.75  ITEM   RELIABILITY .93 |
| S.E. OF ITEM MEAN = .55                                                     |
-------------------------------------------------------------------------------
```

Rajah 3.4 : Nilai kebolehpercayaan item bagi *Connecting with Others*

Rajah 3.5 menunjukkan Nilai kebolehpercayaan individu bagi submodul *Treatment*. Nilai kebolehpercayaan individu ialah .81

SUMMARY OF 9 MEASURED PERSON

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	72.4	20.0	1.18	.34	.87	-.5	1.11	-.2
S.D.	7.6	.0	.83	.02	.47	1.4	1.08	1.4
MAX.	84.0	20.0	2.44	.38	1.58	1.4	3.90	2.5
MIN.	60.0	20.0	-.27	.32	.37	-2.2	.23	-1.9

REAL RMSE .36 TRUE SD .74 SEPARATION 2.04 PERSON RELIABILITY .81
MODEL RMSE .34 TRUE SD .76 SEPARATION 2.23 PERSON RELIABILITY .83
S.E. OF PERSON MEAN = .29

PERSON RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .81

Rajah 3.5 : Nilai kebolehpercayaan individu bagi *Treatment*

Rajah 3.6 menunjukkan Nilai kebolehpercayaan item bagi submodul *Treatment*. Nilai kebolehpercayaan individu ialah .92

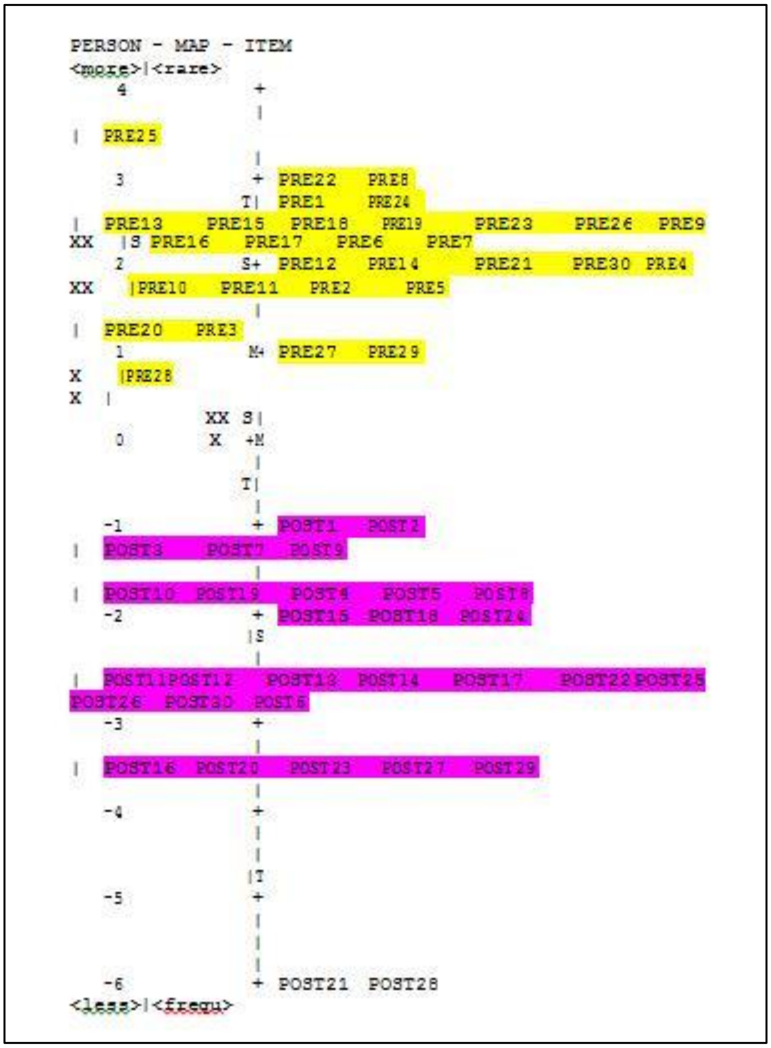
SUMMARY OF 18 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	31.2	9.0	.00	.61	.95	.0	1.11	.1
S.D.	11.6	.0	2.48	.27	.29	.8	.89	.9
MAX.	44.0	9.0	3.46	1.07	1.28	.6	4.27	1.9
MIN.	13.0	9.0	-3.26	.36	.22	-2.4	.24	-1.7

REAL RMSE .69 TRUE SD 2.39 SEPARATION 3.44 ITEM RELIABILITY .92
MODEL RMSE .67 TRUE SD 2.39 SEPARATION 3.60 ITEM RELIABILITY .93
S.E. OF ITEM MEAN = .60

Rajah 3.6 : Nilai kebolehpercayaan item bagi *Treatment*

Rajah 3. 7 menunjukkan peta kedudukan item merentas individu bagi pemerhatian terhadap responden sebelum dan selepas Model ACT dijalankan.



Rajah 3.7 : Peta kedudukan item merentas individu bagi pemerhatian terhadap responden sebelum dan selepas Model ACT dijalankan.

Rajah 3.7 menunjukkan peta kedudukan item merentas individu bagi pemerhatian terhadap responden sebelum dan selepas Model ACT dijalankan ke atas mereka. Dapatan menunjukkan kesemua responden mencapai logit yang lebih baik (Pos) berbanding dengan pencapaian logit sebelum perlaksanaan Model ACT (Pre). Nilai logit tertinggi sebelum perlaksanaan Model ACT adalah pada logit 4 (Pre 25) dan menurun kepada nilai logit -2 (Post 25) selepas perlaksanaan. Model ACT. Begitu juga nilai logit terendah sebelum perlaksanaan ialah pada logit 1 (pre 28), tetapi selepas perlaksanaan Model ACT, nilai logit terendah adalah menurun kepada logit -6 (post 28).

4.0 Conclusion / Kesimpulan

Kajian ini merupakan satu penerokaan ilmu pengetahuan berkaitan psikologi manusia selepas berhadapan dengan bencana alam. Diharapkan kajian ini dapat memberi implikasi yang positif terhadap beberapa pihak seperti pengkaji, mangsa kejadian banjir atau bencana alam yang lain, ibubapa dan juga pemimpin. Antara hasil dapatan yang penting dari kajian yang dilaksanakan adalah seperti berikut:

4.1 Dapatan kajian menunjukkan 61.8% responden adalah perempuan, manakala 38.2% adalah lelaki dan 98.1% adalah kaum Melayu daripada 262 responden pasca bencana banjir. Selain itu, 35.9% responden berumur di antara 30-49 tahun, diikuti 32.1% responden yang berumur 10-29 tahun.

4.2 Selain itu, sebanyak 54.2% responden yang tidak mempunyai pendapatan dan 22.1% mempunyai pendapatan sebanyak RM501sehingga RM1000. Sebanyak 30.2% yang mempunyai tahap pendidikan yang rendah dan 16.4% tidak bersekolah. Dari aspek status perkahwinan, 66% adalah responden yang berkahwin dan 24% merupakan responden yang belum berkahwin.

4.3 Dapatan kajian juga menunjukkan sebanyak 14.5% responden menghadapi *Depression* pada tahap tinggi dan 10.3% di tahap sederhana. Selain itu, 27.1% responden yang menghadapi *Anxiety* pada tahap tinggi dan 16.8% di tahap sederhana manakala 6.5% responden menghadapi *Stress* pada tahap tinggi dan 19.8% di tahap sederhana.

4.4 Selain itu, sebanyak 13.7% responden yang mengalami tahap *Posttraumatic Stress Disorder (PTSD)* dan diikuti 27.9% di tahap sederhana dan 13.7% di tahap rendah.

4.5 Hasil daripada dapatan kajian menunjukkan bencana alam seperti banjir besar memberi kesan emosi ke atas mangsa yang terselamat seperti *Posstraumatic Stress Disorder* walaupun selepas enam bulan banjir telah berlaku. Selain itu, faktor demografi iaitu jantina dan umur mempengaruhi kebarangkalian untuk seseorang mengalami *Posstraumatic Stress Disorder* seperti wanita lebih cenderung mengalami *Posstraumatic Stress Disorder* berbanding lelaki. Malah dari segi umur menunjukkan semakin berusia individu itu, semakin tinggi risiko untuk mengalami *Posstraumatic Stress Disorder.*

4.6 Selain itu, kajian ini juga telah berjaya menghasilkan satu Modul ACT iaitu Modul *Handling The Trauma* bagi membantu responden yang mengalami *Posstraumatic Stress Disorder.*

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CAPACITY BUILDING FOR RESPONSE AND RECOVERY ON SOLID WASTE MANAGEMENT FOR FLOOD DISASTER

Project Information

Project Leader	: Assoc Prof Dr Mohd Suffian Yusoff
University	: Universiti Sains Malaysia
Address	: School of Civil Engineering, Universiti Sains Malaysia, 14300 Nibong Tebal, Penang, Malaysia
Email	: suffian@usm.my
Project Members	: Professor Dr Hamidi Abdul Aziz, Professor Dr Ir Mohd Nordin Adlan Associate Professor Dr Noor Zalina Mahmood (UM) Dr Nastein Qamaruz Zaman, Mr Abbe Hasley Mhd Jalil

1.0 Introduction

Severe seasonal rain and strong wind hit east coast of Malaysia starting from in the middle of December 2014 and continued into the first weeks of January 2015. The rain has caused disastrous floods in the states of Terengganu, Pahang, and Kelantan. In particular, heavy and prolonged rain were reported coincided with higher than normal tides, which effectively increased flood waters from draining to the sea. At the peak of the flooding incident, more than 200,000 affected peoples have been evacuated and unknown numbers have been confirmed dead. Based on affected victims which sought a shelter at relief center implied that between half a million to a million people have been affected, directly or indirectly as a result from the flood incident.

In general, the presence of flood disaster waste affects almost every aspect of an emergency response and recovery effort. In the immediate response, flood disaster debris can cause access road blockages which impedes rescuers, emergency services and lifeline support reaching survivors. Besides, limited recovery effort, rebuilding or restoration process could be carried out before the debris is removed to disposal area. While there are many health concerns in the aftermath of the floods, the more immediate difficulty appears to be how to manage the post-flood waste that grew much faster than they could be disposed of. In the longer term, poor management of a clean-up can result in a slow and costly recovery. Furthermore, existing disaster waste management practice often involves either no action, in which the generated waste is left piling up, accumulated and decomposed onsite, without appropriate treatment in place. As a result, this practice creates long-term environmental impacts that can affect the community and eventually increase handling cost when the waste need to be appropriately disposed at the disposal site.

The flood which occurred on the late December 2014 in Kelantan had a massive impact on people, livestock, agriculture, properties, infrastructure such as roads, railroads, electricity, telephone, water and food supply. Without human capacity and preparedness for the flood incident, many valuable items were destroyed immediately when the flood struck. In response to this, the effect of post-flood waste generation at selected area in Kelantan were studied. This paper also discusses the overview of the daily municipal solid waste generation (MSW) and post-flood waste generation as a basis for capacity preparedness for future flood incident. Impact on the disposal area capacity, post-flood waste recovery measures were studied in order to forecast the actual waste generation for the aftermath.

2.0 Methods

The present study was divided into two parts. The first part of the study concentrated on the existing waste management practice at selected districts in Kelantan especially at the highly affected area (Kuala Krai), least affected area (Kota Bharu) and earliest affected area (Gua Musang) based on the flood incident chronology. The data and reports obtained from various government agencies and stakeholders such as municipalities (Majlis Bandaraya Kota Bharu, Majlis Perbandaran Kuala Krai and Majlis Perbandaran Gua Musang), Solid Waste Management Corporation (SWCorp) and Welfare Department. At present, there is no actual data on waste generation and characteristics throughout Kelantan state. The lack of essential equipment such as weigh-bridge and existing waste generation data at Beris Lalang, Bukit Akil and Renok dumping sites have caused quantification of MSW disposed become difficult. Daily volume of MSW dumped is based on trips arrived at the site by compactors was calculated at 5 Tonnes with 50 number of trips daily for Beris Lalang (Kota Bharu district) dumping site. As a result, the total MSW sent to the dumping site daily is estimated about 250 Tonnes/day. Meanwhile, MSW disposed at

Bukit Akil (Kuala Krai district) is estimated at 20 Tonnes/day followed by Renok (Gua Musang district) dumping site with 40 Tonnes/day of MSW daily. Therefore, waste composition study and classification was performed based on MS2505:2015 in order to deliberate the waste components and total waste generation at the study area. Three dumping sites which receives daily MSW generation at the selected districts were identified as the case studies. The second part of the research discussed on the post flood waste composition and waste generation at Kota Bharu, Kuala Krai and Gua Musang. In view of this, demographic attributes were exploited towards the flood incident parameters such as total evacuees, total rainfall and post flood waste generation.

3.0 Results and Discussions

3.1 Existing Waste Generation Behavior

In general, baseline information on the quantity of solid waste generated is essential for every aspect in solid waste management (Samah et al., 2013). From Table 1, there are 11 active dumping sites currently in operation at which, all of them were poorly design and considered as non-engineered landfills. This is because, in order to classify an appropriate disposal site, the site must at least occupied with minimum facilities which consists of fencing and perimeter drain.

Table 1: Characteristics of dumping sites across Kelantan state

No.	District	Dumping site	Area (ha)	Landfill classification	Status	Daily incoming waste (TPD)	Remarks
1.	Pasir Puteh	Bukit Gedombak	9.70	Non-engineered	Closed	64	
2.	Bachok	Kg Sungai Gali	4.49	Non-engineered	Closed	20	
3.	Kota Bharu	Telok Kitang	32.0	Non-engineered	Closed	280	
		Panji	4.05	Non-engineered	Closed	90	
		Beris Lalang	30.5	Non-engineered	Active	350	Study area
4.	Jeli	Batu	0.5	Non-engineered	Closed	N.A	
		Kg. Sungai Mekong	0.81	Non-engineered	Active	10	
5.	Kuala Krai	Damar	0.81	Non-engineered	Closed	5	
		Bukit Akil	4.05	Non-engineered	Active	20	Study area
6.	Tanah Merah	Chat Rimau	4.90	Non-engineered	Closed	20	
		Bukit Che Ros	5.00	Non-engineered	Active	50	
7	Dabong	Kg. Sungai Sam	4.50	Non-engineered	Active	16	
		Kemubu-Dabong	0.50	Non-engineered	Closed	5	
		Jalan Kuala Krai-Gua Musang	0.20	Non-engineered	Closed	2	
		Jalan Dabong - Sg Sam	3.65		Active	9	
8.	Ketereh	Bukit Pak Ajil	2.90	Non-engineered	Active	70	
9.	Machang	Air Belaga	4.04	Non-engineered	Active	100	
10.	Tumpat	Kg. Kok Bedollah	20.23	Non-engineered	Active	120	

11.	Pasir Mas	Kg. Pusu	4.45	Non-engineered	Active	120	
12.	Gua Musang	Renok	32.0	Non-engineered	Active	40	Study area

In terms of waste generation per capita determination, the calculation is based on the records of the average total waste reaching the dumping sites every day for disposal at each of the study area. The results were than divided by the numbers of residents that municipalities carried out daily MSW collection at their premise and the result is tabulated in Table 2.

Table 2: MSW generation per capita

District	Average MSW collected (Tonnes/day)	Total household at the study area	MSW generation (kg/cap/day)	Reference
Kota Bharu	423	468,438	0.90	This study
Kuala Krai	25	41,694	0.60	This study
Gua Musang	46	51,713	0.89	This study
Kuala Lumpur	3478	2,100,000	1.60	(Budhiarta et al., 2012)
Pahang	957	1,126,000	0.88	(Hamatschek et al., 2010)
Terengganu	883	1,038,436	0.88	(Manaf et al., 2009)

3.2 Waste Composition Study

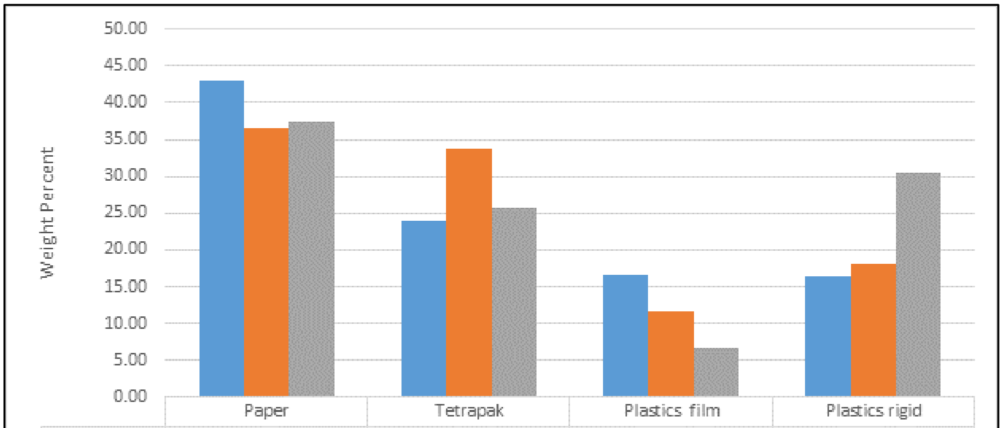
Waste as disposed at the dumping sites was further sorted into 15 sub-components, analyzed and averaged for each of study area and presented in Table 3. The waste components were determined after sorting a known weight of sample in to different waste streams (15 components) and divided from the total weight accumulated. Based on Table 3, the major fractions of MSW component analyzed were organics, papers and tetrapak.

Table 3: Waste composition result

Percentage weight (%)	Beris Lalang (Kota Bharu District)	Bukit Akil (Kuala Krai District)	Renok (Gua Musang District)
Organic	33.13	42.86	27.94
Paper	22.01	12.48	18.28
Tetrapak	12.26	11.53	12.52
Plastics film	8.49	4.01	3.24
Plastics rigid	8.4	6.22	14.84
Napkins	4.36	8.26	2.45
Textiles	2.95	4.01	4.08
Rubber	2.22	5.56	7.07
Leather	2.07	1.07	0.84
Wood	1.14	1.86	1.13
Garden	1.11	0.54	3.66
Glass	0.74	0.41	1.41
Metal	0.74	0.91	1.41
Household hazardous waste	0.37	0	1.13
Others	0.74	0.91	1.41
Total (%)	100	100	100

3.3 MSW recovery potential

Figure 1 illustrates the most acceptable MSW component for recovery process. In the same manner the solid waste composition of dumping sites area was described, Beris Lalang dumping site has the largest share of MSW recovery opportunity of 51.16% followed with Renok (48.88) and Bukit Akil (34.24%). Interestingly, it is estimated nearly 35% of the disposed MSW at studied area has the potential for MSW recovery. The largest recovery of MSW fraction obtained was papers which made up in the range of 36 to 43% followed with tetrapak (24 to 25.61%) and plastics (6.63 to 30.36%). It is clear from observation that there is possibility to divert these waste components for reuse and recycling or so called waste minimization



	Paper	Tetrapak	Plastics film	Plastics rigid
Beris Lalang	43.02	23.96	16.59	16.42
Bukit Akil	36.45	33.67	11.71	18.17
Renok	37.40	25.61	6.63	30.36

Figure 1: Recyclable potential items at three dumping site

3.4 Post Flood Waste Generation

The figure indicated that the highest post flood waste generated was at Gua Musang followed with Kuala Krai and Kota Bharu amounting 14541 Tonnes, 10806 Tonnes and 7940 Tonnes, respectively. According to the field report during post flood recovery process, Gua Musang was severely hit by flood water as a result from continuous rain by which, the highest rainfall recorded for 3 consecutive days led to a sharp increase to the water level of Sungai Lebir which in turn concurrently caused drastic increase to the water level at Tangga Krai. Also, based on Meterological Department statistic, the total rainfall of 1295 mm in Gua Musang on 21-23 December 2014 was equivalent to 64 days of rain. Such a high rainfall intensity have caused catastrophe flood incident to the residence at Gua Musang.

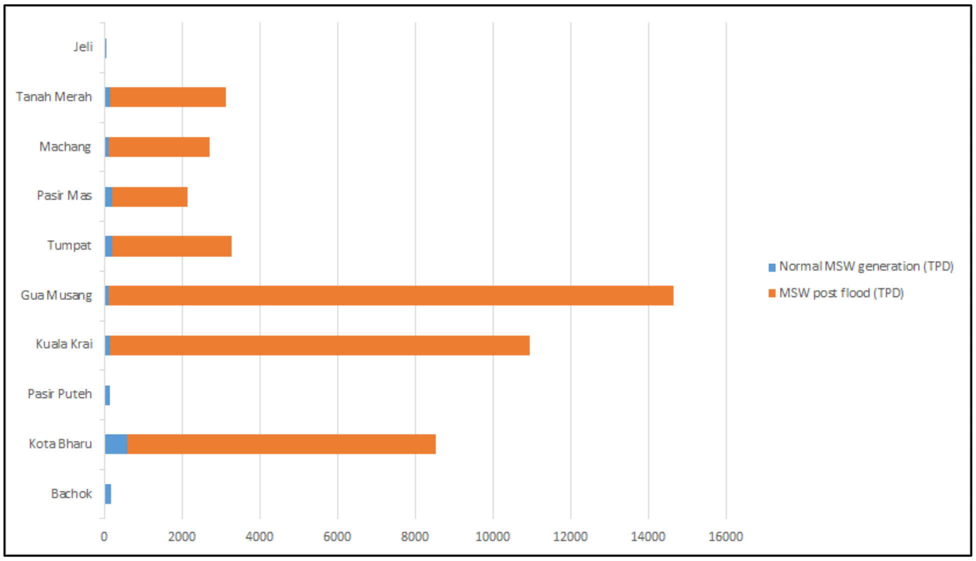


Figure 2: Comparison between normal MSW generation and post-flood waste generation

Based on the number of evacuees and the amount of post flood waste generation, Figure 3 tabulates the waste generated per capita. The figure indicated per capita waste generation was similar to the total waste generation in Figure 2, with Gua Musang has the highest per capita waste generation (3312 kg), followed with Kuala Krai (771 kg), and Kota Bharu (389 kg).

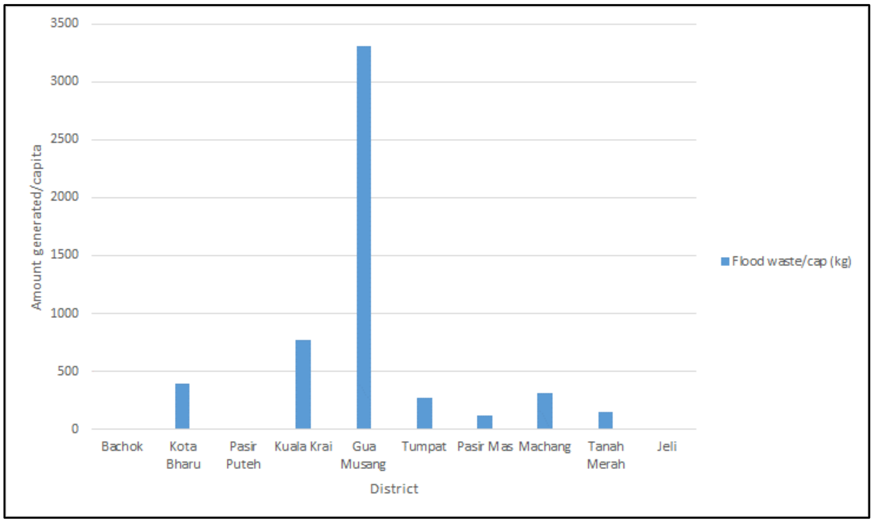


Figure 7: Total waste generation per capita

4.0 Conclusions

Based on data presented and discussed, this study formally established recent weight and composition of MSW fractions generated in three Kelantan's districts namely Kota Bharu, Kuala Krai and Gua Musang. The daily average MSW for the present period estimated is 0.90, 0.60 and 0.89 kg/cap/day for all three districts. A direct sampling of MSW as disposed at three dumping sites was conducted based on MS2505:2012 standard method to determine the MSW composition. In terms of waste diversion possibility, it is estimated that more than 40% of recovered MSW have the potential to be reprocessed for further use in recycling. The data analyzed also indicated that MSW composition for all three dumping sites can be sustain whenever waste diversion process is carried out. Typical waste diversion process. From technical point of view, material recovery facility (MRF) is the most suitable method for recyclable item recovery at all three dumping sites not only its incur low operating expenditure, employment opportunity has the advantage for policy maker to choose with as appropriate waste streams selection. Finally, the technology of the MRF needs to be developed and understood in order to be implemented it in all conventional waste disposal system for treating the waste generated in Malaysia. In terms of flood waste generation, it was estimated that the State of Kelantan generated about 43863 Tonness of waste during the flood incident in 2014. Gua Musang resident generated about 14581 Tonness of flood waste subsidence from severe Sg Lebih spillage to the lowest area and surrounding residence area.

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SAFE FOOD PREPARATION WITH NATURAL ECLIPTA ALBA LEAF ANTIMICROBIAL POLYPHENOL: A PREVENTING STRATEGIES FOR LEPTOSPIRA INFECTION DURING AND AFTER A FLOOD

Project Information

Project Leader	: Sasidharan A/L Sreenivasan
University	: Universiti Sains Malaysia
Address	: Institute for Research In Molecular Medicene, 11800 USM, Penang
Contact number	: 0125323462
Email	: srisasidharan@usm.my
Project Members	: Dr Lai Ngit Shin

1.0 Introduction

Food contamination is a big problem following flooding. Dirty flood waters may exposed with various type of pathogenic microbes such as *Leptospira interrogans* which will eventually contaminate the food and drinks, making it unsafe to eat. The number of leptospirosis cases has tripled in Kelantan following recent massive floods. Twenty to twenty five leptospirosis cases were recorded in Kelantan before the floods, but the number of cases went up to 94 after floods hit the state. *L. interrogans* is a Gram negative, obligate aerobe spirochete, with periplasmic flagella and reported to cause Leptospirosis. Leptospirosis, which is characterized by hemorrhage, diarrhea, jaundice, severe renal impairment, and aseptic meningitis has arose as a global zoonotic infectious disease in the past decade (Bharti et al., 2003; Greig et al., 2005; Vachvanichsanong et al., 1999). Human infection is unintentional, usually happening after direct or indirect contact with urine from leptospiruric animals (Barwick et al., 1997). The main reservoir hosts of *L. interrogans* are wild rodents and domestic animals, which can persistently excrete *L. interrogans* through urine. Moreover, the shed leptospiral cells can survive in moist soil and water for a long time before infecting a new host (Levett, 2001). Other mechanisms like animal bites, handling of infected tissues, spreading via the ingestion of contaminated food and water are unusual. However, the recent association of Leptospirosis in Kelantan, Malaysia may be via the ingestion of contaminated food and water as the primary source of the organism. Recently, the Malaysian Medical Association (MMA) Sibu Sub-Branch advisor Dr Hu Chang Hock cautioned the publics that flood waters mixed with septic tank water can contain both animal and human faeces, and breed lots of bacteria (Such as *L. interrogans*) and viruses. Consequently, usage of natural antimicrobial polyphenol to prepare the food product as preventing strategies for Leptospirosis infection during and after a flood is one of the strategy that has been adopted.

Phenolic compounds are secondary metabolites and one of the most widely occurring phytochemicals in medicnal plants. The phenolic compounds include simple phenols and phenolic acids, quinones, flavonoids and tannins (Cowan, 1999; Balasundram et al., 2006). They contribute to the sensory properties when added to food and have antioxidant and antimicrobial properties (Balasundram et al., 2006), characteristics that are useful in extending the shelf-life of food. Hence, medicinal plants such as *Eclipta alba* L., grouped under the family of Asteraceae are good candidate source for natural antimicrobial polyphenol and may lower the risk of microbial infection such as *L. interrogans* infection. *E. alba* is an annual herbaceous plant, commonly known as false daisy. It is also known as Bhringaraj and Karisilakanni, which is found a common weed throughout Malaysia. It is an erect or prostrate, much branched, roughly hairy, annual, rooting at the nodes; the leaves are opposite, sessile and lanceolate. *E. alba* has been used in various parts of tropical and sub-tropical regions like south America, Asia, Africa. *E. alba* contains wide range of active principles which includes coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, triterpenoids (Mithun et al., 2011). In ayurvedic medicine, the leaf extract is considered a powerful liver tonic, rejuvenative, and especially good for the hair. It is used as a tonic, antiageing agent, diuretic in hepatic, for spleen enlargement, catarrhal jaundice, for skin diseases, inflammation, minor cuts and burns and the fresh leaf-juice is considered very effective in stopping bleeding. The fresh juice of leaves is used for increasing appetite, improving digestion and as a mild bowel regulator (Mithun et al., 2011). Hence, the current study was designed to evaluate the antimicrobial activity of *E. alba* antimicrobial polyphenol against *L. interrogans* and to evaluate the application of this natural polyphenol in the cooked rice and tea for safe food preparation to prevent the *L. interrogans* infection.

2.0 Materials and Methods

2.1 Sample Collection

E. alba leaves were collected from Pulau Pinang, Perak (Taiping), Johor (Segamat), Malaysia and authenticated at the Herbarium of the School of Biological Sciences, Universiti Sains Malaysia, Pulau Pinang, Malaysia, where a sample has been deposited (Voucher specimen: USM/HERBARIUM/11601). The leaves were first washed with tap water and then with distilled water. The leaves were then dried in open air, $25^{o}C$ for 7 days, after which the dried sample was ground into fine powder using a grinder.

2.2 Polyphenol Extraction Procedure

The extractions of *E. alba* leaves were carried out as described Crozier et al. (1997) with some modification. Briefly, air-dried powder of *E. alba* leaves (0.5 g) was weighed and placed into a 100 mL conical flask. Fourty mL of methanol was added, followed by 10 ml and 6 M HCL solution. The mixture was stirred with a magnetic stirrer. The mixture was then be placed in a sample flask (250 mL), attached to the reflux and heated for 2 hours at 90°C, then filtered with a Whatman No.1 filter paper (Whatman, England). Filtrates was dried by using a vacuumed Rotary Evaporator at 40°C. The extracts were preserved in refrigerator for further studies.

2.3 Bacterial Strains

ATCC reference strain of *L. interrogans* (23581) was obtained from the American Type Culture Collection (ATCC) and was used in this study. *L. interrogans* was maintained by continuous culture (stock culture) in semisolid Ellinghausen-McCullough-Johnson-Harris (EMJH) medium (2.3 g/liter; Difco, USA) containing 3% rabbit serum (RS) and 0.1% bacteriological agar.

2.4 Statistical Analysis

Data collected during the experiment was analyzed using SPSS 17.0 software. The data was analyzed using one way ANOVA. The significance level was set at $P < 0.05$.

3.0 Results

3.1 Flavanoid content

The extract yields of polyphenol components from the *E. alba* leaf was 8.23% (w/w). The amount of total flavonoids content of *E. alba* leaves polyphenol was expressed in milligram of rutin equivalent using the standard curve equation: $y = 0.0033x - 0.0251$, $R^2 = 0.9056$. Figure 1 illustrated the variance of mean absorbance with different concentrations of rutin. The total flavonoid content present was found to be 96.7 + 0.9 mg/g equivalent to rutin for *E. alba* leaves polyphenol.

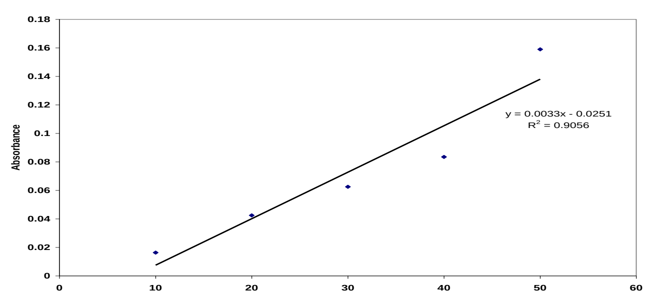

Figure 1: Calibaration curve of rutin

3.2 Antimicrobial activity and determination of MIC of *E. alba* leaves polyphenol

The *E. alba* leaves polyphenol inhibited *L. interrogans* tested in this study. The zone of clearance produced by the commercial pencillin G (positive control) antibiotic disc was larger than that produced by the *E. alba* leaves polyphenol disk. There was no zone of inhibition observed in the disc impregnated with 10% DMSO (negative control). The *E. alba* leaves polyphenol exhibited a favorable antimicrobial activity against the *L. interrogans* tested. The broth dilution method recorded the MIC value of 1250.0 µg/mL

(Figure 2) against *L. interrogans* tested strain. This MIC values was further used for growth profile and ultrastructural studies.

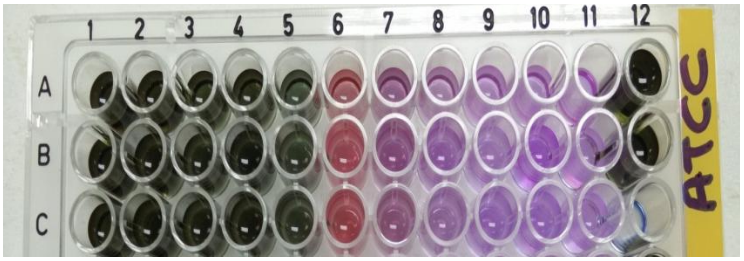

Figure 2: Determination of MIC of Eclipta alba leaves polyphenol against Leptospira interrogans 1, 5000 µg/ml; 2, 5000 µg/ml; 3, 2500 µg/ml; 4, 2500 µg/ml; 5, 1250 µg/ml; 6, 625 µg/ml; 7, 312.5 µg/ml; 8, 156.25 µg/ml; 9, 78.125 µg/ml; 10, 39.06 µg/ml; 11, Positive control (EMJH +10% DMSO +L. interrogans); 12, Negative control (EMJH + 10% DMSO)

3.3 Growth profile of *L. interrogans* in the presence of *E. alba* leaves polyphenol

The growth profile for *L. interrogans* in EMJH medium at 0 (control), MIC, 1/2 MIC and 2 MIC concentrations of *E. alba* leaves polyphenol are shown in Figure 3. The *E. alba* leaves polyphenol treament was altering the normal growth profile for *L. interrogans* compared to the control (0 concentrations). At 1/2 × MIC, *E. alba* leaves polyphenol demonstrated a large drop in OD after 48 h compared with the control. However, at MIC and 2 × MIC, *E. alba* leaves polyphenol produced absolute bacterial eradication after only 24 h. This finding confirms the bactericidal effect of the *E. alba* leaves polyphenol on *L. interrogans* at MIC concentration.

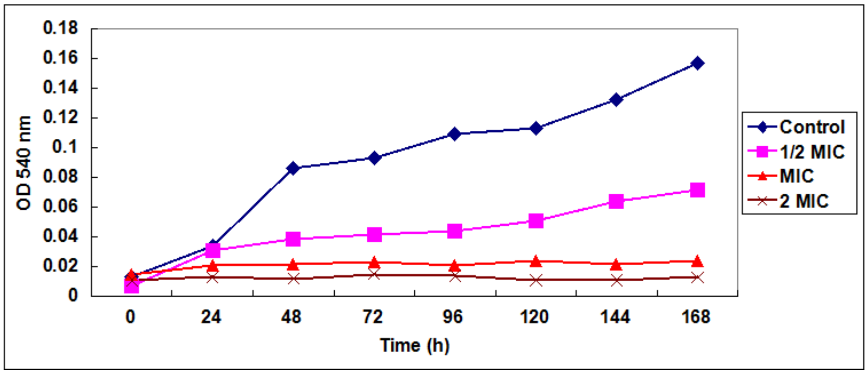

Figure 3: Growth profile for *Leptospira interrogans* in EMJH broth with 0 (Control) ½, 1 and 2 times MIC of *Eclipta alba* leaf extract

3.4 Scanning Electron Microscopy (SEM) observation

Figure 3 shows the SEM micrographs of the *L. interrogans*. *E. alba* leaves polyphenol caused the most change in cell morphology of the *L. interrogans* and the degree of change varied with the time of exposure (Figure 4). The control *L. interrogans* (the unexposed bacteria to *E. alba* leaves polyphenol seen in Figure 4) had apparently normal wave-like shape, while the shape of the *L. interrogans* exposed to *E. alba* leaves polyphenol was deformed and had lost their wave-like shape. After 14 days of exposure to *E. alba* leaves polyphenol, the cells completely collapsed and all of the cells lost the normal morphology (Figure 4).

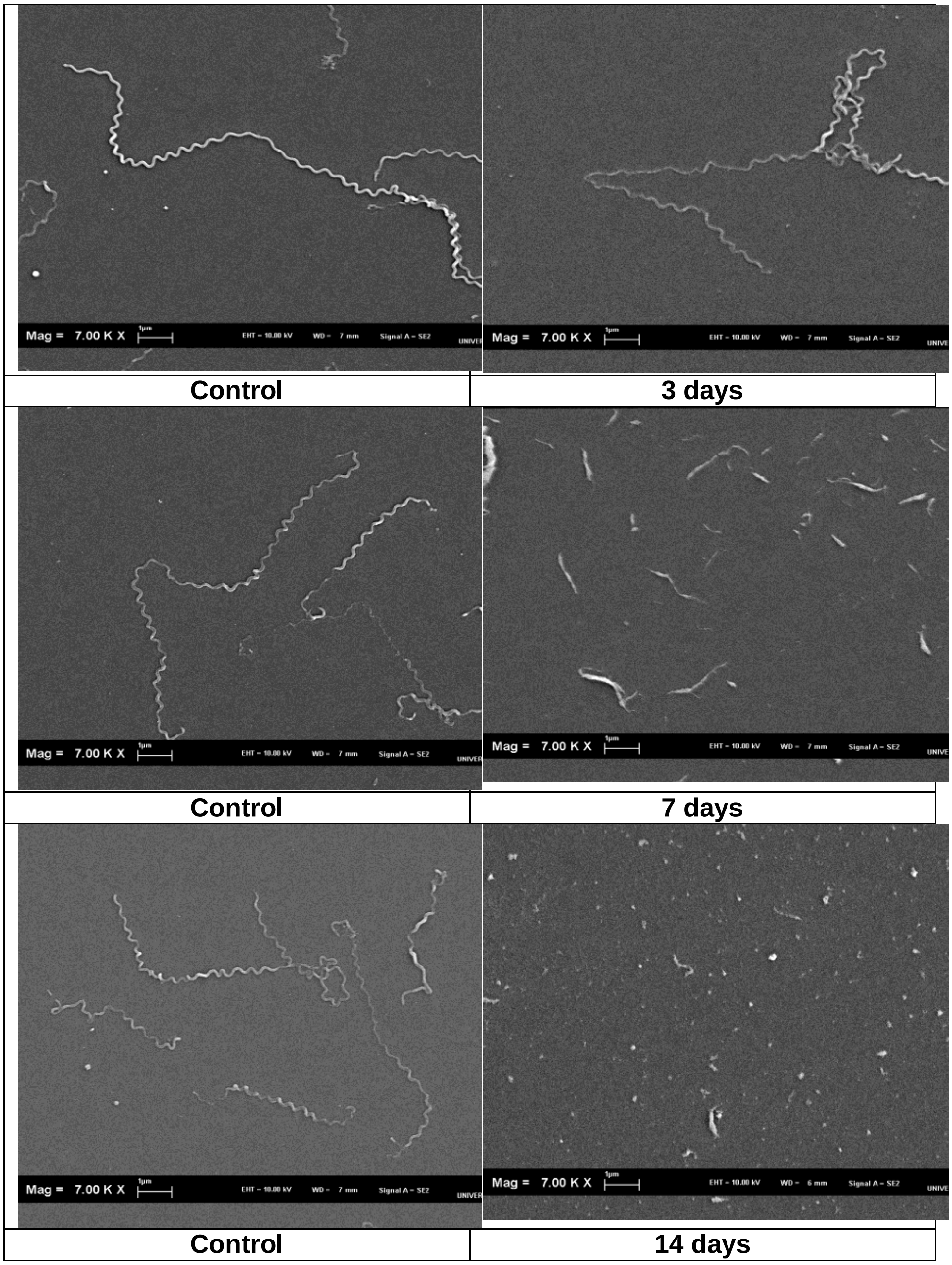

Figure 4: Scanning electron micrograph of *Leptospira interrogans* control, unexposed to *Eclipta alba* leaves polyphenol (left side) and after treatment with 2500 µg/ml of *Eclipta alba* leaves polyphenol for 3 days, 7 days and 14 days (right side). Untreated control shows the typical wave-like shape of a typical leptospire, while the *Eclipta alba* leaves polyphenol exposed sample shows an elongated and deformed structure.

3.4 Transmission Electron Microscopy (TEM) observation

From the SEM findings, it can be suggested that the *E. alba* kills the *L. interrogans*. Further intramorphological features providing evidence of these findings was obtained by TEM observations on similarly treated *L. interrogans*. The control *L. interrogans* (the unexposed bacteria to *E. alba* leaves polyphenol seen in Figure 4) had apparently normal cytoplasm amnd shape, while the shape of the *L. interrogans* exposed to *E. alba* leaves polyphenol was deformed and had lost their cytoplasm contents and wave-like shape. After 14 days of exposure to *E. alba* leaves polyphenol, the cells completely collapsed and all of the cells lost the normal morphology (Figure 5).

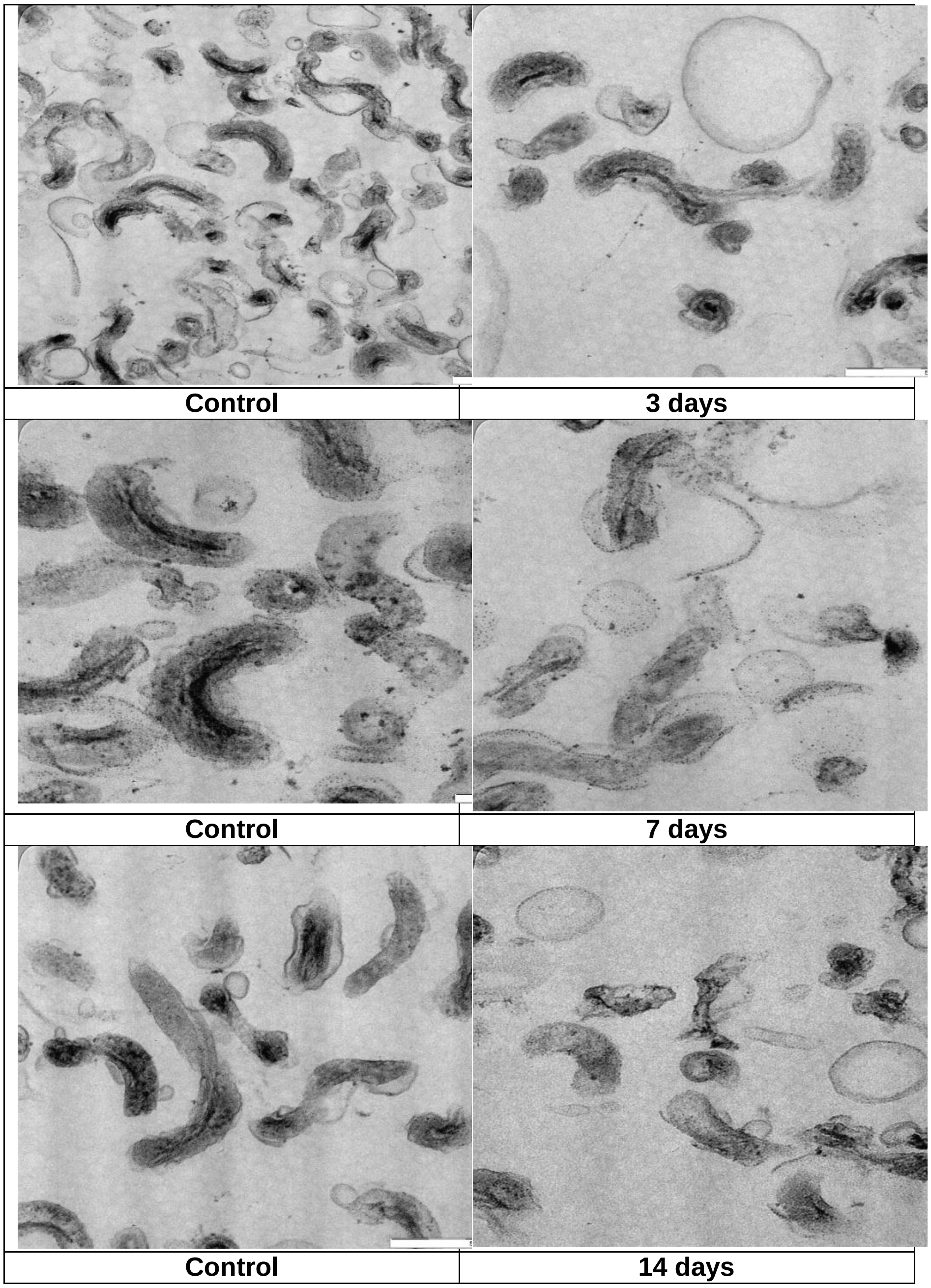

Figure 5: Transmission electron micrograph of *Leptospira interrogans* control, unexposed to *Eclipta alba* leaves polyphenol (left side) and after treatment with 2500 µg/ml of *Eclipta alba* leaves polyphenol for 3 days, 7 days and 14 days (right side). Untreated control shows the typically structured cytoplasm of a typical leptospire, while the *Eclipta alba* leaves polyphenol exposed sample shows with notable structural disorganization within the cell cytoplasm.

3.5 Survival of *L. interrogans* inoculated onto cooked rice and tea

Figure 6 shows the survival of *L. interrogans* inoculated onto three types of rice preparation such as rice alone, rice inoculated *L. interrogans* and rice inoculated *L. interrogans* and mixed with *E. alba* leaves polyphenol. *L. interrogans* survived well in the rice inoculated *L. interrogans* where its survivability was stable and gradually increased up to 24 h incubation. However, the survivability *L. interrogans* in rice inoculated *L. interrogans* and mixed with *E. alba* leaves polyphenol was not good and immediate reduction of OD values was observed up to 24 h incubation. Moreover, the observed OD values for the rice alone preparation which was used as the negative control was lower than the above mention two rice preparation. This finding confirms the anti-leptospiral properties of the *E. alba* leaves polyphenol on *L. interrogans* in rice preparation which is a staple food in the Southeast Asian countries.

Figure 7 depicts the survival of *L. interrogans* inoculated onto three types of tea preparation such as tea alone, tea inoculated *L. interrogans* and tea inoculated *L. interrogans* and mixed with *E. alba* leaves polyphenol. *L. interrogans* survived well in the tea inoculated *L. interrogans* where its survivability was stable and steadily increased up to 24 h incubation. Conversely, the survivability *L. interrogans* in tea inoculated *L. interrogans* and mixed with *E. alba* leaves polyphenol was not good and fast decrease of OD values was observed up to 24 h incubation. Furthermore, the observed OD values for the tea alone preparation which was used as the negative control was lower than the above mention two tea preparation. This result endorses the anti-leptospiral properties of the *E. alba* leaves polyphenol on *L. interrogans* in tea preparation which is a common beverage in Malaysia.

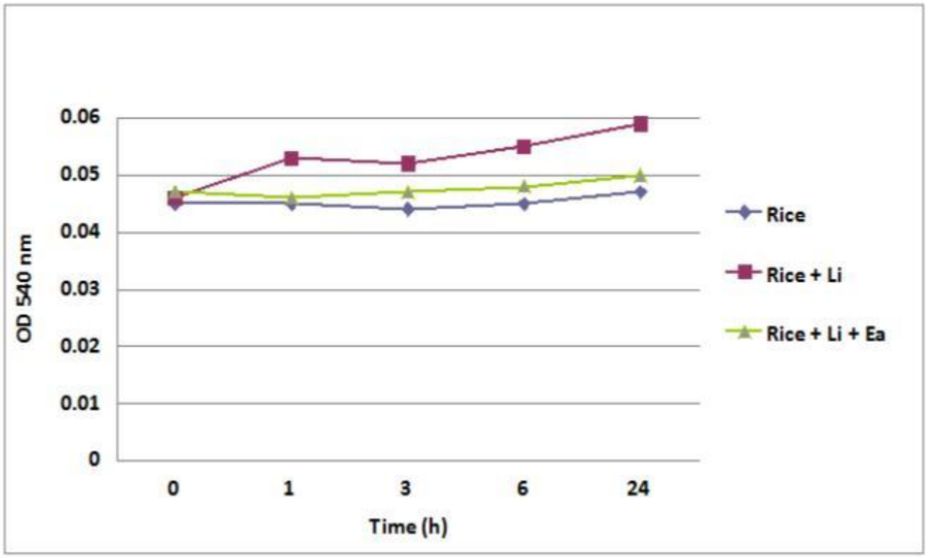

Figure 6: Survival of *Leptospira interrogans* (Li) in cook rice as control (♦), *Leptospira interrogans* inoculated rice (■) and *Leptospira interrogans* inoculated rice with *Eclipta alba* (Ea) leaves polyphenol (▲)

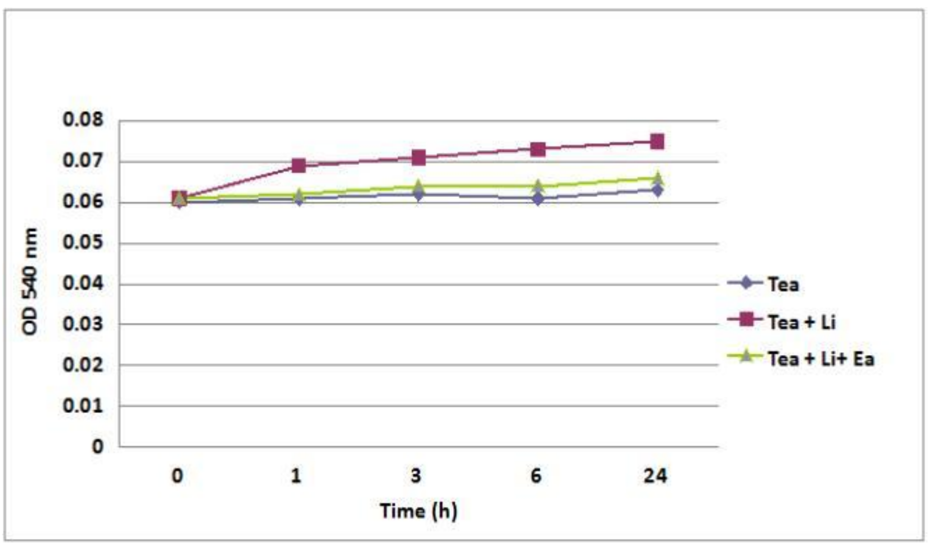

Figure 7: Survival of *Leptospira interrogans* (Li) in tea as control (♦), *Leptospira interrogans* inoculated tea (■) and *Leptospira interrogans* inoculated tea with *Eclipta alba* (Ea) leaves polyphenol (▲)

4.0 Discussions

Foodborne illness caused by *L. interrogans* through cross-contamination of cooked foods and beverage are important reason for Leptospirosis during flood via the ingestion contaminated food and beverage directly exposed to contaminated floodwaters. Moreover, the floodwaters are likely to be polluted with sewage and other contaminants which are a threat to the health of people living in the flooded area. Ready-to-eat (RTE) foods can be contaminated with *L. Interrogans* during and after flood following poor hygiene practices by food handlers, and the organism can multiply rapidly at ambient temperatures. Furthermore, Levett (2001) reported that the shed *L. Interrogans* cells can survive in moist soil and water for a long time before infecting a new host. Thus, application of natural antimicrobial polyphenol in food product might be an attractive strategies for safe food preparation and also as preventing strategies for Leptospirosis infection during and after a flood. Consequently, the antimicrobial activity of *E. alba* against *L. interrogans* and the application of this natural antimicrobial in the cooked rice and tea which is common food and beverage in Malaysia was evaluated in this study to prevent the *L. interrogans* infection through cross-contamination of cooked foods.

Natural medicinal plants are still one of the important sources of new antimicrobial molecules today. In this study *E. alba* was used to developed the natural antimicrobial polyphenol against *L. Interrogans* (subsequently for the safe food preparation) for the reason that its efficacy against *L. interrogans* was previously reported and also this plant commonly used in traditional medicinal practices (Mathew, 2001). The total flavonoid content of the *E. alba* extract was determined which was contributed (Balasundram et al., 2006) to the observed antimicrobial activity against *L. Interrogans* in this study. Besides, flavonoids are formed as antimicrobial barriers in plants response to microbial infection. Therefore, it should not be unexpected that they have been found *in vitro* to be effective antimicrobial compounds against a wide range of microorganisms including *L. Interrogans* tested in this study (Orhan et al., 2010).

In the development of antimicrobial agents, the employment of appropriate *in vitro* antimicrobial assays are vital for successful final outcomes. *In-vitro* assays are essential to determine the minimum inhibitory concentration as well as to evaluate potential susceptibility and/or resistance of specific microbes of interest. Hence in this study various *in vitro* antimicrobial assays were conducted such as antimicrobial disc diffusion assay, broth dilution methods for the determination of MIC, time kill study and ultrastructural observation through SEM. The *in vitro* assays conducted in this study constantly proved the efficacy of *E. alba* leaves polyphenol against *L. interrogans* with the MIC values of 1250.0 µg/mL. The growth profile study in the presence of *E. alba* leaves polyphenol suggested that *E. alba* leaves polyphenol completely inhibited the growth of *L. interrogans* and it also exhibited prolonged anti-leptospiral activity against the *L. Interrogans* at various MIC values tested. These finding hypothesised that the *E. alba* polyphenol attacked the *L. Interrogans* cells and eventually caused cell death. To verify this hypothesis, the untreated and *E. alba* leaves polyphenol treated *L. Interrogans* cells at various incubation time were observed through SEM. Deformed wave-like shape and cellular break in *L. interrogans* indicates the inhibitory activity of the *E. alba* leaves polyphenol and proved the hypothesis that the *E. alba* polyphenol attacked the *L. Interrogans* cells and caused cell death as shown in growth profile study. Nelson et al. (2013), also reported similar morphological changes such as cellular break in *L. Interrogans* cells treated with *Adhatoda vasica* extract through the SEM observation and they concluded that such cellular break in *L. interrogans* indicates the inhibitory activity of the *Adhatoda vasica* extract. Further ultrastructural evidence of SEM observations in in *L. interrogans* was investigated by using transmission electron microscopy (TEM). TEM enables the investigation of the cytoplasmic changes, which cannot be viewed via SEM (Pretorius et al., 2006). The intracellular ultrastructure of *E. alba* leaves polyphenol treated *L. interrogans* cells, examined with the TEM, revealed cytoplasmic changes, which were exhibited the cytoplasmic volume decreased more with notable structural disorganization within the cell. *E. alba* leaves polyphenol possesses good antibacterial activity against *L. interrogans* as shown in the electron microscopy (SEM and TEM) observation of this study. In summary, the present *in vitro* studies demonstrated that *E. alba* leaves polyphenol has significant anti-leptospiral activity, which might be useful for application in the cooked rice and tea for safe food preparation to prevent the *L. interrogans* infection.

The evaluation *E. alba* natural polyphenol in the cooked rice and tea for safe food preparation were conducted for 24 h only since the *end user will most* likely *finished the cooked food and drinks within* 24 h time. In addition, most prepared foods have a shorter storage life and probably not safe to eat. This study showed that *E. alba* leaves polyphenol abandoned the survival of *L. interrogans* in cooked rice and tea. *L. interrogans* cells survive in flood water as reservoirs for leptospiral cells, increasing the chances of leptospiral cross-contamination such as cross contamination from the dirty flood waters caused by improper handling practices by the food handlers can transfer the pathogen to food and drinks. However, this study proved that the incorporation *E. alba* natural polyphenol in the rice and tea are capable to inhibits the survivability of *L. interrogans*. Thus, it would be noteworthy to incorporate *E. alba* natural polyphenol in the cooked rice and tea (a popular food and drink in Malaysia) during flood time to decreased the *L. interrogans infection* through pre and post-cooking contamination.

In conclusion, this study clearly showed that *E. alba* leaves polyphenol is able to inhibit the *L. interrogans* growth in rice and tea that has been prepared with the *E. alba* polyphenol. Therefore, the findings of this study suggest that the *E. alba* polyphenol can be used against *L. interrogans* infection during and after a flood as a preventing strategies by safe food preparation with natural antimicrobial polyphenol to avoid pre and post-cooking contamination.

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BANTUAN DAN PERSEDIAAN BENCANA: PENILAIAN ATRIBUT RESILIEN BAGI MEMPROMOSI KESIHATAN MENTAL DALAM KALANGAN REMAJA DAN DEWASA MANGSA BANJIR DI KELANTAN

Project Information

Project Leader	: Dr Nur Saadah binti Mohamad Aun
University	: Universiti Kebangsaan Malaysia
Address	: Pusat Pengajian Psikologi dan Pembangunan, Manusia, Fakulti Sains Sosial dan Kemanusiaan
Contact number	: 012-3011715/ 03-89213530
Email	: n_saadah@ukm.my
Project Members	: Prof Madya Dr Nor Ba'yah Binti Abdul Kadir Dr Roseliza Murni Binti Ab Rahman Puan Hilwa Abdullah@Mohd Nor Noor Amalina Binti Mohamad Amran

1.0 Introduction

Pada penghujung tahun 2014, Malaysia telah dikejutkan dengan banjir besar yang telah melanda beberapa negeri di pantai timur. Hampir 200, 000 mangsa yang terjejas dengan bencana ini dan sebahagian besarnya adalah di Kelantan. Meskipun negeri tersebut sering dilanda banjir, tetapi banjir pada kali ini ibarat tsunami kecil yang menenggelamkan bukan sahaja rumah mereka tetapi juga kampung mereka. Bukan itu sahaja, semasa bencana banjir ini berlaku, keadaan agak kacau-bilau apabila bekalan elektrik terpaksa diputuskan, perhubungan komunikasi dan jalan raya serta akses kepada hospital turut terjejas. Ini menyebabkan kebanyakan mangsa terputus hubungan dengan dunia luar dan akses kepada kemudahan. Banjir sering disebut sebagai kejadian yang boleh menyebabkan kematian daripada semua bencana alam (Alexander, 1993; French dan Holt, 1989), walaupun terdapat banyak kritikan disebabkan oleh kenyataan yang telah dibuat (EMDAT, 2004; Jonkman, 2005).Selain daripada aspek fizikal dan infrastruktur, impak bencana alam ini turut memberikan kesan kepada kesihatan mental kepada mereka yang terlibat. Selain daripada kehilangan tempat berteduh, kehilangan harta benda dan kehilangan punca pendapatan, mangsa banjir juga bimbang jika bencana banjir kembali melanda kawasan mereka lagi.

Impak daripada banjir ini dilihat memberi kesan dari segi resiliensi bukan sahaja kepada mangsa banjir, malah sistem sosial secara keseluruhannya. Resiliensi adalah keupayaan sesebuah sistem (individu, isi rumah, komuniti, institusi atau negara) untuk bertahan atau pulih daripada kejadian yang mengganggu fungsi adaptasi, viabiliti dan pembangunan. (Abramson et al., 2015; Pfefferbaum et al., 2013). Resiliensi juga boleh terjadi apabila berlakunya proses interaktif antara individu atau mangsa dengan keluarga, rakan-rakan, sekolah dan sistem komuniti (Brown & Westaway, 2011).

Dalam melihat resiliensi ini, pengkaji-pengkaji lazimnya akan mengaitkannya dengan atribut yang menjadi karektor kepada tingkah laku resiliensi. Menurut Abramson dan rakan-rakan (2015), atribut resilien boleh dinilai dari tiga jenis modal iaitu modal insan, modal ekonomi danmodal sosial. Ketiga-tiga modal ini boleh di ukur di peringkat individu dan komuniti mangsa bencana. Modal insan dinilai dari segi akses kepada kesihatan, daya tindak dan reaksi emosi (Abramson et al., 2015; Chandra et al. 2013; Norris et al., 2002; Arata et al., 2000; Norris et al., 1999), modal ekonomi dinilai dari segi duit simpanan dan pekerjaan yang stabil (Abramson et al., 2015; Norris et al., 2002; Arata et al., 2000; Norris et al., 1999), manakala modal sosial dinilai dari segi jaringan sosial dan perkhidmatan (Abramson et al., 2015; Brown & Westaway, 2011; Norris et al., 2002; Arata et al., 2000; Norris et al., 1999).

Objektif kajian ini ialah untuk mengetahui terdapat perkaitan yang signifikan antara atribut resilien dengan kesihatan mental dalam kalangan mangsa banjir. Kajian ini juga bertujuan untuk mengetahui akses kepada/atau keterlibatan dengan sumber sosial (hubungan, harapan dan kepercayaan dengan komuniti) diramal dapat mengaktifkan atribut resilien yang menyumbang kepada kesihatan mental positif. Akhir sekali, melalui kajian ini penyelidik dapat membina satu kerangka atribut resilien dalam memperihalkan tahap kesihatan mental mangsa banjir.

2.0 Methodology

Responden kajian ini terdiri daripada 348 orang yang terdiri daripada dua kategori iaitu remaja yang berumur 16 hingga 19 tahun dan dewasa berumur 21 tahun ke atas. Responden remaja adalah dari Sekolah Menengah Kebangsaan Kuala Krai manakala responden dewasa adalah penduduk di Kampung Guchil, Kuala Krai. Para penyelidik telah mendapat kebenaran Kementerian Pelajaran Malaysia bagi kajian di sekolah manakala bagi responden dewasa pula kebenaran diperolehi daripada Pejabat Daerah Kuala Krai dan kemudian oleh penghulu kampung sebelum kajian ke atas mangsa banjir dijalankan. Responden kajian terdiri daripada etnik Melayu dan Cina.

3.0 Results and Discussion

3.1 Hipotesis : Terdapat perkaitan yang signifikan antara atribut resilien dengan kesihatan mental dalam kalangan mangsa banjir.

Hasil analisis korelasi menunjukkan atribut resilien modal insan efikasi kendiri mempunyai hubungan dengan kebimbangan (r = -0.122), manakala korelasi antara atribut resilien modal sosial mempunyai hubungan dengan kemurungan (r = -0.139), kebimbangan (r=-0.113) dan kesihatan mental (r = -0.127). Keputusan analisis menunjukkan bahawa semakin kurang efikasi kendiri yang terdapat di tempat tinggal, semakin tinggi kebimbangan mangsa. Manakala, semakin baik hubungan mangsa banjir dengan komuniti maka semakin kurang simptom kesihatan mental yang dihadapi. Bagi individu yang mempunyai hubungan yang baik dengan komuniti maka semakin kurang simptom kemurungan dan kebimbangan yang dihadapinya. Pernyataan ini juga ditunjukkan oleh nilai r yang negatif bagi atribut resilien modal insan efikasi kendiri dan atribut resilien modal sosial.

Jadual 1 : Hubungan antara modal insan efikasi kendiri dan modal sosial dengan kesihatan mental

	Somatization	**Kemurungan**	**Kebimbangan**	**Kesihatan Mental**
Modal Insan: Efikasi Kendiri	-.050	-.098	-.112*	-.095
Modal Sosial	-.096	-.139**	-.113*	-.127*

Hipotesis : Akses kepada/atau keterlibatan dengan sumber sosial diramal dapat mengaktifkan atribut resilien yang menyumbang kepada kesihatan mental positif.

Dalam jadual 2 telah diterangkan mengenai min, sisihan piawai dan korelasi Pearson. Seperti yang telah diramalkan, modal sosial harapan dan modal sosial kepercayaan mempunyaihubungan yang signifikan dengan kesihatan mental manakala modal sosial komuniti, tidak mempunyai kaitan dengan kesihatan mental.

Jadual 2 : Korelasi Pembolehubah Kesihatan Mental

Pembolehubah	**Kesihatan Mental**	**Min**	**Sisihan Piawai**
Modal Sosial: Harapan	-.209**	11.1207	1.75349
Modal Sosial: Kepercayaan	-.113*	22.7414	3.52706
Modal Sosial: Komuniti	-.098	52.8103	7.90751

***. Correlation is significant at the 0.01 level (2-tailed)*

4.0 Conclusion

Berdasarkan model kajian ini membuktikan bahawa:

4.1 modal insan yang tinggi akan menyebabkan kurangnya kebimbangan dalam diri mangsa banjir.

4.2 Manakala modal sosial menunjukkan hubungan yang baik dengan komuniti serta dapat mengurangkan kebimbangan dan kemurungan.

4.3 Modal sosial harapan yang tinggi terhadap komuniti akan mengurangkan simptom kesihatan mental mangsa banjir.

4.4 Melalui model kajian yang terbentuk telah menunjukkan bahawa individu yang mempunyai modal insan, modal sosial dan modal sosial harapan akan mengurangkan simptom kebimbangan dan kemurungan serta akan memberikan kesihatan mental yang baik kepada mangsa banjir.

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COGNITIVE DISTORTION, EMOTIONAL SUPPRESSION AND RELIGIOSITY AMONG VICTIMS OF 2014/ 2015 FLOOD IN MALAYSIA: A PSYCHO-SPIRITUAL MODEL OF POST-TRAUMATIC STRESS DISORDER (PTSD) USING ELECTROENCEPHALOGRAPHY (EEG)

Project Information

Project Leader	: Assoc. Prof. Dr. Siti Aishah Hassan
University	: University Putra Malaysia
Address	: 43400 Serdang, Selangor, Malaysia
Contact number	: 019-2292609/013-3919369
Email	: siti_aishahh@upm.edu.my
Project Members	: Uba Ikechukwu Uzodinma Noor Syamilah Binti Zakaria Nor Aniza Ahmad

1.0 Introduction

Commonly, the traumatic episode of flood may co-occur with pathological reactions and undesirable outcomes such as depression, anxiety, cognitive disruption, fear and emotional suppression [1]. Numerous studies have highlighted the life-threatening dangers of Post-traumatic Stress Disorder (PTSD) and have established its physiological etiology in the cerebra of those suffering from the phenomenon [2]. Essentially, PTSD is related with irregularities in brain functioning across a range of instruments. The resultant effect of the phenomenon include, but not limited to hyper-vigilance, hyper-responsiveness and intrusive trauma-related memories [3]. The timely identification of PTSD among flood victims is vital to the improvement of its long-term psychological comorbidity, both financial and social impact on society. Yet gaps in knowledge hamper the progression of the effectiveness of services and helping relationships for PTSD sufferers.

The aim of this paper is to describe the Islamic psycho-spiritual study, an on-going cross-sectional and experi-mental study of 2014/2015 flood in Malaysia to fill the knowledge gap on PTSD and its comorbidities using EEG. Specifically, the paper describes the conceptual framework and the major knowledge gap as the basis for the study design, methodology defies with special consideration for population of flood victims.

2.0 Methodology

2.1 Design

This paper report a 2- Phase quantitative study design. The first phase is ex-post facto research is considered as the most appropriate design to be adopted for this study. The phenomenon occurred naturally and the investigation starts after the fact has occurred without interference from the researcher or any form of manipulation or measurement before the event occurred. The sample of the study will be selected from the three most affected states in the 2014/15 flood in Malaysia. Stratified random sampling will be utilized, where the strata are Kelantan, Pahang and Perak. Since sampling is done independently in each stratum, i.e. the state, separate stratum estimates and their precision can be obtained by treating each stratum as a ``population'' on its own right. In this study, 1000 respondents will be selected from Kelantan, 600 for Pahang and 400 for Perak. An optimum size for SEM data analysis was 200 for each model . Therefore, at least a minimum of n= 400 stratum is needed for SEM invariance model analysis.

2.2 Instrumentation

Cognitive Distortion Scales a 40-item scale used in as-sessing dysfunctional cognitions characterized by self-criticism, helplessness, hopelessness, self-blame and preoc-cupation with danger, scored on a five point Likert scale ranging from 1 = never to 5 = very often will be used in examining cognitive distortion in the present study. The instrument is reliable and valid as reported by many scholars. The Courtauld Emotional Control Scale a 21-item instrument measuring the impact of suppressing anger, depression and anxiety, scored on a four point Likert scale ranging from almost never = 1 to almost always = 4. The instrument is reliable and valid as reported by many schoolars. Universal Religiosity Personality Inventory is an 84-item measure scored on a 5-point scale ranging from 1 = never to 5 = always, appraising three dimension of religiosity namely pro-social, anti-social and ritual behaviours. The Posttraumatic Stress Diagnostic Scale (Lobo et al.,2015) is used in measuring PTSD symptoms among the flood victims.

The second phase is experimental design (n=50).Following the same procedure study on the effect of Muslim Prayer (Salat) on a Electroencephalography and Its Relationship with Autonomic Nervous System Activity , during the experiment, EEG and ECG signals were continu-ously recorded with a computer-based data acquisition system (MP150; BIOPAC Systems Inc., Camino Goleta, California). EEG was recorded with an AgCl electrode cap, with electrodes positioned on the participant's head with the use of the standard 10–20 system. On the basis of previous studies, electrodes were placed at O1, O2, P3, P4, C3, C4, F3, and F4 and referenced to the linked ear lobe electrode during recording. In addition, for detection of PTSD, the present study follow the on functional connectivity of resting state EEG and symptom severity in patients with post-traumatic stress disorder. Symptom severity of the PTSD patients was assessed, and 62-channel EEG was measured. EEGs were recorded during the resting state, with the eyes closed. Three nodal network measures to assess nodal centrality [nodal degree (Dnodal; connection strength), nodal efficiency (Enodal; communication effi-ciency), and between centrality].

2.3 Data Analysis

For phase 1, the collected data will analyzed with SPSS version 22 and AMOS version 22. A two-steps structural equation modeling (SEM) with multi-group invariance analysis will be performed. The first step is to ensure the construct validity of the measurement models. The second step is to assess the causal relationship of the exogenous and the endogenous variables. In addition, multi-group invariance analysis will be conducted in the study due to the efficiency of simultaneous analysis of two models. Only one set of goodness-of-fit statistics GFI, AGFI, IFI, TLI, CFI >0.90, and RMSEA <0.08, will be used for the model evaluation Vanderberg and Lance (2000) suggest hierarchical evaluation of invariance. This study will evaluate the factorial (measurement weight equal) and structural (structural weight equal) invariances. For evaluating the group invariance, a cut off value ΔCFI <0.01 will be used.

For phase 2, experimental data were analyzed with SPSS software, Version 20. Analysis of variance (ANOVA) was used to test the changes in the means of the RPa and HRV variables during psycho-spiritual treatment and pre- and post-baseline. Additional comparisons were also con-ducted with the post hoc test. The Pearson product-moment correlation coefficient was obtained to determine the corre-lation between the HRV frequency power and RPa of the EEG signals and also between HRV and respiration. A p-value less than 0.05 was considered to represent a statistically significant difference.

3.0 Results and Discussion

The results showed that cognitive distortion of creating negatives appraisals of external threat (the world is dangerous place) and internal threat (themselves as incapable) may become a risk factor for PTSD, β=.137, p<.01. Emotional suppression/control that acts as a defence mechanism for the victims to prevent emotional exhaustion may increase/decrease the symptoms of PTSD, however found not to be significant, β=.005, p=.894. Religiosity has been evidence as buffer to psychological distress, β=.093, p <.05. Psycho-spiritual treatment for the victims seems to be promising, there was a significant different in Autonomic nervous system activities (ANSA) of experimental group between pre and post treatment t= 3.43, p<.05 but not for control group t=.216, p= .843.

4.0 Conclusion

4.1 This paper report a 2- Phase quantitative study design. The first phase is ex-post facto research is considered as the most appropriate design to be adopted for this study. In this study, 1000 respondents will be se-lected from Kelantan, 600 for Pahang and 400 for Perak. An optimum size for SEM data analysis was 200 for each model . Therefore, at least a minimum of n= 400 stratum is needed for SEM invariance model analysis.

4.2 Data analysis for phase 1, the collected data will analyzed with SPSS version 22 and AMOS version 22. A two-steps structural equation modeling (SEM) with multi-group invariance analysis will be performed. The first step is to ensure the construct validity of the measurement models. The second step is to assess the causal relationship of the exogenous and the endogenous variables. In addition, multi-group invariance analysis will be conducted in the study due to the efficiency of simultaneous analysis of two models. Only one set of goodness-of-fit statistics GFI, AGFI, IFI, TLI, CFI >0.90, and RMSEA <0.08, will be used for the model evaluation Vanderberg and Lance (2000) suggest hierarchical evaluation of invariance. This study will evaluate the factorial (measurement weight equal) and structural (structural weight equal) invariances. For evaluating the group invariance, a cut off value ΔCFI <0.01 will be used.

4.3 For phase 2, experimental data were analyzed with SPSS software, Version 20. Analysis of variance (ANOVA) was used to test the changes in the means of the RPa and HRV variables during psycho-spiritual treatment and pre- and post-baseline. Additional comparisons were also con-ducted with the post hoc test. The Pearson product-moment correlation coefficient was obtained to determine the correlation between the HRV frequency power and RPa of the EEG signals and also between HRV and respiration. A p-value less than 0.05 was considered to represent a statistically significant difference. The second phase is experimental design (n=50). Following the same procedure study on the effect of Muslim Prayer (Salat) on a Electroencephalography and Its Relationship with Autonomic Nervous System Activity , during the experiment, EEG and ECG signals were continu-ously recorded with a computer-based data acquisition system (MP150; BIOPAC Systems Inc., Camino Goleta, California). EEG was recorded with an AgCl electrode cap, with electrodes positioned on the participant's head with the use of the standard 10–20 system. On the basis of previous studies, electrodes were placed at O1, O2, P3, P4, C3, C4, F3, and F4 and referenced to the linked ear lobe electrode during recording. In addition, for detection of PTSD, the present study follow the on functional connectivity of resting state EEG and symptom severity in patients with post-traumatic stress disorder.Symptom severity of the PTSD patients was assessed, and 62-channel EEG was measured. EEGs were recorded during the resting state, with the eyes closed. Three nodal network measures to assess nodal centrality [nodal degree (Dnodal; connection strength), nodal efficiency (Enodal; communication effi-ciency), and between centrality].

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NUTRITION DENSE READY-TO-EATMEAL TO HEAL (M2H) AS ENERGY AND IMMUNITY BOOSTER FOR FLOOD DISASTER VICTIMS

Project Information

Project Leader : Dr Dayang Norulfairuz Abang Zaidel
University : Universiti Teknologi Malaysia
Address : Faculty of Chemical & Energy Engineering,
Universiti Teknologi Malaysia, 81310 Johor Bahru
Contact number : 018-2245756
Email : dayang@cheme.utm.my
Project Members : Prof. Dr. Ida Idayu Muhamad, Dr. Yanti Maslina Mohd. Jusoh
Dr. Eraricar Salleh, Dr. Zulkifli Hamisan @ Khair
Assoc. Prof. Dr. Angzzas Sari Mohd. Kassim

1.0 Introduction

In Malaysia, flood disaster has affected many areas since 1971 (Sipon et al., 2015). Up till now, Malaysia had been affected with devastated seasonal flood which jeopardize access to essential treatment, care, equipment, water and food which result in exacerbation of existing conditions or even preventable death.

In response with natural disaster, Ready-to-Eat Meal to Heal (M2H) without reheating prior to consumption serves a useful temporary purpose in some emergency situation. According to the United State Department of Defense (USDD), the ready-made meals which initially introduced in 1963, play very significant role as intermediate response at the emergency when no other food or in worse situation no cooking facilities are available. Nowadays, due to growing need of ready-made meals among consumers, the ready-made meals not only being served in emergency situation, but it become one of the fastest growing sectors in developed countries (Schmidt Rivera et. al, 2014). The advantages of ready-made meals described by consumers as fast-handling and needing minimal preparation before consumption are important driving factor to the increase the need and demand of ready-made meals (Calderón et. al, 2010). Nevertheless, today challenges encountered of ready-made meals are the complexity of composite dishes resulted into less total energy, low in sugar, high in saturated fat and salt.

The important qualities of food are textural and rehydration capability. Rehydration capability depends on the food structure (Luangmalawat et. al, 2008). Different drying conditions and different drying techniques can create diverse food structures (Ibrahim and Osman, 2012). In this case, the application hot air drying in the first stage followed by microwave technology might help maintaining the high quality of M2H.

2.0 Methodology

Formulation Development of M2H

Content of M2H should comprise of a balanced nutrition. According to (MDG) 2010, the suggested diet should include carbohydrate, protein, vitamin and fat provided with the right portion.

Preparation of M2H Using Microwave Heating

Microwave heating technique will be applied to cook and preserve the meal. In order to prolong the shelf life, M2H will then be freeze-dried. Freeze-drying method could prolong the shelf life of the product, (M. E. Gounga et al., 2008)

Food Quality Analysis

Total Calories, Total Carbohydrates, Total Fat, Dietary Fiber, Iron, Protein, Sodium, Sugars, Vitamin A, Vitamin C, Ash and Moisture Content, and Antioxidant

Texture analysis was done to ensure the product is prepared according to expectation of the consumers.

Rehydration test will be performed to evaluate the rehydration ability of the M2H for porridge and beverages applications.

3.0 Results and Discussion

The preliminary result was only at the stage of improving formulation, sensory analysis and proximate analysis. The proximate analyses were conducted to determine the nutritional values of product in terms of energy content, carbohydrate, fat, protein, vitamin C and moisture content. As expected, the proximate composition shall contain of 78% of carbohydrate, 14.7% of protein, and 6.8% of fat as recommended by Malaysia Dietary Guidelines (MDG). The result of proximate analyses for M2H energy content was presented in Figure 1, demonstrating that the M2H which contained 200g of rice and 40g of minced chicken respectively contributed to the highest energy content suitable with Malaysian energy requirement. While Figure 2 showed textural structure of M2H after being dried in oven and microwave, indicating that drying parameters from different cooking technique significantly affected the textural quality.

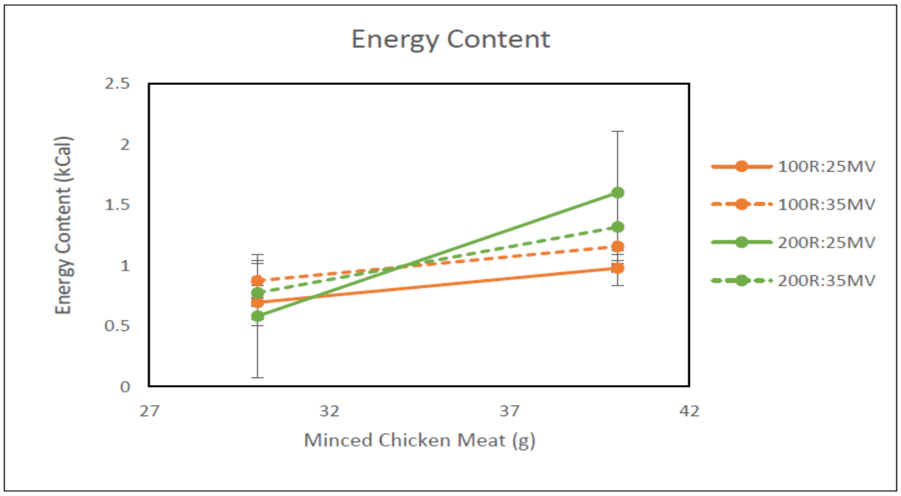

Figure 1 Energy content of M2H formulation

(a) (b)

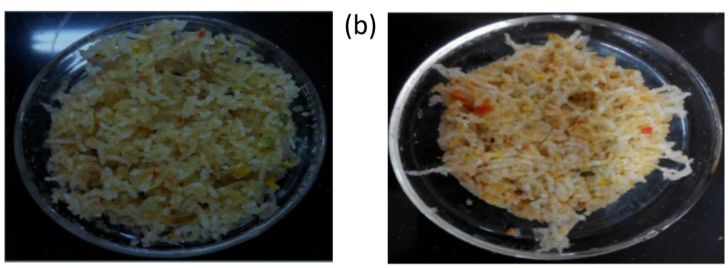

Figure 2 M2H dried in microwave technique at different microwave power levels (a) 200W; (b) 400W

The result of rehydration of M2H was presented graphically in Figure 3. The M2H was easily rehydrated after being immersed in water at room temperature, indicating the M2H has potential food aid during natural disaster without reheating prior to consumption. The product can be consumed as snack or immerse in water as porridge.

Figure 3 Rehydration of cooked M2H

4.0 Conclusion

Different processing conditions of drying have different effect on the physical and physicochemical properties of M2H. Combination of microwave technique and oven drying was found to be a remarkably key effect on nutritional quality of M2H.

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DETECTION OF LEPTOSPIRA-SPECIFIC ANTIBODIES IN FLOOD VICTIMS WITH ACUTE FEBRILE ILLNESS USING RECOMBINANT ANTIGEN LIPL32

Project Information

Project Leader	: Daisy Vanitha John
University	: Universiti Malaysia Sabah
Address	: Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia
Contact number	: 0119071716
Email	: daisyv@ums.edu.my
Project Members	: Dr. Timothy William, Assoc. Prof. Dr. Kenneth Rodriges Assoc. Prof. Dr. Ivy Wong Nyet Kui, Dr. Rafidah Binti Othman

1.0 Introduction

Leptospirosis is a zoonotic disease caused by infection of the pathogenic *Leptospira interrogans* that affects both humans and animals. According to World Health Organization's Leptospirosis Burden Epidemiology References Group (LERG), there is an estimated 873,000 cases of human leptospirosis reported annually with 48,000 fatalities (Bandara et al., 2014). Countries with the highest reported incidence are located in the Caribbean, Latin America, Indian subcontinents, Southeast Asia, Oceania and Eastern Europe (Pappas et al., 2008; Shafei et al., 2012). Timely diagnosis of leptospirosis remains a challenge since the organism is not easily cultivable and the available diagnostic tests show varying levels of performance (Yaakob et al., 2015). Even though microscopic agglutination test (MAT) assay is considered as the reference method for diagnosis of leptospirosis, this assay is not effective in early detection of the disease. Attempts have been made to develop enzyme-linked immunosorbent assays (ELISAs) for detection of *Leptospira*-specific antibodies using recombinant *Leptospira* outer membrane proteins (OMP) as antigens (Dey et al., 2004; Tomich et al., 2007; Chen et al., 2013; Alizadeh et al., 2014). Due to variations in codon usage among species, codon optimization is required for increasing the translational efficiency of target genes by modifying their codons without changing the amino acid sequences. This technology has been widely used for diagnostic purposes such as antibody detection against swine fever virus, equine infectious anaemia virus (EIAV), and foot and mouth disease virus (Sodoyer, 2004; Jin et al., 2004; Sun et al., 2008; Liu et al., 2011; Menzella, 2011; Gao et al., 2012). In this study, the synthetic gene encoding LipL32 protein was designed and expression in *E. coli.* The expressed protein was purified and subsequently used as antigen in ELISA for detection of *Leptospira*-specific antibodies in human serum samples.

2.0 Methodology

Synthesis of codon optimized *lipl32* gene: The LipL32 amino acid sequence was retrieved from the NCBI (Accession number: ACZ73827.1). This sequence was codon optimized for expression in *E. coli* BL21 (DE3) using Gene Designer software (Villalobos et al., 2006). A single stranded oligonucleotide was synthesized after reverse translation of the optimized codon, assembled and inserted into the open reading frame (ORF) of pET22b plasmid expression vector using *Bam*H1 and *Eco*RI restriction sites. The insert was verified by Sanger DNA Sequencing and restriction digestion. The synthesis of this synthetic nucleotide sequence was carried out by GENEWIZ Inc.

Screening for transformants carrying the plasmid encoded *lipL32* gene: The pET22b-*lipl32* plasmid was transformed into *E. coli* BL21 (DE3) strain. Recombinant clones were selected on Luria-Bertani (LB) agar plates supplemented with ampicillin and subjected to direct colony PCR to detect the recombinants harboring the *lipl32* insert. The positive clones were further screened using restriction enzyme digestion analysis. A true positive clone was inoculated into 5 mL of lysogenic broth and incubated overnight at 37°C in a shaker incubator at 200 rpm. Fresh lysogenic broth was added the following day and incubated at 37°C until the optical density (OD_{600}) reached 0.6 to 0.8. The culture was induced with 1.0 mM of isopropyl-*β*-*D*-thiogalactopyranoside (IPTG) and shaken (200 rpm) at 37°C overnight. Aliquots of culture were taken every hour for expression and solubility studies. These aliquots were lysed by sonication and analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE).

Production and purification of synthetic rLipL32 protein: The transfomant was grown in 2 L of broth and incubated at 37°C until the optical density (OD_{600}) reached 0.6 to 0.8. The culture was induced with

IPTG and incubated for 3 hrs at 20°C. The culture was harvested by centrifugation and the pellet was resuspended in 5 mL/g of lysis buffer (20 mM sodium phosphate, 500 mM NaCl, 20 mM imidazole pH 7.4) and 1% Triton X-100. The cells were homogenized by sonication and the lysate was separated from the cell debris by centrifugation. The pellet was subjected to a second round of washing with 5 mL/g of deionized water and followed by centrifugation. The pellet was resuspended in 5 mL/g of phosphate-buffered saline (PBS) pH 12.0 for solubilisation and purified by affinity chromatography using HisTrap FF crude column (GE Healthcare, USA) with AKTA™ Pure Purification System (GE Healthcare, USA). After adsorption of the rLipL32 protein to the column, the bound proteins were eluted with elution buffer (20 mM of sodium phosphate, 500 mM NaCl, and 500 mM imidazole pH 7.4). Fractions were collected, analyzed with 10% of SDS-PAGE and quantified by Bradford method.

Detection of *Leptospira*-specific antibodies by ELISA: Human serum samples (MAT positive and MAT negative) were provided by Kota Kinabalu Public Health Laboratory, Sabah, Malaysia. All serum samples were stored at -20°C until they were tested. Purified rLipL32 protein (0.25 µg/50 µL well) was used for coating 96 well Maxisorp immunoassay plates (Nunc, Denmark) and incubated overnight at 4°C. The plates were washed with washing buffer (PBS-0.05% Tween 20) and blocked with blocking buffer (PBS-3% BSA) for at least 90 min. The plates were washed and 50 µL of serial two-fold dilutions of serum starting from 1:100 to 1:3200 were added. The plates were incubated for 4 hours at room temperature. The plates were washed and 1:1000 dilutions of alkaline phosphatase (ALP)-conjugated goat anti-human IgG or IgM antibodies (Southern Biotechnology, USA) were added into each well. The plates were incubated overnight at 4°C and washed and the bound secondary antibodies were detected by adding p-nitrophenyl phosphate (PNPP) in diethanolamine substrate buffer (DSB). The plates were read at 405 nm with microplate reader (TECAN Infinite 200® PRO, Switzerland). The antibody concentrations were expressed in optical density (OD) values. A serum sample was considered as positive when the OD value was two-fold higher than the negative control. Positive and negative controls were included in each assay. The relative sensitivity and specificity of the ELISA for the detection *Leptospira*-specific IgM and IgG was calculated by the following formula: Sensitivity (%) = (a/[a+c]) x 100%, where ‘a’ is the number of true positive samples and ‘c’ is the number of false negative samples. Specificity (%) = (d/[b+d]) x 100%, where ‘d’ is the number of true negative samples and ‘b’ is the number of false positive samples (Sivakolundu et al., 2012).

3.0 Results

Generation of synthetic *lipl32* gene, expression and purification of rLipL32 protein: The codon optimized *lipl32* gene construct in pET22b plasmid expression vector is shown in Fig 1. The gene contained additional His-tag sequences at the C-terminus and the expression was regulated by T7 promoter. Constructed recombinant plasmid (pET22b-*lipl32*) was introduced into *E. coli* BL21 (DE3) host strain and then the transformants were selected in the presence of ampicillin and cultured for expression.

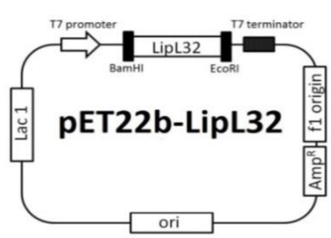

FIGURE 1: The schematic diagram of codon optimized *lipl32* gene construct in pET22b plasmid expression system.

In this study, a specific band of approximately 40 kDa representing the rLipL32 protein was obtained at the highest concentration after 3 hours following IPTG induction (Fig. 2). The protein was detected primarily as inclusion bodies. The rLipL32 protein was purified by immobilized metal affinity chromatography (IMAC). Fractions collected after purification was analyzed by SDS-PAGE (Fig. 3). Lanes 1 and 2 show the un-induced culture of insoluble and soluble fraction that served as controls. The first wash with Triton X-100 after sonication process indicated that the rLipL32 protein was preserved in the sample (Lane W1) and even after the second wash using deionized water (Lane W2). As shown in Lanes E1 to E3, the 40 kDa purified rLipL32 protein was present in all the three fractions.

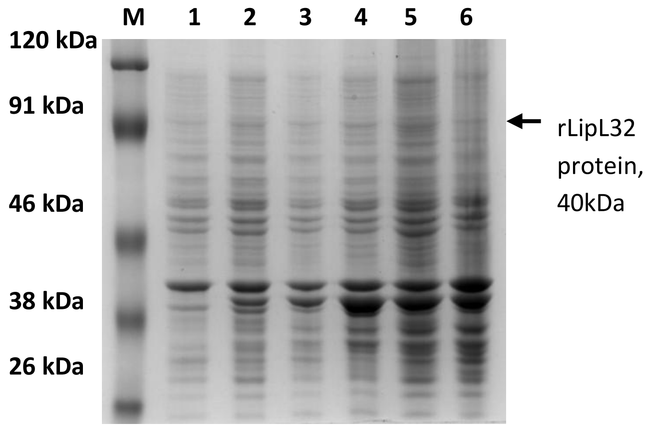

FIGURE 2: SDS-PAGE of total protein from *E.coli* BL21 (DE3) expressing rLipL32 protein at different incubation times (inclusion bodies). Lane M: Low range protein ladder; Lane 1–6: 0 hour, 1 hour, 2 hours, 3 hours, 4 hours and overnight incubations (16 hours).

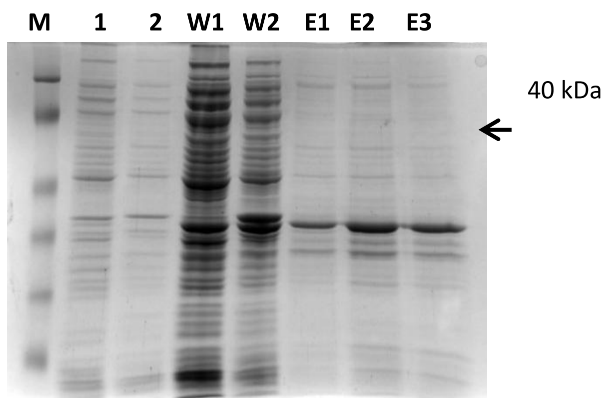

FIGURE 3: SDS PAGE analysis of purified rLipL32 protein. Lane M: Low range protein ladder; Lane 1–2: Un-induced culture of insoluble & soluble fractions; Lane W1: Insoluble fraction (Triton-X 100), 3 hours post induction; Lane W2: Insoluble fraction (deionized water), 3 hours post induction; Lanes E1–E3: Elution fractions of purified rLipL32 protein.

LipL32 detects *Leptospira*-specific antibodies in human sera: The purified rLipL32 antigen was able to detect the presence of *Leptospira*-specific antibodies in the tested serum samples by ELISA. *Leptospira*-specific IgG was detected in 71.3% of the MAT positive serum samples while 67.5% of these samples were also positive for *Leptospira*-specific IgM. Of the 20 MAT negative serum samples, 25% (n = 5) were positive for *Leptospira*-specific IgM and 45% (n = 9) were positive for *Leptospira*-specific IgG (Table 1). Figs. 4 (a) and (b) shows the presence of *Leptospira*-specific IgM and IgG antibodies in representative serum samples by ELISA. The comparative analysis with MAT assay showed that rLipL32 ELISA was able to distinguish the presence of *Leptospira*-specific IgM and IgG in the serum samples. The overall agreement between the tests was 87%.

TABLE 1: Detection of *Leptospira*-specific IgM and IgG in human serum samples

	IgM ELISA		IgG ELISA	
	Positive	Negative	Positive	Negative
MAT Positive (n=80)	54 (67.5%)	26 (32.5%)	57 (71.3%)	23 (28.7%)
MAT Negative (n=20)	4 (20%)	16 (80%)	9 (45%)	11 (55%)

IgM ELISA: Sensitivity= 67.5%; Specificity= 80%
IgG ELISA: Sensitivity= 71.3%; Specificity= 55%

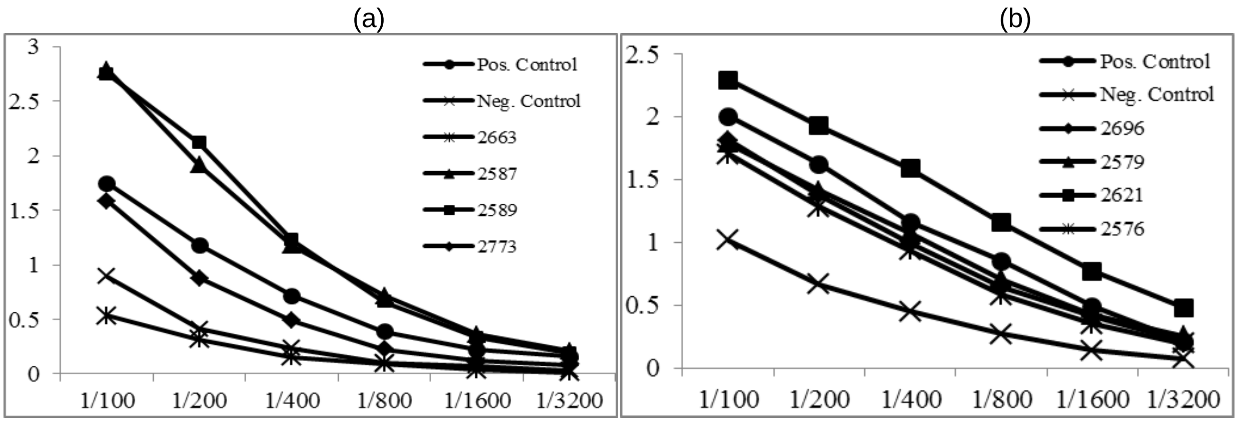

FIGURE 4: Presence of (a) *Leptospira*-specific IgM and (b) *Leptospira*-specific IgG detected in representative serum samples by ELISA. Serum samples were serially diluted from 1:100 to 1:3200 (x-axis). The y-axis indicates the OD reading at 405nm.

4.0 Discussion

In this study, the diagnostic potential of rLipL32 based ELISA in detecting *Leptospira*-specific antibodies in human serum samples was evaluated. Our data suggest that the rLipL32 ELISA is able to detect both *Leptospira*-specific IgM and IgG antibodies and thus can be used for detecting recent as well as past infection of *Leptospira*.

The lipoprotein LipL32 is the most studied outer membrane protein (OMP) relative to other major classes of OMPs due to the conserved pathogenicity among the pathogenic strains of *Leptospira*. Development of ELISA based on recombinant *Leptospira* antigen is advantageous as it bypasses the need for culturing hazardous *Leptospira* in the laboratory. The efficiency of the expression of rLipL2 protein in *E. coli* was enhanced by codon optimization. A 26 amino acid synthetic peptide HapI/LipL32 which had been synthesized for use in serodiagnosis of human leptospirosis has been reported earlier (Aviat et al., 2010). The rLipL32 was expressed with a His-Tag at the C-terminus in *E.coli* under the control of an IPTG-induced T7 promoter. The expressed protein was present exclusively in inclusion bodies. Analysis by the SDS-PAGE showed that the rLipL32 expressed was approximately 40 kDa in size. The molecular size of rLipL32, however differed from what has been reported in literature (Haake et al., 2000; Zhang et al., 2005; Tahiliani et al., 2005; Boonsathorn et al., 2009; Hartwig et al., 2010; Pinne and Haake, 2013). The synthetic *lipl32* gene in this study was designed without its own start codon (ATG) and the expression of rLipL32 was initiated by the start codon from the pET22b expression vector, thus causing slightly bigger molecular weight of rLipL32 protein

The sensitivity of the rLipL32 IgG ELISA when compared to MAT assay was found to be 71.3%, suggesting the potential use of rLipL32 ELISA in assessing the seroprevalence of leptospirosis. Meanwhile, the sensitivity of rLipL32 IgM ELISA was lower than earlier reports (AiHua et al., 2012; Vedhagiri et al., 2013; Alizadeh et al., 2014). The MAT assay does not distinguish IgM and IgG and it may not be an ideal method for comparison, thus, the lower level of the performances in this study may not be accurate as it was compared to the MAT assay. The MAT negative samples that showed reaction in ELISA could be due to higher sensitivity of ELISA since the OD values are read by the spectrophotometer in contrast to visual measurement in MAT assay or due to cross reactivity which needs further confirmation (Hartleben et al., 2013). Determining immunodominant epitopes of LipL32 is needed to reduce any cross-reaction that might occur during detection of the *Leptospira*-specific antibodies in the serum samples.

5.0 Conclusion

Synthetic rLipL32 antigen-based ELISA for the detection of *Leptospira*-specific antibodies developed in this study was able to able to detect the presence of the *Leptosira*-specific IgM and IgG in human serum samples. The findings presented demonstrated the capability of synthetic rLipL32 ELISA in early diagnosis of leptospirosis as well as its potential use in assessing the seroprevalence of leptospirosis in the community.

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DEVELOPMENT OF A PROTOTYPE RAPID ANTIGEN DETECTION TEST FOR LEPTOSPIROSIS

Project Information

Project Leader : Prof Dr Rahmah Noordin
University : Universiti Sains Malaysia
Address Institute for Research in Molecular Medicine (INFORMM), Universiti Sains Malaysia, 11800 Penang, Malaysia
Contact number : Office 04-653 4854; Hp: 012 522 8485
Email : rahmah@usm.my
Project Members : Dr. Mehdi Riazi

1.0 Introduction

Leptospirosis is caused by a pathogenic *Leptospira spp.*, a tiny and highly motile spirochete. It is a re-emerging global health threat with high mortality rate. Yearly, there are more than 500,000 cases reported, with more than 10% deaths [1]. As one of the most common zoonotic disease, leptospirosis is endemic in developing and industrialized countries, particularly in tropical countries because warm and high rainfall rate climate favors its growth. The bacteria infects human via open wound and mucous membrane upon contact with contaminated fresh water or wet soil. Leptospirosis cases due to occupation (e.g. military troops, farmers) and recreational activities (water sports) have been frequently reported [2]. Heavy rainfall flushes high doses of the bacteria into mainstream water, thus it is not surprising that most of major leptospirosis outbreaks have been associated with monsoon season [3, 4].

Leptospirosis showed multifaceted symptoms such as severe headache, fever and diarrhea . While most cases have mild to moderate symptoms, a severe and potentially fatal form called Weil's syndrome can occur which causes pulmonary haemorrhage, jaundice and renal failure. Due to the similarity of its symptoms with dengue, typhoid and malaria, laboratory diagnosis turns to be very important to identify and assist in treatment of leptospirosis. Most current laboratory diagnosis aims to detect anti-leptospiral antibody developed by patient upon infection. While the diagnostic kits generally performed well with serum from convalescent patients (more than two weeks post-infection), they have limited diagnostic value in detecting acute (first ten days) infection [5]. Low antibody titer in patients during acute phase is a major drawback for leptospirosis antibody detection. Moreover, differences in seroconversion rates among individuals and administration of over-the-counter antibiotics complicate the diagnosis [6].

Diagnosis of leptospirosis in the critical first ten days of infection is important so that prompt clinical decision can be made. Due to the high bacterial load in patient's blood during the acute phase, detection of *Leptospira* bacteria or antigens is a promising strategy. The strategy has been applied in detecting dengue virus infection [7] but not well demonstrated for leptospirosis. Thus, the present study was aimed at developing an early prototype (proof of concept) lateral flow rapid antigen detection test to complement the existing antibody test for early detection of leptospirosis in humans.

2.0 Methodology

E. coli BL21 (DE3) was used as a host to recombinantly express eight leptospiral proteins. They included an *in- vivo* induced antigen protein (rLepS8A1) and its truncated derivatives (rF24 and rF34), which were previously identified *in house* using *in vivo* induced antigen technology. In addition the following leptopiral recombinant outer membrane proteins were also included i.e. two surface-exposed proteins (LipL32 and LipL41); leptospiral porin (OmpL L) and leptospiral immunoglobulin-like surface-associated protein (Lig A).

The proteins were purified by immobilized metal affinity chromatography in denaturing condition. Prior to immunization, the purity of each protein was further enhanced by gel electroelution. An immunogen cocktail comprising whole cell lysate of three common *Leptospira* serovars (Australis, Birkini and Javanica) was also prepared. Three-month-old New Zealand white rabbits were used to raise polyclonal antibody against each of the immunogens mentioned above. The titers and limits of detection of the antibodies raised were evaluated in enzyme-linked immunosorbent assay (ELISAs) and Western Blots, respectively. Subsequently, immunoglobulin G (IgG) fraction of the rabbit hyperimmune sera were purified and sent to Nanobiotechnology laboratory (INFORMM, USM) for custom conjugation to 40 nm colloidal gold nanoparticles.

Lateral flow dipstick (LFD) in this study consisted of Hi-flow Plus 90 nitrocellulose membrane card (Milipore, USA) with membrane flow rate of 90 ± 23 sec/4cm and a 5 cm absorbent pad. The strips were prepared in two different forms: the dot and lined dipsticks. For dot dipstick, 1 µL of different concentration of antibody was spotted on each strip. For the lined dipstick, 2 mg/mL antibody was dispensed at a rate of 0.1 µL/mm using IsoFlow™ Dispenser (Imagene Technology, New Hampshire, USA). Control line consisted of 0.15 mg/mL goat anti-rabbit IgG (Invitrogen, USA). The LFD assay was performed using a pooled healthy serum samples (n=4) diluted in equal volume of diluent containing spiked organisms. Gold-conjugated antibody was added into the serum samples and incubated for 15 min. The dipstick test was then dipped into the mixture allowing the sample to be transported through the dipstick via capillary action. The background was cleared in the final washing step. For dot dipstick, the test was positive when distinct purplish red was observed, and negative when there is no signal observed after washing step. For lined dipstick, the test was interpreted as positive when both control and test lines were observed; and negative when only control line was observed. The limit of detection of the prototype was evaluated with different cell number of *Leptospira spp.* Reactivity of the prototype towards other *Leptospira* serovars were tested with a battery of *Leptospira spp.*, while the diagnostic specificity of the test was evaluated with a panel of control bacteria.

3.0 Results and Discussion

Production of Rabbit Polyclonal Antibodies against Leptospiral recombinant Proteins and Lysate

Under IPTG induction, all leptospiral recombinant proteins with the expected target sizes were successfully expressed with satisfactory yields (Figure 1). The reactivity of hyperimmune rabbit antisera against leptospiral recombinant proteins and cocktail of leptospiral lysates were determined by Western Blot (Figure 1). Antisera against rLepS8A1, rF24, rF34 and LigA detected as low as 2.5 ng of the respective immunogens, suggesting high sensitivity of the antibodies produced. LipL41, LipL32 and OmpL1 demonstrated slightly lower sensitivity of 25 ng. The antibodies developed against rLepS8A1 and its truncated derivatives (rF24 and rF34) showed expected cross-reactions with each other. The results showed that rF34 fragment was the immunodorminant epitope of the full length rLepS8A1. Anti-leptospiral lysate antiserum was successfully raised by the demonstration of strong immunoreactivity against 20 µg leptospiral lysates from each of the three *Leptospira spp.* serovars. The polyclonal antibodies were specific since no reactivity was observed when the immunogen was probed with their respective pre-immunized serum. The titers of each antibody was determined using indirect sandwich ELISA. Anti-rLepS8A1, rF24, rF34, LigA and leptospiral lysate elicited titers of ≥ 1,024,000. OmpL1, LipL41 and LipL32 produced antibody titers of 128,000, 256,000 and 512,000, respectively.

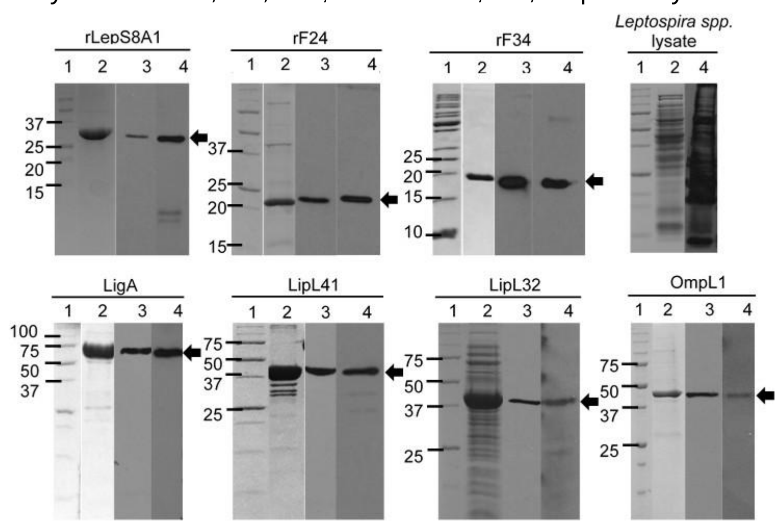

FIGURE 1: Western blot s of *Leptospira spp.* lysate (representative) and purified recombinant leptospiral antigens. The proteins were analyzed on SDS-PAGE and probed with anti-His antibody and/or the respective rabbit antiserum. Arrow indicates the target protein. Lane 1, Unstained Protein Standard (Bio-Rad, US); Lane 2, purified protein analyzed on SDS-PAGE; Lane 3, purified protein probed with anti-His antibody; Lane 4, purified protein probed with the respective rabbit antiserum.

Evaluation of Best Assay Format for Detection of *Leptospira*

With availability of eight antibodies targeting different leptospiral proteins or lysate, preliminary experiments were conducted to determine the best combination of immobilized and gold-conjugated antibodies for *Leptospira* detection. Surprisingly, all combination which involved antibodies against leptospiral recombinant antigens did not show any signal when tested with *Leptospira* spiked serum (Figure 2). The format using anti-LigA antibody showed non-specific reaction with negative control (data not shown). The assay format using anti-leptospiral lysate as both capture and gold-conjugated antibody developed signal against leptospiral sample. Thus, further test development was performed using this assay format.

Subsequent preliminary work was performed to determine the optimum parameters for the test. The best amount of capture antibody was determined to be 1 µg, while the optimum optical density of gold-conjugated anti-leptospiral lysate antibody was found to be 3.

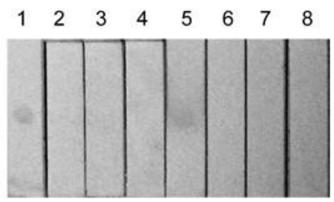

FIGURE 2: Evaluation of the best assay format for detection of *Leptospira* using dotted dipstick format. Anti-leptospiral lysate antibody was used as immobilized antibody. Strip 1-8 was tested with gold-conjugated anti-leptospiral lysate, LipL41, LipL32, OmpL1, LigA, rLepS8A1, rF24 and rF34 antibody, respectively.

Reactivity against Common *Leptospira* Serovars in Malaysia

The prototype test was evaluated with nine most common pathogenic serovars of *Leptospira spp.* in Malaysia and *L. biflexa*, a non-pathogenic species of *Leptospira*. The prototype showed positive signals in all serum samples spiked with *L. interrogans* serovar Australis, Birkini, Birkini (local isolate), Copenhageni, Icterohaemorrhagiae, Lai (local isolate), Smithi, Pomona, *L. borgpetersenii* serovar Javanica and *L. biflexa* serovar Patoc (Figure 3). This suggested broad reactivity of the test.

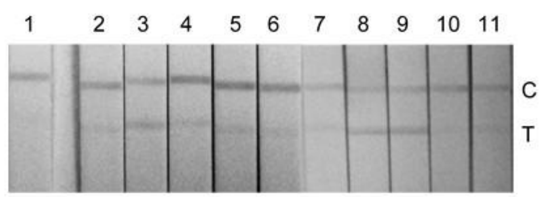

FIGURE 3: Detection of common *Leptospira* serovars in Malaysia. Strip 1 is reaction without any bacteria, strip 2-11 was tested with *L. interrogans* serovar Copenhagani , Australis, Birkini (local isolate), Lai (local isolate), Icterohaemorrhagiae, Smithi, *L. borgpetersenii* serovar Javanica, *L. interrogans* serovar Pomona, Birkini and *L. biflexa.* C and T denoted control and test line, respectively.

Sensitivity and Specificity of the Prototype

The prototype test was evaluated with pooled healthy serum spiked with individual component of the *Leptospira* lysate cocktail. The prototype showed good sensitivity against *L. interrogans* serovar Australis and *L. borgpetersenii* serovar Javanica. Strong reactivities were observed with 10^7 to 10^6 cells of the bacteria. Doubtful lines were observed with 10^4 cells, while 10^3 or lower number of cells did not produce any lines. The sensitivity of *L. interrogans* serovar Copenhagani was weaker as shown by weak positive reaction with 10^5 cells. No reaction was observed when it was tested with healthy sera. Thus, the detection limit of the prototype test was found to be approximately 10^4-10^5 *Leptospira* cells (Figure 4A). The prototype test was also tested with other clinically important pathogens. The assay was negative for all of the control bacteria tested, thus demonstrating high specificity (100%) (Figure 4B).

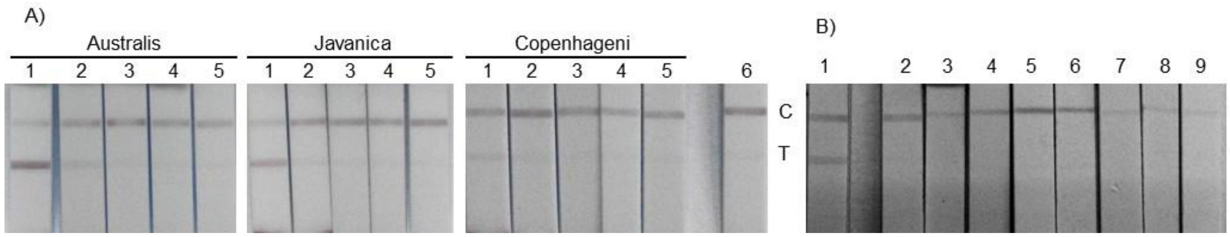

FIGURE 4: Performance evaluation of the prototype. C and T denoted control and test line, respectively. (A) Limit of detection was tested with various amount of *Leptospira spp*. Strip 1-5 was tested with 10^7, 10^6, 10^5, 10^4 and 10^3 of respective *Leptospira* cells; Lane 6 was tested without spiking bacteria. (B) Specificity was evaluated with other relevant pathogens. Strip 1-9 was tested with equal number of *L. interrogans* serovar Australis*, Salmonella typhi*, *Streptococcus* group B, *Enterococcus faecium*, *Escherichia coli*, *Acinetobacter baumannii*, *Klebsiella pneumonia* and *Enterococcus faecalis*, respectively.

4.0 Conclusion

We have developed a lateral flow prototype (proof of concept) test for laboratory diagnosis of acute leptospirosis. It is rapid (<20 min), easy to use and to interpret. The important findings of the study are summarized below:

4.1 Eight rabbit polyclonal antibodies targeting rLepS8A1, rF24, rF34, LigA, LipL32, LipL41, OmpL1, and *Leptospira* whole cell lysate were produced. All the antibodies showed high titers and good reactivities against their respective immunogens.

4.2 After experimenting with different formats (i.e. antibody combinations), the prototype using anti-*Leptospira* lysate as both the immobilized and labeled antibodies demonstrated the best performance in detecting spiked *Leptospira* antigens.

The prototype showed broad reactivity in detecting common pathogenic *Leptospira* serovars in Malaysia, namely *L. interrogans* serovar Australis, Birkini, Birkini (local isolate), Copenhagani, Icterohaemorrhagiae, Lai (local isolate), Smithi, Pomona and *L. borgpetersenii* serovar Javanica. The detection limit of the prototype was determined to be in the range 10^4-10^5 of *Leptospira* cells, which represented bacterial load similar to actual leptospirosis scenario. The prototype did not cross-react with antigens from other related pathogens. It seemed to be able to discriminate leptospirosis from infections by other clinically important bacteria, thus demonstrated good specificity.

The present study has achieved its objectives in developing an antigen detection test prototype for diagnosis of acute leptospirosis. Further studies are needed to refine the rapid test and to evaluate it with an appropriate number of actual clinical samples in order to show evidence of its diagnostic value. The samples should originate from different locations in Malaysia to address the immunoreactivity variations contributed by the different *Leptospira* serovars; thus collaboration with the researchers from Ministry of Health is imperative. Since some *Leptospira* are excreted into patient's urine in the early phase of the infection, the application of the rapid test in detecting the organism in urine should also be investigated. Other than allowing concentration of the *Leptospira* bacteria/antigens, the use of urine may facilitate multiple sampling since it is a non-invasive sample.

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REAL TIME DETECTION OF *BUKHOLDERIA PSEUDOMALLEI* AND PATHOGENIC *LEPTOSPIRA* SPP USING A NEW PORTABLE AMPLIFICATION DIAGNOSTICS SYSTEM

Project Information

Project Leader	: Aziah Ismail
University	: Universiti Sains Malaysia
Address	: Institute for Research in Molecular Medicine, Health Campus, 16150 Kubang Kerian, Kelantan
Contact number	: 09-7672426
Email	: aziahismail@usm.my
Project Members	: Foo Keng Yuen

1.0 Introduction

Burkholderia pseudomallei is the causative agent of melioidosis, an infectious disease with multifarious manifestations. The gold standard for diagnosis is the culture that requires 2-7 days to obtain a result hindering successful treatment of the patients. *Leptospirosis* is a widespread infection of human and animals (Rao et al., 2003), and locally it assumes considerable importance as a public health and economic problem. Early detection of *Leptospira* spp. is an essential requirement in management practice. Microscopic agglutination test (MAT) is the gold standard with high sensitivity that detects the group-specific antibodies but it is complex due to the requirement of maintaining strains or isolates for the preparation of live antigens. The microscopy method using dark field microscope is reported as a common method for visualizing leptospires in blood and urine but it lacks of sensitivity. As an alternative to these methods, *orf2* and *lip32L* genes were used to develop the DNA-based diagnostics and detect for the presence of *Burkholderia pseudomallei* and pathogenic *Leptospira* spp. Two sets of primers were designed and used to optimize the amplification of the two specific regions of the desired genes. The amplification was successfully developed with the detection limit of detection limit of the *orf2* and *lipL32* amplification 10 pg/µl and 26.75 pg/µl respectively. Both tests showed the amplification of the two genes are specific and could be used to further verification and evaluation of the test. The findings suggested that the verification of the specific primers for both *Burkholderia pseudomallei* and pathogenic *Leptospira* spp. was successful. A probe-based amplification system will be further optimised with the presence of heating system as a complete portable system for the preparedness of the bacterial detection during the flood situation.

2.0 Methodology

Two sets of primers were designed for the amplification of the two specific regions of the desired genes, *orf2* and *lipL32*. The amplification parameters such as annealing temperature, concentration of $MgCl_2$, dNTPs, Taq polymerase and primers were optimized to develop an asymmetric PCR for pathogenic *Leptospira* spp and *Bukholderia pesudomallei*. Analytical sensitivity and specificity were then performed using genomic DNA from other bacteria to check for the performance of the test.

3.0 Results and Discussion

The primer used for melioidosis sample was derived from *orf2* gene (encodes for open reading frame) to identify *Burkholderia pseudomallei*. For leptospirosis sample, the primer was derived from *lipL32* genes (encodes for lipoprotein) to detect the pathogenic *Leptospira* sp. The optimum condition for PCR assay of *Burkholderia pseudomallei* and pathogenic *Leptospira* spp. were obtained as followed, 2.5mM of $MgCl_2$, 0.2mM of dNTPs, 1U of *Taq* DNA Polymerase and 0.3µM of forward and reverse primer concentration. The optimum annealing temperature for *Burkholderia pseudomallei* and pathogenic *Leptospira* spp. were 63°C and 56°C respectively. The optimum conditions were used for asymmetric PCR. The amplification cycle of asymmetric PCR was 40 cycles for *Burkholderia pseudomallei*, and 45 cycles for pathogenic *Leptospira* spp. The ratio of forward and reverse primer used was 1:50 for both meliodosis and leptospirosis samples. Analytical sensitivity and specificity were validated using the optimized conditions. For melioidosis sample, the detection limit of PCR and asymmetric PCR is up to 10 pg/µl and one ng/µl respectively. Meanwhile, for leptospirosis sample, the detection limit of PCR and asymmetric PCR is 100 pg/µl and 8.85 ng/µl respectively.

The result showed 100% specificity for both melioidosis and leptospirosis when tested against DNA of 25 bacterial isolates (*Burkholderia pseudomallei*, pathogenic *Leptospira* spp. and other strains of bacteria).

4.0 Conclusion

Summarized all the important findings of the project in point form.

4.1 A probe based nucleic acid detection assay for pathogenic *Leptospira* has been developed a proof of concept

4.2 A probe based nucleic acid detection assay for *Bukholderia pesudomallei* has been developed a proof of concept

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PROTYPE DEVELOPMENT OF LOW COST WATER FILTRATION UNIT FOR SMALL SCALE USE IN EMERGENCY SITUATION

Project Information

Project Leader : Dr Sarva Mangala Praveena
University : Universiti Putra Malaysia
Address : Department of Environmental and Occupational Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia 43400 Serdang, Selangor
Email : smpraveena@upm.edu.my
Project Members : Dr Karmegam Karuppiah, Dr Leslie Than Thian Lung
Dr Ho Yu Bin, Dr Sharifah Norkhadijah Binti Syed Ismail
Dr Emilia Zainal Abidin, Prof Dr Zailina Hashim
AP Dr Ahmad Zaharin Bin Aris

1.0 Introduction

The World Health Organization/UNICEF (2014) reported that 1.8 billion people billion people use a source of drinking-water that is faecally contaminated. Fecal contamination in drinking water is crucial as it poses the greatest danger to public health which can led to outbreaks of diseases such as cholera (Federal-Provincial-Territorial Committee on Drinking Water 2011). Point of use system involves treatment units installed at the water dispensing points such as at specific tap/ faucet. which are more efficient on overall energy consumption, cost effective, easy to use and maintain as well as highly portable (Dankovich and Gray 2011). One of the most promising point-of-use system drinking water treatment technologies is by using cellulose filter papers. Cellulose is a primary component in paper and acts as a good material for silver nanoparticle impregnation due to its absorption. Cellulose filter paper allows for a reasonably rapid flow by gravity without the need for pressure or suction (Dankovich and Gray 2011). Cellulose filter paper is highly potable, nontoxic, easily adaptable by house owners, environmentally friendly and requires low energy input from the sustainable development standpoint (Kong and Fu 2012; Brame et al. 2011; Guo, 2011). This study is to design and fabricate a prototype of portable low cost water filtration unit for smallscale. Lastly, this study is also to test the performance of prototype of water filtration unit using Kelantan river water.

2.0 Methodology

Methodology of this study is divided into development of prototype and field-testing (Figure 1). Development of prototype will be divided into 5 stages to finalize simple and low cost water filtration unit for small scale designs. After completion of questionnaire survey involving flood victims and literature search, a prototype design company will be approached to fabricate a prototype of low cost water filtration unit for small-scale. Lastly, filed testing of this prototype will done in using water samples from Kelantan river.

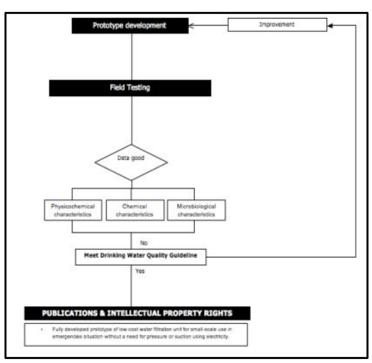

Figure 1 Methodology involved in prototype development

3.0 Results and Discussion

A questionnaire survey showed that about 42.7% used rainwater while 24.7% used bottled water as their drinking water during the flood. Moreover, about 18.7% used rainwater and bottled water supplied in relief center. A total of 13.9% used various combinations of other drinking water supplies such as tap water and well water (Figure 2). Moreover, 99.9% of them are willing to use portable water filtration unit during flood.

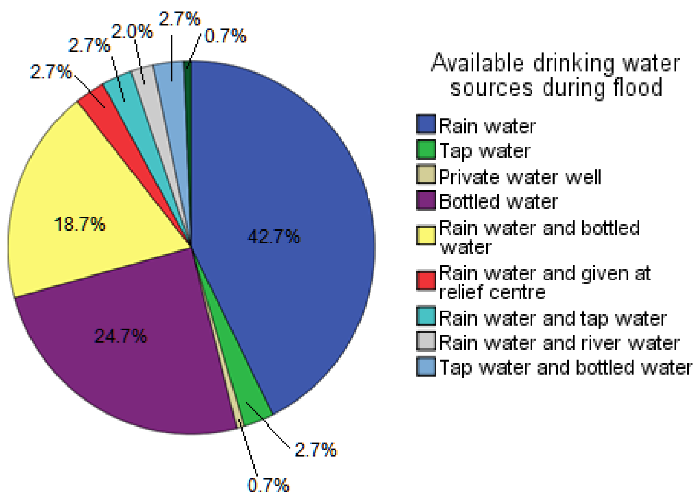

Figure 2. Drinking water supply during flood

The results showed that this emergency nano water filter is suitable for low turbid water (rainwater and surface water). The results also indicated that the filtered water using low turbid water met World Health Organization and Drinking Water Quality guidelines (Table 1). This prototype is a low cost, light, foldable, easily transported water purification device and assembled into a water filtration unit.

Table 1: Characteristics of filtered water

	Clear water				Muddy water	
	Tap water		Rain water		River water	
Parameter	Without E.coli	With E.coli (10^3 cfu/100 mL)	Without E.coli	With E.coli (10^3 cfu/100 mL)	Kuyoh river	Kelantan river
pH	6.4	6.4	6.3	6.3	6.5	6.6
Temperature (^oC)	24.4	24.2	23.9	24.0	24.1	24.9
Turbidity (NTU)	4.3	4.4	5.1	5.3	6.6	>10
Electrical conductivity (mS/cm)	179.3	180.1	49.6	51.3	73.5	77.9
E. coli (cfu/100 mL)	NIL	NIL	NIL	NIL	Present	Present
Heavy metal (mg/L)						
Ag	0.00114	0.00123	0.00155	0.00136	0.21	0.35
Al	0.00136	0.00144	0.00036	0.00049	0.5	1.3
Cd	0.00024	0.00022	0.00027	0.00034	0.1	0.3
Cr	0.000074	0.000087	0.000066	0.000094	0.006	0.07
Cu	0.00034	0.00045	0.00022	0.00037	2.6	2.2
Fe	0.000036	0.000055	0.000055	0.00065	0.56	1.7
Mn	0.0059	0.0065	0.0089	0.00015	0.29	0.9
Pb	0.0013	0.0021	0.0044	0.00041	0.12	0.15
Zn	0.0037	0.0045	0.0055	0.0057	0.12	0.5

4.0 Conclusion

This study showed that drinking water supply has been an important issue during the flood disaster.

4.1 Questionnaire survey output showed that the victims faced inadequate drinking water supply.
4.2 Moreover, 99.9% of them are willing to used portable water filtration unit during flood.
4.3 This emergency nano water filter is suitable for low turbid water (rainwater and surface water).

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NUTRACEUTICAL KIT FOR FLOOD MANAGEMENT

Project Information

Project Leader	: Wan Iryani Wan Ismail
University	: Universiti Teknologi MARA (UiTM)
Address	: Faculty of Pharmacy, UiTM Puncak Alam Campus, 42300 Bandar Puncak Alam, Selangor
Contact number	: 0166632985
Email	: waniryani@gmail.com
Project Members	: Mohd Mansor Ismail Tommy Julianto Bustami Effendi Zakhbah Mian Nurul Akmal Abdul Wahab

1.0 Introduction

The 2014 massive flood evacuees stood close to 200,000, with 21 fatalities and reports of malnutrition due to limited and inaccessible rations[1]. Improving the disaster management issues, along with development of rapid deployment of nutraceutical kit, will greatly improve the survival, health and moral among flood victims. Four attributes were considered essential in developing functional nutraceutical kit; (1) safe, (2) nutritionally sufficient, (3) user friendly, (4) palatable, and (5) portability[2]. The nutraceutical kit also should be locally sourced and produced to ensure continuous supply and economically viable.

2.0 Methodology

The prototype of high nutrient energy bar and honey drink were formulated based on the emergency relief food product criteria prepared by the National Coordinating Committee on Food and Nutrition, Ministry of Health (MOH), Malaysia[3] and the Institute of Medicine (IOM), USA[2]. Physicochemical analysis, antioxidant activity and proximate analysis for quality assessment[4] were determined before and after packaging processes of both prototype energy bar and honey drink under different temperatures (-20°C, 21°C or 40°C) for 30 days.

3.0 Results and Discussion

A nutrient dense nutraceutical kit was successfully developed based on the MOH and IOM requirements. The kit was consist of prototype energy bar and honey drink (Figure 1) that would provide approximately 2000kcal per unit kit (combination serving size made up of 25g prototype energy bars and 15g honey drinks). Quality control analyses indicate no changes in physicochemical properties due to packaging process. The packaging process also helps to improve the antioxidant properties in both prototype energy and honey drink. The kit is specifically designed to provide complete nutraceutical needs of one adult per day. Recommended storage temperature for the nutraceutical kit is at ambient temperature (21°C) or lower.

Figure 1: Prototype of nutraceutical kit for disaster relief

4.0 Conclusion

Several achievements have been obtained at the end of this study as follows:

4.1 Nutraceutical kit for disaster relief and management was successfully developed containing three sachets of honey drink (15g each) and 14 energy bars (25g each).

4.2 The kit contains 2000kcal for one adult's consumption per day or one child's consumption for two days without any other foods available for their consumption.

4.3 The kit contains antioxidant properties, high with carbohydrates, proteins and other minerals.

4.4 The kit can be consumed directly without requirement of any cooking apparatus or procedures.

4.5 The kit can be used as the first line supply to the disaster victims particularly during the flood season.

4.6 Packaging design for the kit is suitable for delivery by all means/vehicles (air, water or land) because it is light, robust and protect/prevent the kit from damages (water, high temperature up to 40°C and rough conditions).

4.7 The cost is considered cheap, which is RM15 per kit.

4.8 Patent application has been submitted and is being processed for the kit.

4.9 Combination of various disciplines in this project (members of the project) to deliberate all aspects related to the disaster management and food requirement such as from the Institute of Agricultural & Food Policy Studies, UPM, Nutraceutical Research Group from Faculty of Pharmacy and Faculty of Art and Design, UiTM for packaging design.

4.10 This is a collaborative project between the project leader with the Department of Agriculture and beekeepers (among orang kampong) in supplying the local honey for the production sustainability and to increase the local income.

4.11 However, further studies are required to evaluate the effectiveness of the kit in the real condition. Because of time constraint (9 months only), the study was just focused on the product development and the packaging design.

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DEVELOPMENT OF PORTABLE EARLY BACTERIA MONITORING SYSTEM FOR CONTAMINATED FLOOD WATER

Project Information

Project Leader	: Dr Mohd Zainizan Sahdan
University	: Universiti Tun Hussein Onn Malaysia
Address	: Parit Raja 86400 Batu Pahat, Johor
Contact number	: 019-7276903
Email	: zainizan@uthm.edu.my
Project Members	: Dr Asmah Mat Taib

1.0 Introduction

Bacteria monitoring and detection are important for diagnosis and therapy of infectious disease, as well as for countermeasure to potential biological threats. Infectious bacteria in water have been categorized as a considerable threat to global health. The established finding for coliform bacteria in water includes the total coliforms, fecal coliforms, and Escherichia coli (E. coli) [1]. The detection of coliform bacteria is very helpful as indication of water contamination, which may contain many dangerous microorganisms [2]. Microorganisms are primary reasons for the infectious diseases. Therefore, the concentration of harmful bacteria should be routinely monitored to maintain the quality of water. Along with the importance of bacteria analysis, suitable detection system is required for point of care (POC) devices. Over the past years, much advancement and technology had been investigated and applied for improving the detection and analysis of bacteria. A portable and miniaturized system is believed to be beneficial for faster bacteria analysis.

This work aimed at developing microfluidic-based device for miniaturizing the analytical instrumentation and methodology in bacteria detection from contaminated water. Microfluidic is a rapidly expanding scientific discipline which deals with fluids flowing in miniaturized systems [3]. Microfluidic offers the ability of a system to work with smaller sample volumes (micro scale), shorter reaction times, and the possibility of parallel operation. Microfluidic is expected able to employ different approaches of bacteria detection technique including optical measurement method. Absorption measurement is the simplest optical detection method [4]. Ultraviolet (UV) and visible absorption spectroscopy is a well-established technique. Development of a portable optical absorbance measurement device can miniaturize and simplify the bulky and complicated measurement machine. Combination of microfluidic device with miniaturized optical absorbance measurement method is expected to produce a complete portable system for bacteria detection.

2.0 Methodology

The methodology consists of design simulation, surface tension analysis, microfluidic device fabrication, hardware construction, bacteria sample preparation, and absorbance measurement.

Microfluidic Device Fabrication

The microfluidic device was fabricated using PDMS (Sylgard 184 silicon elastomer and curing agent) and glass slide. The fabrication process involves with photolithography, soft lithography, and oxygen plasma treatment techniques. Photolithography was performed to fabricate SU-8 master mold with specific microchannel design. The mold was then used to pattern the PDMS microchannel using replica molding technique (soft lithography). Finally, the oxygen plasma treatment was performed to create irreversible bonding on the PDMS micro channel and glass.

Coliform Bacteria Sample Preparation

The coliform bacteria suspension was prepared from the waste water sample. The waste water sample was streaked on chromocult agar and incubated for 24 hours at 37 °C. A single coliform bacteria colony from the chromocult agar was selected and transferred into nutrient broth medium using a sterile wire loop and incubated at 37 °C in the microbiological incubator. In this study, the sample was prepared with different incubation time.

UV-Visible Spectrophotometer Measurement on Coliform Bacteria Sample

The absorbance of the coliform bacteria suspension sample was analyzed using the UV-Visible spectrophotometer (SHIMADZU, UV-1800). The absorbance measurement was performed using the developed PDMS-glass based microfluidic device. Absorbance readings were taken hourly with optical wavelength between 350 nm and 750 nm (visible light) for 5 hours incubation time.

Optical Absorbance Measurement Device Development

The overall idea of the optical absorbance measurement device is based on Beer-Lambert Law [5-6]. The absorbance was calculated from the original light intensity (I_0) in the medium with no sample (base) and the transmitted light intensity (I) in the medium with sample as shown in equation (1).

$$\text{Absorbance of sample} = -\log_{10}(\mathrm{I}/\mathrm{I}_0) \qquad (1)$$

The device consists of optical absorbance measurement circuit and mechanical chasing. The optical absorbance measurement circuit was constructed with four main parts; light source, detector, microcontroller, and data display. The light source, detector, and display part are controlled by the ARDUINO microcontroller. The light source consists of light emitting diode (LED) connected to the digital port of the microcontroller via current limiting resistor. The OPT101 photo detector was used to detect the light intensity and the analog output voltage from the sensor is collected by the microcontroller analog port. Then, the display part was constructed using the 16x2 liquid crystal display (LCD). Each circuit elements were placed at suitable position in the mechanical chasing. The mechanical chasing was built using mild steels and aluminium. It was developed with dark chamber and microfluidic stage. The developed device was used for the coliform bacteria absorbance measurement inside the microfludic device. The measurement was performed hourly for 5 hours incubation time.

Coliform Bacteria Number Measurement

The coliform bacteria number was measured using colony forming unit (CFU) with the aid of the digital colony counter device. For high concentrated and uncountable sample, dilution step is required in order to determine the colony number. Each dilution was made by transferring 1.0 ml of the sample to 9.0 ml blank broth solution. Then, after shaking the solution, 1.0 ml was transferred into agar plate. After 24 hours of incubation, the number of coliform bacteria colony on each agar plate was counted using the digital colony counter device. The plate should have appropriate number of colonies which is in the range of 30-300. The counted colony number should be multiplied with the dilution factor as in equation (2). In this work, the bacteria colony number is presented in CFU/ml unit.

$$\text{Colony number} = \frac{\text{colony counted x dilution factor}}{\text{volume plated}} \qquad (2)$$

3.0 Results and Discussion

With a proper process, the PDMS-glass based microfluidic device was fabricated with no leaking at the channel wall. The microfluidic device consists of one inlet channel and one observation channel. The coliform bacteria suspension from contaminated water was inserted into the microfluidic device and the coliform bacteria were observed under the light microscope as shown in Figure 1 (a) and (b). It had been reported that coliform bacteria are typically rod-shaped, about 2.0 μm to 3.0 μm long, and 0.25 μm to 1.0 μm in diameter [7]. The microscopic image in Figure 4.33 shows the indicated coliform bacteria were measured at approximately 2.4 μm and 2.7 μm long.

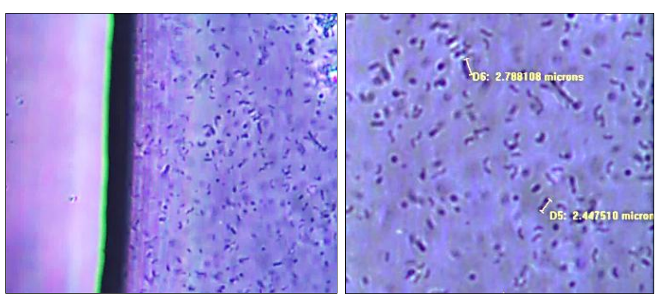

Figure 1 (a) Microscope image (40X magnification) of coliform bacteria suspension in the microfluidic device (b) Coliform bacteria size indication from the microscope image

The coliform bacteria suspension that had been injected into the microfluidic device was measured using the UV-Visible spectrophotometer for absorbance analysis. The optical density of sample is the most often used method in determining the density of bacteria and cell in suspension as it will apparently absorb light due to scattering. Myers et al. (2013) explained that absorbance of the sample measured in a spectrophotometer is correlated to either the dry weight or the number of cells per volume [8]. Based on this explanation, the UV-Visible spectrophotometer absorbance measurement can be used analyzed the coliform bacteria suspension within a certain time range.

The UV-Visible spectrophotometer measurement result in Figure 5 (a) shows increment in the absorbance reading as the incubation time increased. From past study, higher absorbance reading indicates higher concentration of bacteria [9]. Therefore, the result represents increment of coliform bacteria concentration for every increment of incubation time which indicates the bacteria growth. Based on the highest absorbance reading at 470 nm, the coliform bacteria growth curve was obtained as shown in Figure 5 (b). The growth curve demonstrates that the absorbance reading of coliform bacteria in the suspension evolve as a function of time.

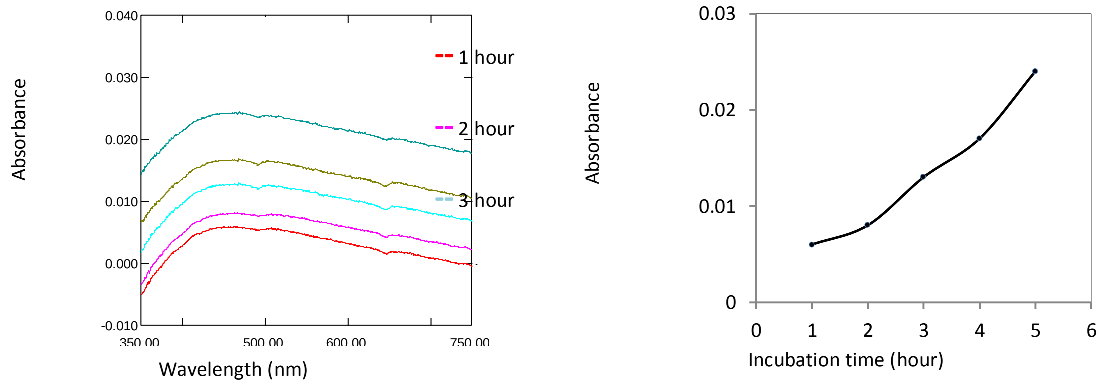

Figure 5 (a) UV-Visible spectrophotometer absorbance measurement of coliform bacteria suspension in microfluidic device for every 1 hour incubation time (wavelength range: 350 nm – 750 nm) (b) Growth curve of coliform bacteria based on UV-Visible spectrophotometer readings at 470 nm

At optical wavelength between 350 nm and 470 nm, the graphs in Figure 5 (a) show increasing absorbance reading and the highest reading was obtained at 470 nm. Then, in the wavelength range from 470 nm and 750 nm, the absorbance reading starts to decrease and approaching zero. Theoretically, the absorption characteristics can give indication of the bacteria in a suspension based on their possible chromophores [10]. The absorbance measurement at different incubation time show the same plotting pattern which describes the coliform bacteria growth did not changed the chromophores and pigmentation elements. Based on the UV-Visible spectrophotometer measurement finding, the portable optical absorbance measurement device as shown in Figure 8 was developed with 470 nm LED as light source. On top of the device, LCD was mounted to display the measurement result to user. Three switch buttons were placed near the LCD for operation handling.

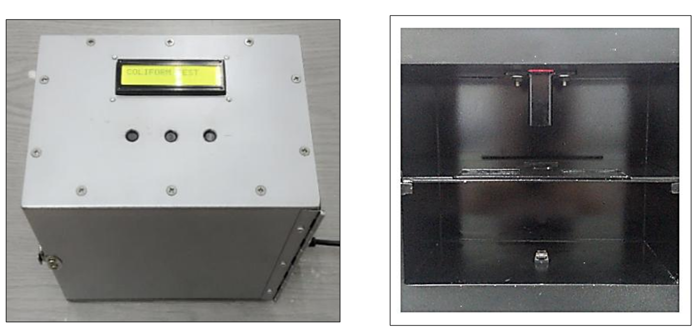

Figure 3 (a) The developed optical absorbance measurement device (b) Dark measurement area inside the device chasing

Based on the absorbance measurement concept, the dark measurement chamber as shown in Figure 9 was constructed inside the device casing in order to avoid stray light from outside. In absorbance measurement, it is important to avoid errors caused by stray light from the surrounding [11].During the optical absorbance measurement device operation, the light from the LED will penetrate through the sample in microfluidic device and fall on top of the optical sensor. The coliform bacteria sample will absorb the light and transmission of the light will be reduced. Based on Beer-Lambert law, it had been explained that atoms or molecules take up the photon energy during light absorption [12]. Therefore, the reduction of the transmitted light is exponentially related with the sample concentration.

In this work, the coliform bacteria suspension that had been injected into the microfluidic device was measured using the optical absorbance measurement device for coliform bacteria detection and analysis. Table 1 shows the base voltage, sample voltage, and absorbance value for coliform bacteria suspension with different incubation time. The absorbance value was calculated by the device program and displayed on the LCD for observation. The absorbance measurement from the developed device shows zero readings between 1 hour and 4 hours of incubation time. It started to produce absorbance reading at 5 hours to 7 hours of incubation time.

Table 1 Voltage and absorbance reading for different incubation time

Incubation time	Voltage (V)		Absorbance
	Base voltage	Sample voltage	
1 hour	0.04874	0.04874	0.00000
2 hour	0.04874	0.04874	0.00000
3 hour	0.04874	0.04874	0.00000
4 hour	0.04874	0.04874	0.00000
5 hour	0.04874	0.04786	0.00079
6 hour	0.04874	0.04854	0.00180
7 hour	0.04874	0.04844	0.00269

Then, with the aid of colony counting method, the relation between the absorbance reading and the coliform bacteria colony number in CFU/ml unit was analyzed. Table 2 shows the coliform bacteria colony number in CFU/ml and absorbance reading for different incubation time. Then, Figure 10 shows the correlation graph for the absorbance measurement and coliform bacteria colony number in CFU/ml. The results show that the device had produced significant absorbance reading and detect the presence of coliform bacteria for 17,200 CFU/ml and above. Bacteria colony number in CFU/ml is very useful to indicate the number of viable microorganisms in a sample. Colony number information of bacteria was also useful for disease prevention and environmental monitoring (water and food safety). It had been discovered that colony number determination is important in assessing bacterial vaccines. In 2005, Putman *et al.* had used the colony forming unit indication to evaluate the response of the pneumococcal vaccines [13]. Colony number indication also had been applied for investigating failing septic system caused by fecal coliform bacteria [14]. From the colony number indication, an accurate antibiotic resistance analysis to solve the environmental problem was successfully demonstrated.

Table 2 Absorbance reading and coliform bacteria colony number for different incubation time

Incubation time	Absorbance	Colony number (CFU/ml)
1 hour	0.00000	134
2 hour	0.00000	930
3 hour	0.00000	2,300
4 hour	0.00000	9,800
5 hour	0.00079	17,200
6 hour	0.00180	27,600
7 hour	0.00269	53,000

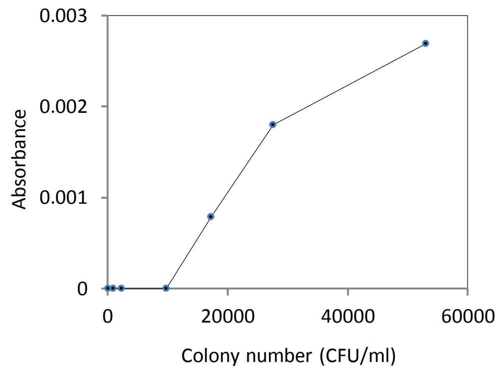

Fig. 10 Absorbance versus coliform bacteria colony number graph based on the data in Table 2

The measurement from the developed optical absorbance measurement device shows high detection limit of 17,200 CFU/ml of coliform bacteria number. There are two major factors that could affect the performance of the device. The first factor is the properties of the LED that being used in the device. Compared to the laser light, LED suffered from incoherent and divergence light properties. LED generates incoherent light as the result of random movement of photons in different directions which generating random light frequencies [15]. It also had been discovered that LED is not capable in providing one point source of light due to its high divergence degree [16]. Collimating lens and optical mirror could be used to narrow down the divergence degree of the LED light. The second factor is the colour changes in the suspension sample. The nutrient broth medium was observed to only produce turbidity changes in the suspension as indication of different bacteria concentration. Low concentration of coliform bacteria produced low turbidity changes which is difficult to be differentiated by the optical sensor. Medium or solution that can produce more significant colour changes is believed able to produce better absorbance reading for coliform bacteria detection.

4.0 Conclusion

From this work, the PDMS-glass based microfluidic device was successfully fabricated for low sample volume of coliform bacteria suspension. Then, the absorbance measurement using UV-Visible spectrophotometer had indicated a suitable optical wavelength of 470 nm for coliform bacteria indication which leads to successful development of the portable optical absorbance measurement device. The absorbance measurement from the developed device was able to detect the presence of coliform bacteria starting at 17,200 CFU/ml. Even though the detection limit of the device is high, the measurement readings are still beneficial for coliform bacteria detection and analysis. Future improvement could be done for better quality and performance.

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NEW METHOD OF PREVENTIVE MAINTENANCE FOR PUBLIC BUILDINGS BASED ON BIOLOGICAL FACTORS

Project Information

Project Leader	: Rosfarizan Mohamad
University	: Universiti Putra Malaysia
Address	: Faculty of Biotechnology and Biomolecular Sciences, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor
Contact number	: 603-89471050
Email	: farizan@upm.edu.my
Project Members	: Mohamad Ridzuan Yahya (Sub-project Leader, UiTM) Wan Zuhainis Saad (UPM), Md Najib Ibrahim (UiTM)

1.0 Introduction

East coast of Peninsular Malaysia is commonly affected by flood disaster, which leads to buildings damaged and decayed. Building structures that undergo bio-deterioration usually exposed to contact with soil, water, sewage, agricultural products and waste materials (Shinkafi and Haruna, 2013). There are two types of agents related to buildings deterioration, which include microbial and non-microbial agents. Temperature, moisture, and acid rain are examples of non-microbial agents. Meanwhile, the biological or microbial agents are the fungi and bacteria (Bock and Sand, 2001). Buildings that immersed are more liable to be affected by a variety of biological factor particularly microorganisms that associated to human health and environmental quality. The damage caused by microorganism is very unfamiliar, as is the destruction arising from attempts to eradicate them by the use of chemicals, which not only are the matter for concern health authorities, wildlife interests, and environmentalists but also lead to the development of resistance in the target organisms. Correct identification of the microbial pest is essential as not all microbes are equally destructive. Microbial contamination in building represents a dangerous risk factor in public areas especially human health and environmental quality (Salonen et al., 2012). The defected buildings areas in long-term period attributed to economic failure and improved building maintenance methods are required for prevention measures of building deterioration.

Initially, microbial culture collections were established to preserve cultures from fungi and bacteria for use in taxonomy. Success in the continued preservation of the microorganisms, and recognition of the importance of their availability not only for taxonomic studies but for academic and industrial research, led to further research especially on industrial microbial enzymes. Microbial enzymes are of great importance on the development of biotechnology products industrially. Hence, the present research highlights on identifying the microbial community in public buildings affected by the flood and relate it to human health, which will contribute to further knowledge and suitable approach for planned building maintenance to ensure cost-effective preventive building maintenance. The research is focussing on two aspects, which are on the microbial community identification and influence of the biological aspect towards current planned building maintenance. On the other hand, rapid microbial identification methods were applied and the collected microbes were deposited at the Microbial Culture Collection Unit, Universiti Putra Malaysia for other potential bio-industry applications exploration.

2.0 Methodology

Eight flood-affected mosques in Kelantan, Terengganu and Pahang, were selected as the case studies including one mosque, which unaffected by flood (FELDA mosque, 4°15’51.2”N, 103°15’09.1”E). Al-Jauhar (5°32’36.8”N, 102°12’03.0”E), Ar-Rahman (5°33’48.6”N, 102°11’31.4”E) and Kuala Krai (5°31’44.9”N, 102°11’55.8”E) mosques are located in Kuala Krai, Kelantan (Sg. Kelantan riverbank). Seberang Tayor (4°15’29.7”N; 103°16’14.6”E), Air Putih (4°16’02.9”N, 103°12’39.3”E) and FELDA mosques are located in Kemaman, Terengganu (Sg. Kemaman riverbank). Kg. Labu (4°10’01.2”N, 102°22’34.9”E) and At-Taqwa (3°37’07.7”E, 3°37’09.1”N) mosques are located in Jerantut and An-Nur (3°37’09.1”N, 102°23’10.8”E) mosque in Temerloh, Pahang (Sg. Pahang riverbank). Different sample sites for sample collections were selected within the mosque areas. Nutrient agar and potato dextrose agar media were used for the isolation of microorganisms. Air Putih mosque was selected for the scheduled cleaning and maintenance of mosque areas, which was conducted within a month (December). The cleaning application involved usage of common chemicals, detergent, and tools.

The airborne samples were collected at different places using open plate technique. The plates were exposed for 90 min at a height of 1.0 m to 1.5 m. The nutrient agar plates were incubated at 37°C for 48 h while the potato dextrose agar plates were incubated at 28°C to 30°C for 3 to 5 days in the laboratory. Cultivation and total macroscopic enumeration methods for the sample analysis were applied. The swab samples were collected from different areas using the pre-moistened sterile cotton swab. The desired area was swab thoroughly, rolling the swab tightly back and forth over sampling area. The swabs were soaked in normal saline and incubated at 37°C for 18 – 24 h prior to analysis. Further identification of the bacteria groups was conducted based on colony characterization, microscopic methods and biochemical test, which include gram staining, oxidase and catalase examinations. For the fungi group identification, preliminary screening was conducted according to macroscopic and microscopic morphological characteristics of vegetative mycelium and reproductive structures. The antagonistic effects were also tested to select beneficial microorganism for further analysis.

3.0 Results and Discussion

Figure 1 shows the results of a total number of airborne microorganisms or isolates obtained from all selected mosques in different states. Higher number of airborne contamination was obtained in Kelantan (946) as compared to Terengganu (676) and Pahang (519). Fungi showed a greater level of contamination compared to bacteria in all flood-affected mosques. Al-Jauhar (631) and FELDA (421) mosques showed a higher number of isolates compared to other mosques (Figure 2). The presence of microorganisms in buildings usually depends on several factors, which are the number, hygienic standard of people present, the quality of the occupational system and mechanical movement within the enclosed space (Vinita, 2013). The level of occurrence of airborne contamination in the toilet, shoe area, and entrance were higher compared to other sampling locations (Figure 3). For both total numbers of bacteria and fungi isolates, the outdoor airborne contaminations were higher as compared to indoor contamination. Figure 2 shows the numbers of indoor and outdoor microbial contamination isolated. Both indoor and outdoor contaminations showed higher level of fungi as compared to bacteria contamination. High number of fungi presence is due to the potential of viable spores and pathogenicity of viable fungi to release allergens by the individual in the mosque (Yassin and Almouqatea, 2010).

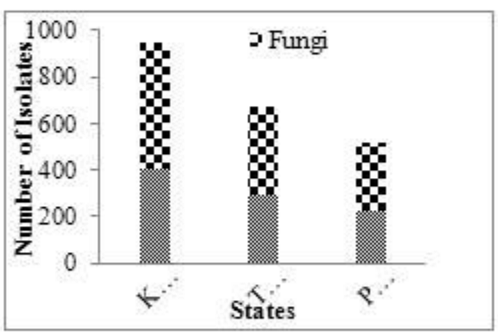

Figure 1: Total numbers of microbial isolates from the airborne samples of mosques in different states

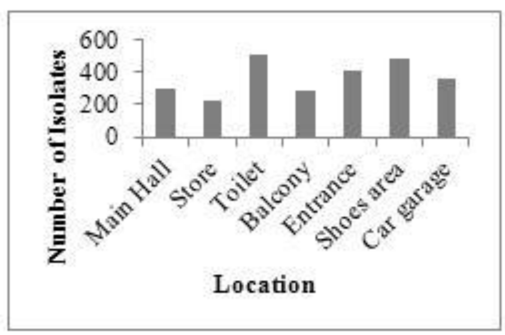

Figure 3: Numbers of microbial isolates from the airborne samples at different sampling locations of mosques

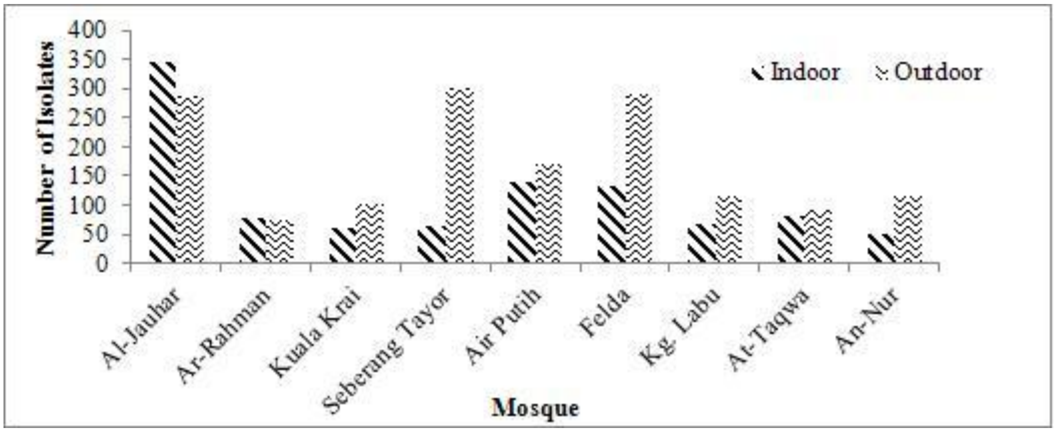

Figure 2: Numbers of microbial colonies isolated from airborne samples of different mosques

For the solid surfaces samples, a total number of 266 bacteria and 276 fungi were isolated. Air Putih mosque has a higher number of isolates compared to other mosques. From the results, least contaminated areas were at the water taps, stairs, and slippers. While areas of furniture (wood), tiles and wall surface were highly contaminated. This phenomenon is may be due to the large surface area compared to the other solid areas. The fungi showed a higher number of microbial colonies due to the temperature and environmental conditions in the mosque that favorable for fungi growth. Usually, the fungi required substrates for energy that leads to the building deteriorate (Shinkafi and Haruna, 2013).

From our initial finding, there was improper cleaning schedule was implemented at Air Putih mosque after the flood due to many factors. The mosque is commonly affected by flood each year since 1980s and immersed in long period during monsoon season. The results clearly showed that the number of contamination is reduced about 40% after the cleaning application within a month. Most of the affected mosques were immersed in flood for 4 to 5 days, which allow the buildings material in contact with water. As mentioned by Parker (2007), it was suggested that the concentration of microorganism seem to be very high due to the moisture and environmental conditions in the buildings. The occurrence will lead to the existence of fungi in higher concentration because of the present of the substrate for growth of fungi. This moisture and environmental conditions provide a suitable condition for bacteria growth, which leads to rapid deterioration of buildings. From this study, the dominant microorganisms isolated were preliminarily identified as *Escherichia coli*, *Staphylococcus* sp., *Micrococcus* sp., *Bacillus* sp., *Aspergillus* sp., *Candida* sp., *Cladosporium* sp. and *Alternaria* sp. The present of this dominant microorganisms also reported by Garcia-Cruz et al (2012) because this is the common contamination that can be found in a wide range of environment.

4.0 Conclusion

Important findings of the study are summarized as below:

4.1 The first study reports on the microbial contamination level of selected public buildings (mosques) due to flooding in Kelantan, Terengganu and Pahang.

4.2 A higher level of fungal contamination was found in the flood-affected mosques as compared to the unaffected mosque.

4.3 Scheduled building cleaning and maintenance for effective hygiene results are required to ensure minimal microbial contamination.

4.4 Industrial potential and beneficial local microorganisms for bio-products and other applications were deposited in the microbial culture collection.

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THE USE OF PCR-BASED TECHNIQUES TO DETERMINE MOLECULAR CHARACTERISTICS CHANGES IN THE ENTERIC PATHOGENS FOR EFFECTIVE POST-FLOOD INFECTION CONTROL STRATEGIES

Project Information

Project Leader	: Assoc. Professor Dr. Azian Harun
University	: Universiti Sains Malaysia
Address	: Department of Medical Microbiology & Parasitology, School of Medical Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kelantan
Contact number	: +6 09 7676282 (Office), + 6 019 9060393 (Mobile)
Email	: azian@usm.my
Project Members	: Professor Dr Habsah Hasan Assoc. Professor Dr. Zaidah Abdul Rahman Assoc. Professor Dr. Kirnpal Kaur Banga Singh

1.0 Introduction

In December 2014, Malaysians have been shocked by the massive flood involving the states in the east coast of Malaysia. The aftermath was devastating and the state of Kelantan was the most badly affected involving thousands of population in many localities. Food and water-borne diseases have been commonly reported in Kelantan. In the recent decades, Kelantan has seen outbreaks of cholera (1) and typhoid fever (2-4). The occurrence of these infectious diseases is closely related to sanitation-related factors such availability and accessibility to clean water supply and proper excreta and waste disposal. The population of Kelantan receives water supply from many sources. A large number of Kelantan population obtain water supply from wells, gravity feed water or directly from the nearby river. Tube wells are commonly used as alternative to piped water, and in many instances used as a sole source of potable water. During flood many of these water supply points and sewerage were submerged in flood water. Therefore contamination of the water supply was inevitable. Given the considerable time taken to improve post-flood water quality and sewerage management, a significant number of Kelantan populations are at risk of developing food and water-borne diseases during this critical period. The general effect of flood on water quality has been well-known. However, given the magnitude of the recent flood in Kelantan, a great deal of changes are expected namely in the rates and severity of microbial contamination, microbiological profiles of the water sources, and consequently the incidence of infectious diseases associated with contaminated food and water. Immediate humanitarian aids to the flood victims have been widely supplied including shelter, food, clothing and medications. Broad spectrum penicillins (e.g ampicillin, amoxicillin), first generation cephalosporins (e.g. cephalexin), ciprofloxacin and doxycycline were among the oral antimicrobial agents which may have been distributed by unauthorized personnel (among the relief volunteers). There was a huge possibility of inappropriate prescription, suboptimal dosing and consequently overexposure of community pathogens to these antimicrobials. Therefore, the effect (collateral damage) of such practices needs to be addressed, most importantly the emergence of resistance among community pathogens, which consequently renders the commonly prescribed antimicrobials useless in treating even non-complicated community-acquired infections. This study describes and compares the types, proportion, antimicrobial susceptibility profiles and the genetic relatedness of enteric pathogens isolated immediately before and after massive flood in December 2014.

2.0 Methodology

Enteric pathogens isolated from stool samples of patients attending Hospital Universiti Sains Malaysia after the flood (January 2015 through June 2015) were collected. Laboratory data on enteric pathogens isolated from July 2014 through December 2014 was recorded to represent the pre-flood samples. Bacterial identification was performed according to standard method. Serotyping and PCR-based methods were used for specific identification of *Salmonella* species. Antimicrobial susceptibility testing was performed using disc diffusion method in accordance to CLSI standards. For screening of antimicrobial resistance genes, PCR was used to amplify the quinolone resistance-determining regions (QRDRs) of target genes *gyrA*, *gyrB*, *parC*, and *parE* as previously described (5, 6). Screening for the *qnrA*, *qnrB*, and *qnrS* genes was carried out by multiplex PCR using a previously described method (7). Multilocus sequence typing (MLST) of seven genes, *aroC*, *dnaN*, *hemD*, *hisD*, *purE*, *sucA*, and *thrA* was performed to determine the genetic relatedness among *Salmonella* species isolated before and after flood (http://web.mpiib-berlin.mpg.de/mlst).

3.0 Results and Discussion

It was shown that there was a significant increment in the isolation of enteric pathogens during immediate post-flood period in January 2015. During this period many water sources such as open and tube wells were contaminated with flood water, which subsequently might have caused the increment of enteric infections among the vulnerable populations. *Salmonella* species were shown to be the predominant pathogen implicated in the enteric infection cases. This organism has been reported to be associated with enteric infections following consumption of contaminated chicken/poultry (8). During a massive flood, debris from chicken/poultry farms may be washed away by flood water and subsequently contaminate the water sources. Another organism showing increment after flood was *Campylobacter jejuni*, which has also been reported to be present in chicken/poultry (9).

Comparing the two groups of isolates (before and after flood), the post-flood enteric pathogens showed higher percentage of resistance to ciprofloxacin than pre-flood group. Similar finding was noted for cefuroxime, erythromycin and nalidixic acid. Resistance to ceftriaxone was also seen in post-flood pathogens, which was not seen in pre-flood group. This findings are rather alarming as ciprofloxacin, ceftriaxone and erythromycin are the common antimicrobials used for community-acquired infections. Screening for antimicrobial resistance genes among the *Salmonella* species was done for quinolones only due to time and budget constraints. There was no significant difference in the detection of selected quinolones resistance genes in *Salmonella* species isolated before and after the flood.

Preliminary analysis of MLST of Salmonella enteric revealed close relationship between the pre- and post-flood cohort. No clear segregation among the two groups. Nevertheless the genetic study of resistance genes in *Salmonella* species and genotyping are still ongoing using other supplementary fund. It is important to emphasize that if the percentage of resistance among the pathogens in the population keeps increasing, the commonly used antimicrobials will lose their usefulness in treating infections in a community. Many factors contribute to the emergence of antimicrobial resistance. One of the main factors is uncontrolled use of antimicrobials following uncontrolled prescription which may have happened during the flood relief activities. Therefore, a policy on judicious use of antimicrobials during flood relief is necessary to prevent the worsening of antimicrobial resistance among enteric pathogens in the community.

4.0 Conclusion

4.1 There was an increment in the isolation of enteric pathogens after flood

4.2 *Salmonella* species were the most frequently isolated enteric pathogens after flood. There was an increment in the isolation of *Campylobacter jejuni* and *Aeromonas hydrophila*.

4.3 There was higher percentage of resistance to commonly prescribed oral antibiotics such as ciprofloxacin, cefuroxime and erythromycin in post-flood enteric pathogens (compared to pre-flood). Policies need to be delineated to ensure appropriate antimicrobial prescription and usage during future flood response.

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VULNERABILITY ANALYSIS TO FLOOD-RELATED COMMUNICABLE DISEASES WITH ASSESSMENT OF ENVIRONMENTAL HEALTH PREPAREDNESS, RESPONSE AND RECOVERY FOLLOWING THE SEVERE KELANTAN RIVER BASIN FLOODING

Project Information

Project Leader	: Jamal Hisham Hashim / Rozita Hod
University	: Universiti Kebangsaan Malaysia
Address	: Jabatan Kesihatan Masyarakat, Pusat Perubatan Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, 56000 Kuala Lumpur.
Contact number	: 016-6742642/ 019-6073701
Email	: jamalhas@hotmail.com
Project Members	: Mohd Hasni Jaafar, Azmawati Mohammed Nawi Norfazilah Ahmad, Rohaida Ismail Gul Muhammad Baloch

1.0 Introduction

Global climate change will definitely have an impact on the patterns and trends of natural disasters in the future. Climate change in the long run leads to more frequent extreme weather events like flooding and this may cause more outbreaks of leptospirosis and other flood-related communicable diseases (Hashim & Hashim, 2016).The risk of morbidity and mortality resulting from communicable diseases may be increased as a result of a rapid onset and broad impact natural disasters, and disease outbreaks are more likely to occur when disasters hit developing countries (Toole 1997). The current modelling predictions by various credible authorities have suggested a worsening trend of disasters especially flooding with the ever rising sea levels. The recent 2014 year-end flood that hit Kelantan was the worst in the state's history which superseded the state's last major flood in 1967 (National Security Council, 2015). This study was conducted to determine the spatial-temporal distribution as well as clustering and vulnerability analysis of flood-related communicable diseases in relation to environmental factors following the major flooding in Kelantan as well as asssessing the environmental health preparedness, response and recovery following the event.

The use of Geographical information system (GIS) allows policy makers to easily visualize problems in relation to existing health and social services and the natural environment, and so, more effectively target resources (WHO, 2015). GIS not only provides maps and plots of the cases but also gives the spatial combination of various data including the socioeconomic, distribution of disease, geographical data such as landscape, rivers and weathers (Shamsul *et al*., 2012). The call for the use of GIS in public health has increased recently with advancement of knowledge leading to improved use of this highly useful tool.

In exploring our overall environmental health services throughout the disaster, the use of qualitative research methods allow the understanding of the experiences of the healthcare and rescue personnel. The experience of the community with regards to these services are also important for us to understand their needs and priorities. Qualitative research has been increasingly employed and acknowledged in public health and health service research (Bradley *et al*., 2007). By assessing these facets of human experiences, we hope to understand the complex exposure-outcome relationship and develop better insight on proper disaster risk reduction and management.

2.0 Methodology

This study was conducted in Kelantan, a state in the northeast of Peninsular Malaysia. This state covers an area of about 15,000 km^2 and comprises 10 districts. Malay makes the main ethnic group of about 94% from approximately 1.5 million population from the latest census in 2012 (Department of Statistics 2012), followed by other ethnic groups like Chinese, Indian, Orang Asli (indigenous tribes) and others. During the end of year 2014 flooding, vast areas within the Kelantan River Basin system were severely affected and due to the extensive widespread of the flooding. All incident cases of selected flood-related communicable diseases in every district of Kelantan during the 3 different flood periods (pre, during and post) were studied. The pre-flooding period was from 17th of September to 16th of December 2014, the during flood period was from 17th of December 2014 to 8th of January 2015, and the post-flooding period was from 9th of January to 9th of April 2015.

All quantitative data were analysed using SPSS version 20.0. The mean and standard deviation (sd) were used to describe the characteristics of the cases for continuous data, whereas percentage was used for categorical data. The level of significant was set at p value <0.05. Temporal patterns were investigated according to epidemiological curves of epidemiological weeks over the pre, during and post flooding periods.

All cases were recorded with complete addresses and coordinates in the Kertau (RSO) Malaya coordinates system format which were used for the ArcGIS analysis. Data on flooded areas and water levels were obtained from the Malaysian Department of Irrigation and Drainage. A total of 4 functional and complete water level gauge station readings were obtained and used for this study which covers the Kelantan River Basin area (Pradhan and Youssef 2011).

Incidence rates of cases were analysed based on the population density data of the 78 sub-districts obtained from the Malaysian Town and Regional Planning Department. Clustering analysis were performed on leptospirosis cases using Average Nearest Neighbourhood (ANN) and spatial autocorrelation using Global Moran's I. Local Indicators of Spatial Association (LISA) were then used to identify area of clusters (Anselin 1995). Optimized hotspot analysis as well as Kernel Density analysis were then used to determine the hotspot areas of leptospirosis cases all over Kelantan. Kernel density calculates the magnitude of cases per unit area and it is suitable to calculate the density of cases that fall within a neighbourhood or cluster. An additional geographical weighted regression (GWR) was performed to look for relationships between incidence of diseases and distance to water bodies.

In determining the relationship between meteorological parameters and the incidence of leptospirosis cases, a Poisson generalized linear model (GLM) was used. Disease count was modelled into the generalized linear model initially but we noted that overdispersion were exceptionally high rendering a more suitable analysis using a negative binomial regression model. The final negative binomial regression model will yield an equation similar to that of Poisson regression (Lord & Park 2012).

$$\text{Log (expected weekly case count)} = \alpha \text{ (intercept)} + b_1 \text{ (weekly } X_1) + b_2 \text{ (weekly } X_2)......$$

The qualitative research method used was focus group discussion (FGD). Three FGD were conducted comprising two groups from health, rescue and welfare personnel; one from the state level, another from the district level and another group from community members. All health, rescue and welfare staff were selected from various public agencies in order to capture a diversity of views. Representative community members were selected for the community FGD.All qualitative data (transcribed verbatims) were analysed using the Atlas.ti software (Version 7.5.10 GmbH, Berlin). Frequency of codes within a theme were then compiled in a table for better visualization of results. Apart from that, network view of results were developed by using thesoftware to delineate the complexity of responses and the links of recurring quotations or codes included in other themes.

3.0 Results and Discussion

Throughout the three periods, there was no recorded case of dysentery, cholera or tetanus, but with minimal changes in malaria, typhoid, paratyphoid, hepatitis A and E cases. Dengue showed the highest incidence during pre flood, followed by marked reduction during and post flood periods. Leptospirosis cases doubled during post flooding. Leptospirosis analyses were carried out extensively according to the methods described above. The following Figure 1 shows the difference in leptospirosis incidence between the pre and post periods. It shows the increase in overall incidence as described in Table 1 below.

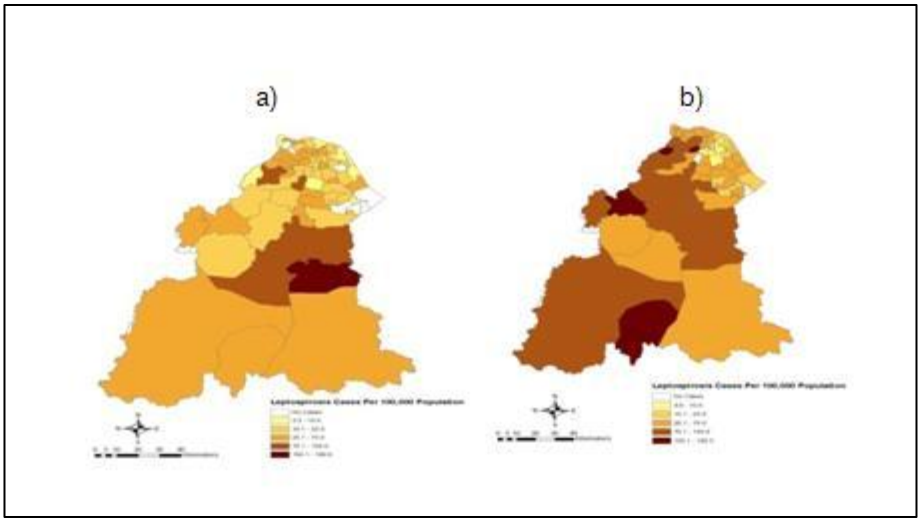

Figure 1 Spatial difference in the incidence of leptospirosis cases per 100,000 population. a) Leptospirosis incidence map 3 months before the flood. b) Leptospirosis incidence map during and 3 months post flooding

Table 1. Leptospirosis incidence rates according to sub-districts by period of flooding

No	3 months pre-flooding			During and 3 months post flooding		
	Sub-district	District	IR	Sub-district	District	IR
1	Olak Jeram	Kuala Krai	190.6	Alor Pasir	Pasir Mas	192.5
2	Chetok	Pasir Mas	119.3	Galas	Gua Musang	163.5
3	Batu Mengkebang	Kuala Krai	117.9	Kubang Sepat	Pasir Mas	158.8
4	Temangan	Machang	107.0	Jeli	Jeli	152.2
5	Gual Periok	Pasir Mas	83.6	Pasir Mas	Pasir Mas	147.6
6	Dabong	Kuala Krai	80.9	Chetok	Pasir Mas	143.1
7	Pasir Mas	Pasir Mas	69.2	Kuala Lemal	Pasir Mas	139.5
8	Alor Pasir	Pasir Mas	64.2	Olak Jeram	Kuala Krai	137.8
9	Kebakat	Tumpat	54.6	Ulu Kusial	Tanah Merah	131.9
10	Panyit	Machang	48.4	Wakaf Bharu	Tumpat	127.1

Average nearest neighbourhood (ANN) analyses were done for the different periods of flooding. All periods showed that the nearest neighbourhood ratio of below 1 indicating that the pattern of occurrence in all 3 periods were clustered. This index indicates the ratio between observed mean distance to expected mean distance, whereby the smaller ratios for during and post-flood periods indicates that the cases were more clustered (nearer to each other). The following Table 2 shows the differences in observed mean distance and it shows that in post flooding, cases tend to be more clustered.

Table 2. Average nearest neighbourhood analysis of leptospirosis cases for different flood periods

Period	Observed Mean Distance	Expected Mean Distance	Nearest Neighbourhood Ratio	z-score	p-value
Pre-flooding	1665.70	3226.45	0.52	-18.58	< 0.01
During	2175.48	4381.76	0.49	-12.15	< 0.01
Post-flooding	1138.83	2311.28	0.49	-25.84	< 0.01

Geographic weighted regression (GWR) were performed to look into the association of living in proximity to nearest water bodies, including rivers, lakes, channels, etc., based on the regression coefficient (R^2) and the Akaike Information Criterion (AICc). This analysis was done after we noted poor correlation by using Ordinary Least Square (OLS) analysis with the following statistics (R^2= 0.0062, coefficient= -0.602, p>0.05, AICc= 516.76). The GWR diagnostics gave these results (R^2= 0.227, AICc= 509.01). Figure 2 shows the area where cases coincides with the risks mentioned before. Sub-district Batu Mengkebang in the Kuala Krai District was indicated to have the highest vulnerability of incidence in association with distance to water bodies.

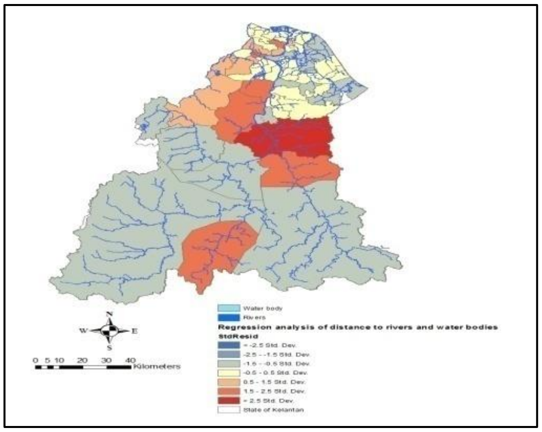

Figure 2 Spatial regression analysis of leptospirosis incidence risk among those living in inundated areas close to water bodies

Different environmental parameters were found to be significantly associated with leptospirosis across the 3 periods of the disaster. Cases were positively associated with average rainfall, water level and minimum temperature, while being negatively associated with humidity and maximum temperature. Figure 3 below shows the distribution of the average weekly environmental parameters and cases which occurred. The final model of the GLM is as follows where all variables are significant at $p<0.05$.

Log (weekly no. of cases) = 22.150 + weekly average (rainfall (0.008) + water level (0.097) + minimum temperature (0.134) - humidity (0.196) - maximum temperature (0.145))

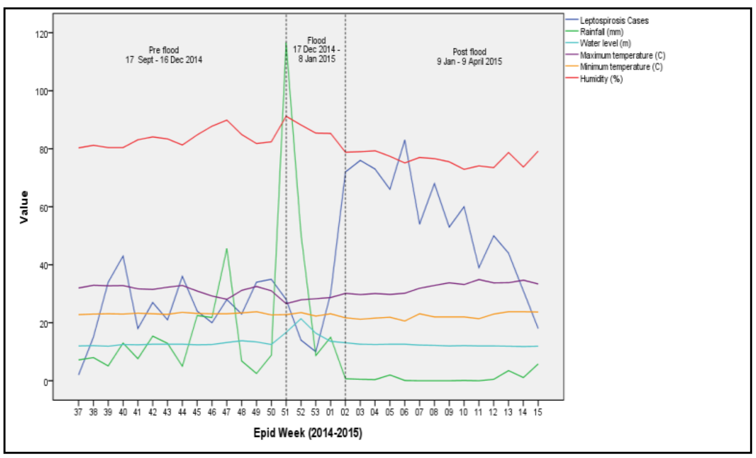

Figure 3 Leptospirosis cases and environmental parameters according to epidemiological weeks

Qualitatively, experiences of healthcare, rescue and welfare personnel were complex and evolved around common topics of environmental health preparedness, response and recovery efforts. Differences can be seen in the responses between the state level administrators and the district level personnel. Both state and district level personnel were involved with preparedness activities through intra and inter-agency meetings. However, during the disaster response and recovery periods, the state level officers were faced with mainly communication and coordination issues as compared to those at the district levels. One fire and rescue officer stated the following:

"As I understood, as mentioned before by Mr. A, the specific agency Y should handle coordination among the top-level officers in an inter-agency network, so that each agency can communicate effectively. The channel was opened, but there were no specific direction for its use."

"We use GIRN, but another agency use RMPNET, another uses VHF or HF. Different systems were used, leading to erratic rescue effort coordination."

At the district level, a problematic disaster response occurred due to the unprecedented severe flooding. Health and rescue responses were hampered due to challenges in transportation, communication, food and water supplies, relocation centres and waste management. A medical officer stated:

"The clinic was totally submerged, all medicines washed away, all our pregnancy delivery sets and other equipments...this clinic is supposedly a self sustaining clinic since we are far from the hospital. But the flood was too severe."

From the community point of view, they were highly affected during the response phase of disaster management. Issues pertaining to water and food supplies, relocation centres, emergency management and sanitation were on top of their list. A lady from the community uttered:

"The flood water was used for personal cleaning (after toilet use) throughout the stay in relocation centres."
"When it rains, water was collected using the available water tanks and the rain water was used for bathing and cooking."

4.0 Conclusion

4.1 Throughout the three periods, there was no recorded case of dysentery, cholera or tetanus, but with minimal changes in malaria, typhoid, paratyphoid, hepatitis A and E cases. Dengue showed the highest incidence during pre flood, followed by marked reduction during and post flood periods. Leptospirosis cases doubled during post flooding.

4.2 The mean age of the leptospirosis cases was 31.66 (±19.96) years with approximately a third (32.1%) of the cases being in the 15-30 years old age group. Almost 60% of the cases were male and the majority were Malaysians and of the Malay race. A total of 60% were from the unemployed/homemaker occupational category.

4.3 A total of 19 out of 78 sub-districts recorded leptospirosis incidence rates of over 100 per 100,000 population during flood and in the post-flood periods, in comparison to only 4 sub-districts in the pre-flood period.

4.4 Average nearest neighborhood analysis indicated thatleptospirosis cases were more clustered in the post-flood period as compared to the pre-flood period, with observed mean distance of 1138.8 meters and 1665.7 meters, respectively (both at $p<0.01$). Global Moran's I was higher in the post-flood period (0.19; $p<0.01$) as compared to the pre-flood period (0.06; $p<0.01$). Geographic weighted regression showed that living near to rivers increased the risk and vulnerability of contracting the disease.

4.5 Kernel density also showed that post-flooding leptospirosis hotspots were concentrated in areas where garbage cleanup occurred. Increased rainfall was observed three weeks prior to the surge in cases, confirming the lag phase of disease incubation. Leptospirosis incidence was also significantly associated with temperature, humidity, rainfall and river levels.

4.6 The unprecedented severe flooding affected our environmental health and disaster preparedness, response and recovery measures leading to communication and coordination problems along with challenges in transportation, water, food, relocation centres, sanitation and solid waste management.

4.7 State level officers faced greater challenges in inter-agency communication, coordination and collaboration. District level personnel faced more complications during disaster and emergency response. Recommendations were made based on the challenges and suggestions from both groups. These include improved coordination, effective communication, improved human resource management, accessible early warning system, community empowerment and awareness, and prioritization of continuous environmental health services.

4.8 The community were mostly affected by issues during the response phase including water and food supplies, relocation centres, emergency management and sanitation.

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METAGENOMIC ANALYSIS OF KELANTAN RIVER POST-FLOOD FOR PATHOGENIC AND NONPATHOGENIC MICROBIAL IDENTIFICATION

Project Information

Project Leader	: Suganthi Appalasamy
University	: Universiti Malaysia Kelantan
Address	: 6 Jalan Lumut Mutiara 1, Taman Lumut Mutiara, 32200 Lumut Perak
Contact number	: 016 528 1956
Email	: suganthi.a@umk.edu.my
Project Members	: Jayaraj Vijaya Kumaran
	Mohamad Fikri Bin Sudin

1.0 Introduction

Situated in northeastern of Peninsular Malaysia, Kelantan's longest river is the Kelantan River or commonly known as Sungai Kelantan. Feeding more than 180 streams and draining at a catchment area of 11,900 square kilometer, Kelantan River is considered as a lowland stream flowing towards the river mouth (Ahmad et al., 2009). The river flows through major towns in Kelantan; Kuala Krai, Tanah Merah, Pasir Mas and Kota Bharu (Kelantan state capital) before flowing into the South China Sea (Ambak et al., 2010). With the recent flood catastrophe that almost covered the nearby cities of Kelantan River, the level of pathogenic contamination in the Kelantan River remains unknown. Formed by the combination of Galas River (Sungai Galas) and Lebir River (Sungai Lebir) situated near Kuala Krai, Kelantan river plays a prominent role in the lives of local people, eg. in domestic use, as a transportation mode, agriculture and plant irrigation, and small scale fishing activities (Ambak and Zakaria, 2010). With the leptospirosis outbreak during recent flood and previous cases of *Salmonella typhii* and *Vibrio cholera*, the risk of water borne pathogen diseases in Kelantan River after remain unanswered. Without proper record of river microbial content, proper river cleanup and management could not be planned and carried out so that the ecosystem of river microbial is not disrupted while preserving certain highly useful microbes and getting rid of the pathogenic microbes.

Flooding is usually associated with an increased risk of infection and changes in the water microbial community. Although the percentage of an outbreak due to water borne disease was low in Kelantan after the major flood disaster in 2014, the presence of human and nonhuman pathogenic microbial was not properly studied in Kelantan River. Flood being the annual occurrence in Kelantan affecting mostly the areas surrounding the river, a proper documentation of the microbial diversity and taxonomy is deemed to be highly appropriate. Hypothetically, Kelantan River should face an influx in pathogenic microbial due to the flowing in of human and animal waste contaminated water to the river during flood season. In future the outcome of this study could be used to address any sudden water borne disease outbreak that could happen in Kelantan areas and identify the source of pathogenic contamination. The documented microbial community in Kelantan River could also be used to identify novel bacteria and the enzymes that can be applied in pharmaceutical industries. Metagenomic analysis is an important tool that allows researchers to understand the taxonomic identity and functioning between various environmental samples. It is an easy tool that allows for exploratory and comparative analysis using freely available software and databases, MG-RAST (Meyer et al., 2008). Many reports previously have been published for studies that use metagenomic as a tool for water microbial diversity identification and functioning analysis for example Meyer et al. (2008), Johnston (2009), Sinigalliano et al. (2010), Gomez-Alvarez et al. (2012), Chao et al. (2013).From the metagenomic analysis, not only the microbial identification can be done, the functions of the enzymes in the microbes and the concentration of the microbe can be studied as well. The environmental quality act (1974) underlined the management of rivers in Malaysia. The monitoring and management of rivers which is currently tasked to the Department of Environment under the Ministry of Natural Resources and Environment has been tasked in monitoring of the water quality and for pollutants in Malaysia rivers.

2.0 Methodology

2.1 Sampling of water samples

The water samples was collected using water sampler at four main cities that the Kelantan river flows-Kuala Krai, Tanah Merah and Kota Bharu (Figure 1). At each location, the water sample were collected in the replicate of three at interval of five meter. The water sample will be collected about three meter from the river bank using water sampler.

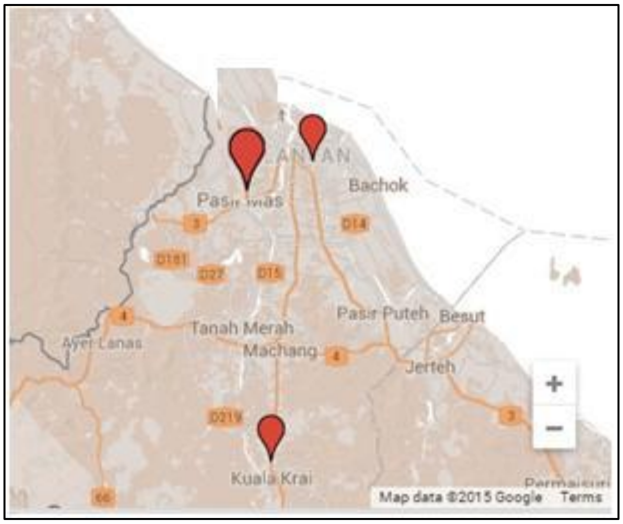

Figure 1. The map showing three water sample (Kota Bharu, Tanah Merah, Kuala Krai) collection points along Kelantan river

2.2 Isolation of DNA from water samples
Extraction of DNA from water samples (9 samples, 3 points) was extracted following the method reported by Alvarez-Gomez et al. (2012). The water sample DNA with high quality and quantity was used for sequencing and subsequent metagenomic analysis.

2.3 Deep sequencing using sequence by chemical synthesis method (Illumina Miseq)
The water sample DNA were subjected to deep sequencing following the method suggested by Illumina Miseq protocol.

2.4 Metagenome analysis using 16S based assembly and annotation
The raw reads were then subjected to MG-RAST pipeline for further assembly and annotation. Through this annotation, the taxonomy and functioning of the microbial in the water sample at different water level was attained and then further used for comparative study.

2.5 Comparative study of the water sample microbial at different water level and different locations in Kelantan River
The taxonomy and functioning results from MG-RAST pipeline was used for further comparative analysis. The comparative study will encompass metagenomic data from the three locations to determine the diversity of microbial community and the concentration of the community present at the three locations along Kelantan River.

3.0 Results and Discussion
The microbial diversity in the Kelantan River along three cities (Kota Bharu, Tanah Merah and Kuala Krai) were determined using metagenomics 16S rRNA analysis. The water samples at these three points along Kelantan River were collected in triplicate at depth of five meter and three meter away from the river bank. The collected water were then used for microbial DNA isolation and metagenomics sequencing with MiSeq sequencing system. The raw reads (1868713 reads at an average of 400 bp) obtained from metagenomics sequencing were analysed for 16S rRNA gene using MG-RAST database for comparison of microbial diversity in each point of Sungai Kelantan. The metagenomics analysis showed absence of human pathogenic microbes such as Enterobacter or coliforms in Kelantan River. Three major groups of microbes that were found in high concentration in Kota Bharu, Tanah Merah and Kuala Krai river points are Armatimonadaceae (34.1%), Limnohabitatan (4.6%), Sporichthyaceae (3.7%) and Verrucomicrobra (3.3%) (Figure 2). The water microbial metagenomics library from these three river points also showed

that the bacteria belong to a several widespread nonpathogenic freshwater clusters, including clusters of Polynucleobacter, beta-proteo bacteria, Actinobacteria, Acidovorax and Methylophilaceae. There was also a group of bacteria ie Prosthecobacter found in concentrations of 3% in all the three river points and this bacteria is commonly found in water with high heavy metal concentration. These microbes that were found in the Kelantan River indicated that the river is void of human pathogenic microbes. However, the mitigation process in Kelantan River could be more focused on reducing the chemical pollutants in the river water which could endanger the surrounding soil and livestock that depend on river water.

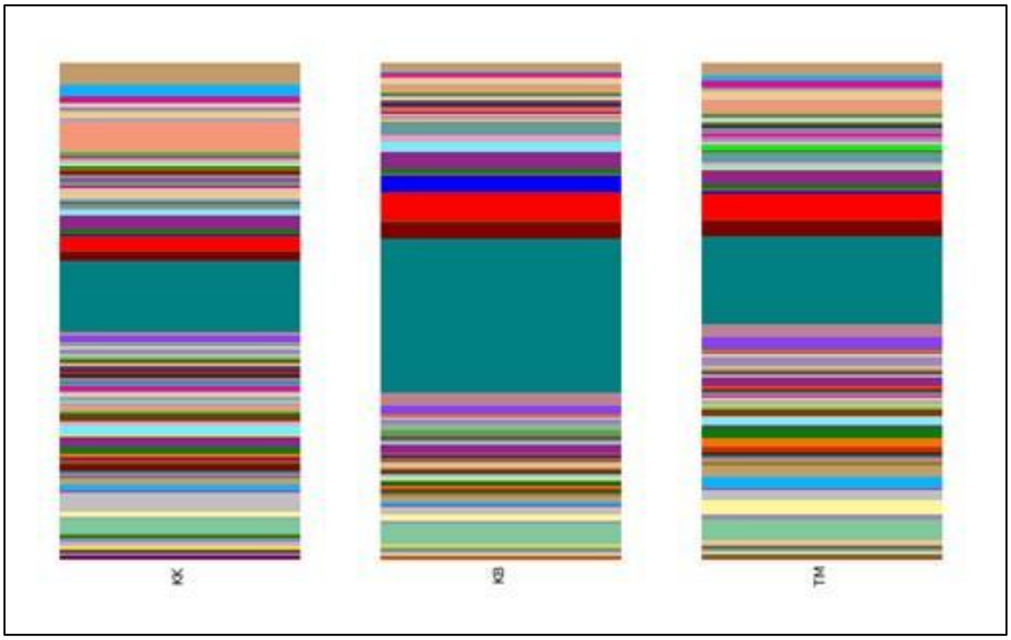

Figure 2: The comparison of microbe concentration and diversity at three points of Sungai Kelantan. KK: Kuala Krai, KB: Kota Baru, TM: Tanah Merah

4.0 Conclusion

The findings relate to the microbe diversity in Sungai Kelantan at three main points/cities that it flows. These three cities in Kelantan were chosen as they were badly hit during the big flood 2014. The metagenomics analysis of microbe indicated that the presence of common nonpathogenic bacteria in the river water. The water samples collected five months after the big flood thus the dynamics of water microbe could have changed during that period. However, these data will be the reference for future analysis of microbe diversity for Sungai Kelantan.

The economic activity along Sungai Kelantan influences greatly the diversity of microbes as indicated by the microbes that occurred at high concentration in the water sample. This points to the pollution of the Sungai Kelantan river water that could be caused by the deposition of heavy metals from the nearby industry. Further data on land use near these three points is needed for future analysis.

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MONITORING THE DISTRIBUTION OF PATHOGENIC *Leptospira SP* IN WATER, SOIL AND ANIMALS PARTICULARLY AFTER FLOOD ARE THE KEY FACTORS FOR THE CONTROL AND PREVENTION OF LEPTOSPIROSIS

Project Information

Project Leader	: Assoc. Prof. Dr. Siti Khairani binti Bejo
I/C Number	: 670118-01-5658
University	: Universiti Putra Malaysia
Address	: Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor
Contact number	: 603-86093460
Email	: skhairani@upm.edu.my
Project Members	: Prof. Dato' Dr. Abdul Rani Bahaman Assoc. Prof. Dr. Zunita Zakaria

1.0 Introduction

Leptospirosis represents a risk after flooding due to moisture which provides favorable survival conditions for pathogenic *Leptospira sp*. in the environment. In tropical and subtropical, fluctuation of leptospirosis occurs during period of heavy rainfall, flooding as well as during high density of rodent population and high incidence of leptospiral infection in animals. A wide variety of animals may serve as carriers or maintenance host for *Leptospira sp.* which may excrete the organism in their urine and contaminate water or soil then becomes the source of infection for human and livestock such as cattle, goat, sheep and buffalo. Kelantan have been hit by massive flood in December 2014. A considerable number of *Leptospira sp*. carriers or maintenance host have succumbed to the flood thus contaminating the flood water and soil. After the flood, *Leptospira sp.* might have remained in water or moist soil and become a main source of infection for human and livestock. Therefore, detection of pathogenic *Leptospira sp.* in livestock after massive flood need to be carried out to determine the distribution of infection amongst livestock in affected area.

2.0 Methodology

Serum samples (1749) were obtained from livestock in Kelantan state of Malaysia in June 2015. The samples were collected from cattle (1024 samples), sheep (388 samples), goat (367 samples) and buffalo (20 samples) in livestock farms which have been hit by flood in December 2014. All serum samples were tested by microscopic agglutination test (MAT) for detection of leptospiral antibodies using method described by Cole et al. (1973). The antigens used for MAT were made up of 7 days old live culture of non-pathogenic *Leptospira sp* (*Leptospira biflexa* serovar *Patoc* and *Leptospira biflexa* serovar *Andaman*) and pathogenic *Leptospira sp* (*Leptospira interrogans* serovar *lai, hardjo, pomona, canicola, australis, javanica, habdomadis, icterohaemorrhagiae* and *bataviae*). Polymerase chain reaction (PCR) using a mixture of primer sets 16'S rRNA (genus specific) and lipL32 (pathogenic *Leptospira sp*) was performed.

3.0 Result and Discussion

Antibodies against pathogenic leptospira namely serovars *hardjo* (4.2%), *pomona* (1.1%), *australis* (0.8%), *canicola* (0.5%), *javanica* (0.2%), *hebdomadis* (2.0%), *icterohaemorrhagiae* (0.3%) and *bataviae* (0.3%) were detected. The antibody titers were ranges from 1/40 to 1/1280. Antibodies to serovar *hardjo* was highly detected in cattle as expected as cattle in Malaysia were reported as the maintenance host for serovar *hardjo* (Bahaman et al., 1988; Khairani-Bejo et al., 2004). Multiple serovar infection was detected in livestock in studied area. Pathogenic *Leptospira sp* was detected by PCR in one cattle's blood sample. It shown that combinations of serological and molecular method were highly recommended for diagnostic of leptospirosis in livestock.

4.0 Conclusion

In conclusion, multiple serovars infection were detected in livestock involved in the 2014 massive flood in Kelantan and this finding suggests that the livestock may become source of infection in human population.

4.1 Overall prevalence of leptospira infection in livestock in Kelantan which involved with massive flood in 2014 was 9.4%

4.2 *Leptospira interrogans* serovar *hardjo* was the main serovar infected livestock in the study area.

4.3 Multiple serovar infection was detected in livestock which included serovars *hardjo* (4.2%), *pomona* (1.1%), *australis* (0.8%), *canicola* (0.5%), *javanica* (0.2%), *hebdomadis* (2.0%), *icterohaemorrhagiae* (0.3%) and *bataviae* (0.3%).

4.4 Polymerase chain reaction (PCR) was able to detect leptospires in blood. Therefore, PCR was suggested to be included in routine diagnostic method for detection of leptospiral infection in livestock.

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SMALL INTESTINAL BACTERIAL OVERGROWTH IS THE FUNDAMENTAL MECHANISM FOR DEVELOPMENT OF ABDOMINAL DISCOMFORTS FROM POOR WATER, SANITATION AND HYGIENE (WASH) PRACTICES AFTER FLOOD DISASTER

Project Information

Project Leader	: Prof. Dr. Lee Yeong Yeh
University	: Universiti Sains Malaysia
Address	: Kubang Kerian, Kota Bharu, Kelantan
Contact number	: +60179028147
Email	: yylee@usm.my
Project Members	: Prof. Dr. Liong Min Tze Assoc. Prof. Dr. Wan Mohd Zahiruddin Wan Mohammad Dr. Wan Mohd Izani Wan Mohamed, Dr. Wong Mung Seong Dr. Nurfadhilah Bt. Yusof, Ong Ean Wah

1.0 Introduction

In a survey we conducted in the Tumpat district immediately post-flood in December 2014, we observed a rise in cases of acute gastroenteritis and non-specific abdominal complaints (unpublished observation). One major reason is poor sanitation, water and hygiene practice (WaSH) by flood victims during the flood because of poor access to clean water [1]. The mechanism how poor hygiene causes non-specific abdominal complaints is unknown. Our study objectives were firstly, to establish the connection between chronic abdominal discomfort and poor WaSH practices during flood, and secondly, to determine if small intestinal bacterial overgrowth (SIBO) and gut dysbiosis play a role in the causation of abdominal discomfort in this community, and thirdly, to evaluate the effect of probiotics on symptom improvement and also gut dysbiosis.

2.0 Methodology

For objectives one and two, flood victims from the district of Tumpat, Kelantan were invited to assess their abdominal symptoms that persisted for six months, quality of life (SF-36), psychological measures (Hospital Anxiety Depression Scale or HADS) and WaSH practices (a self-developed questionnaire) during flood and 6 months later. Agreed participants were also consented for glucose breath test to assess for SIBO [2] and stools to assess their gut microbiome profile using the 16S rRNA pyrosequencing. Multiple logistic regression analysis (adjusted odds ratio or AOR) was used to test for factors associated with abdominal pain, poor WaSH practices during flood, SIBO and gut microbiome profile respectively. For objective three [3], participants with chronic abdominal pain were identified and a group of asymptomatic participants from the same population were included as controls. The probiotic, *Bifidobacterium infantis* M63 1 g of sachet (9 Log CFU/g)/day was given for 3 months in the abdominal pain group. Pre- and post-treatment evaluations included SF-36 quality of life assessment and a subjective symptom assessment score. Primary outcome was improvement in SF-36 and symptom scores. A p-value < 0.05 was considered significant in all tests.

3.0 Results and Discussion

Of 211 participants (mean age 54.5 years, females 71%), 37.9% had chronic abdominal pain. Abdominal pain was significantly associated with a worse WaSH score during flood (AOR 1.11, P = 0.04) and also irritable bowel syndrome (AOR 9.53, P < 0.001). Of 135 participants who agreed to take part in breath-testing, SIBO was present in 12.6% (n=17) and it was significantly associated with chronic abdominal pain (AOR 4.94, P = 0.01), poor water practices (AOR 1.14, P = 0.04) and limitations in physical functioning domain of SF-36 (AOR 0.98, 95% CI 0.96; 1.00, P = 0.02). Of 73 participants consented for stool pyrosequencing, the most commonly found phyla were Bacteroidetes (37%), Firmicutes (25%) and Proteobacteria (8%). There was significantly more Fusobacteria in those with vs. without abdominal discomfort (1.76 ± 1.0 vs. 0.1 ± 0.05%, P = 0.003) while Firmicutes was higher in those with vs. without SIBO (p=0.03). Twenty participants with chronic abdominal pain were given probiotics vs 32 controls. Mental well-being of SF-36 and subjective symptom score were significantly better post-probiotic (p=0.002, p<0.001, respectively). More Bacteroidetes (57%) and lower Firmicutes (24%) were noted post-probiotic compared to controls (p=0.02 & p=0.008).

4.0 Conclusion

We have reported significant association between persistent abdominal pain post-flood with poor WaSH practices and also SIBO and gut dybiosis. Major findings in our study are summarized below:

4.1 More than a third of post-flood population in the community can be affected by persistent abdominal pain
4.2 The abdominal pain is associated with poor WaSH practices
4.3 The persistent pain in those with poor WaSH practices is due to SIBO and gut dysbiosis especially of the Fusobacteria phyla, which is known to contain pathogenic strains
4.4 The probiotic, *Bifidobacterium infantis* M63 has been shown to improve symptom but also mental well-being scores
4.5 The probiotic improves symptom and mental well-being scores through alteration in the gut microbiota

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PSYCHOLOGICAL DISTRESS AND RESILIENCE OF FLOOD VICTIMS IN KELANTAN: TOWARDS THE DEVELOPMENT OF A TRAUMA TREATMENT MODULE

Project Information

Project Leader	: Prof. Dr. Rozumah Baharudin
University	: Universiti Putra Malaysia
Address	: Dept. of Human Dev. & Family Studies, Fac. of Human Ecology, UPM
Contact number	: 03-89467082
Email	: rozumah@upm.edu.my
Project Members	: Dr. Nor Sheereen Zulkefly Dr. Wan Munira Wan Jaafar

1.0 Introduction

Floods, like any other natural disasters are usually sudden and traumatic events which may results in varying psychological damage to individuals (Shalev, Tuval-Mashiach, & Hadar, 2004) such as distress, depression, anxiety, and post-traumatic stress disorder (PTSD; Kuo et al., 2003; Yang et al., 2005). The Stressful Life Events Theory (Holmes & Rahe, 1967) indicated that specific and or negative life events may cause stress on individuals' life which affect their coping and adaptive behaviors. Individual and families with high coping efficacies will more likely have better adjustment in the aftermath of trauma (Kirby, Shakespeare-Finch, & Palk, 2011).

Research on psychological distress and resilience of flood victims is scare in Malaysia. Two studies found had limited focus. Johari and Marzuki (2013) presented theoretical perspective of the effects of floods on quality of life. While Nasir, Zainah and Khairudin (2012) explored the thinking, emotion and behavior of five victims of the Johor flood whom however, were elderly. The present study therefore attempts to fill-up the knowledge gaps by investigating the extent of the psychological distress and resilience of flood victims (specifically, parent and adolescents) in Kelantan, with factors such as social support, attachment relationship and resilience as predictors.

2.0 Methodology

Flood victims (n=600, Malay parent-adolescent dyads) from Kuala Krai (20%), Pasir Mas (19%), Tumpat (21%), Gua Musang (20%), Tanah Merah (20%) were purposively identified. They were generally female (61.3%, mean age = 15 years) adolescents and their mothers (51.3%, mean age = 48 years). Data gathered via face-to-face interview included family and personal characteristics, and key measures: 1). Attachment relationship - using the Inventory of Parent and Peer Attachment-Malay (IPPA-Malay; Zulkefly & Wilkinson, 2015) (($\alpha_{adolescents}$=.74; $\alpha_{parents}$=.62) 2). Coping skills - using a literature-based developed scale ($\alpha_{adolescents}$=.68; $\alpha_{parents}$=.49), 3). Psychological Distress - using the Depression Anxiety Stress Scale (Lovibond & Lovibond, 1995) with three subscales: Depression ($\alpha_{adolescents}$=.67; $\alpha_{parents}$=.78), Anxiety ($\alpha_{adolescents}$=.62; $\alpha_{parents}$=.63) and Stress ($\alpha_{adolescents}$=.65; $\alpha_{parents}$=.61), 4). Resilience - using an adapted version of the Resiliency Scale (RS-14; Wagnild, 2010) ($\alpha_{adolescents}$=.86; $\alpha_{parents}$=.87), and 5). Social support was measured using qualitative questions.

3.0 Results and Discussion

Adolescents rated themselves as having good coping skills and attachment relationships to their parents. Nevertheless, some adolescents showed symptoms of psychological problems (27.3% - mild to severe depression, 58.4% - signs of anxiety, and 23% - mild to severe stress). Nonetheless, encouraging results was found on resiliency. Nearly 40% of adolescents showed high tendency in resiliency. Qualitative findings showed that during the flood adolescents' received support from their parents, siblings and extended families. Goverment and non-goverment bodies, friends, neighbours were also provided support to the victims.

Parents indicated having good coping skills and attachment relationships with their adolescents. Some parents reported symptoms of psychological problems (16% - mild to extremely severe depression, 52% - mild to extremely severe anxiety, and 9.3% - mild to severe stress). Most (80%) parents reported having high to very high resilience tendencies. Qualitatively parents reported receiving social support from their children, spouse, siblings, parents, and extended families. Goverment agencies, friends, non-goverment bodies, and neighbours were also noted as providing social supports.

For adolescents, attachment to parents was significantly ($p<0.01$) related to stress ($r=-.24$), anxiety ($r=-.23$) and depressive ($r=-.42$) symptoms, and resilience ($r=.32$). Similarly for coping skills to psychological distress and resilience variables, i.e., stress ($r=-.28$), anxiety ($r=.27$) and depressive ($r=.12$) symptoms, and resilience ($r=.37$). As expected, stress related to anxiety ($r=.62$) and depressive ($r=.61$) symptoms. However, no significant correlation was indicated between stress symptoms and resiliency. Anxiety symptom was found related to depressive symptom ($r=.47$, $p<0.01$), but not with resiliency. Only depressive symptoms was found to have significant correlation with resiliency ($r=-.25$, $p<0.01$).

Results revealed significant ($p<0.01$) associations between parents' attachment relationships to adolescents and coping ($r=.17$), depressive symptoms ($r=-.20$), and resiliency ($r=.31$). Additionally, parents' coping skills were related to anxiety ($r=-.23$) and stress ($r=-.25$) symptoms, and resiliency ($r=.27$). As expected, psychological distress variables were intercorrelated with one another where parents' depressive symptoms were related to anxiety ($r=.51$) and stress ($r=.61$) symptoms, while anxiety was related to stress symptoms ($r=.62$). Only parents' depressive symptoms had significant relations to resiliency ($r=-.24$).

The hybrid structural equation modelling (SEM) technique was used to identify the direct and indirect influence of the exogenous variables (attachment relationships and coping skills) on the endogenous (depression, anxiety, stress, and resilience) variables in the model. Several measurement statistics such as chi-square (χ^2), normed chi-square (χ^2/df), the root mean square error of approximation index (RMSEA; <0.08); the comparative fit index (CFI; >.90); the goodness-of-fit index (GFI; >.90) were employed in order to determine model fit (Kline, 2004).

The study's initial structural model for psychological distress and resilience of adolescents demonstrated adequate fit statistics ($\chi^2=203.93$, df= 90, $\chi^2/df=2.27$, $p<0.001$; CFI = 0.90; GFI = 0.90; RMSEA = 0.07). However, two paths were found to be non-significant, i.e., Stress to Resilience, and Coping Skills to Depression which were removed (Holmes-Smith et al., 2006) This did not yield any significant change in the χ^2 value and jeopardize the overall fit of the model resulting in a final model with a good fit to the data with $\chi^2=208.43$, df= 92, $\chi^2/df=2.27$, $p<0.001$; CFI = 0.90; GFI = 0.90; RMSEA = 0.07.

Further inspection of the final model revealed that attachment had negative moderate direct effect on depression, anxiety, and stress, and a positive direct effect on resiliency. The indirect effect of attachment on resiliency was small (.07). Meanwhile, coping skills were found to have negative and moderate direct effects on anxiety and stress, and a positive direct effect on resiliency. Coping skills was also found to have a relatively small indirect effect (.11) on resiliency. Further, depression and anxiety had negative and moderate direct effect on resiliency of adolescents. Stress, however, did not have any significant direct effect on adolescents' resiliency.

The analysis on the model for parents revealed an unacceptable fit to the data with $\chi^2=290.42$, df= 91, $\chi^2/df=3.19$, $p<0.001$; CFI = 0.88; GFI = 0.90; RMSEA = 0.09. Four paths were found non-significant, i.e., the paths from attachment to stress and anxiety, and the paths from stress and anxiety to resiliency which were then removed one at a time to obtain possible better-fit statistics (Holmes-Smith et al., 2006). The final model yield adequate fit to the data where $\chi^2=291.80$, df= 95, $\chi^2/df=3.07$, $p<0.001$; CFI = 0.90; GFI = 0.90; RMSEA = 0.08.

Examination of the model revealed attachment had negative moderate direct effect on depression. The indirect effect of attachment on resiliency, mediated through depression was small (.04). Meanwhile, coping skills showed negative and moderate direct effects only on anxiety. Moreover, out of the psychological distress variables, only depression had negative direct effect on resiliency of parents.

Multi-group invariance analysis across gender of adolescent indicated differences with respect to the paths from attachment and coping to the psychological distress variables (i.e., depression, anxiety, and stress), and resiliency across male and females. On the contrary, the model did not vary across gender of the parents. This means that the structural path from attachment and coping to depression, anxiety, stress, and resiliency are similar across father and mother.

4.0 Conclusion

4.1 A considerable proportion of the flood victims (i.e., parent and adolescents) were found to suffer from various psychological distress from depression, anxiety, and stress.

4.2 Despite having some psychological issues, the flood victims had overall good coping skills, attachment relationships, and high level of resiliency.

4.3 Support from family members and the community at large are essential for recovery from traumatic events.

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GENETIC RELATEDNESS OF ENVIRONMENTAL EXPOSURE OF LEPTOSPIRAL PRE- AND POST-FLOOD: TOWARDS STRATEGIC PREVENTION OF LEPTOSPIROSIS

Project Information

Project Leader	: Dr Nabilah Ismail
University	: Universiti Sains Malaysia
Address	: Department of Medical Microbiology & Parasitology, Health Campus
Contact number	: 013-9233635
Email	: drnabilah@usm.my
Project Members	: Prof Madya Chan Yean Yean, Prof Madya Dr Azian Harun Prof Madya Dr Siti Asma Hassan

1.0 Introduction

Leptospirosis is one of the most important zoonoses worldwide. Malaysia is a tropical country with high seasonal rainfall, warm temperatures, and wet and humid climate. These conditions lengthen the survival of leptospires in the environment. It is common that floods occur following heavy rainfall during monsoon season in the East Coast. The presence of leptospires in the environment during flooding may potentially cause an outbreak of leptospirosis. A novel pathogenic species, *Leptospira. kmetyi*, has been isolated from environmental samples in Malaysia (Slack *et al.,* 2009). In order to identify the potential threats of leptospirosis in the environments, the present study aims to isolate and identify *Leptospira* spp. from the selected environments affected by flood in Kelantan, Malaysia.

2.0 Methodology

2.1 Sampling sites

Samplings were conducted from May to September 2015 at the selected environment affected by flood including recreational areas (Jeram Pasu and Jeram Linang) and markets (Pasar Khadijah, Pasar Wakaf Che Yeh and Pasar Manik Urai Lama) in Kelantan, Malaysia. Those sampling sites were selected based on previous reports of leptospirosis cases, rat infestations and improper waste management.

2.2 Isolation of leptospires

Sample collection

Water samples were filtered through 0.2 µm Nalgene® Filter Unit and 40 ml of the samples were transferred into centrifuge tubes then centrifuged at 4 000 x g, 27ºC for 20 minutes. For soil samples, they were mixed with sterile water in sterile 50 ml falcon tubes and shaked vigorously. The suspension was allowed to settle for 5-10 minutes before being filtered using 0.2 µm Nalgene® Filter Unit.

Culture of leptospires

Several drops of the filtrates were inoculated into liquid EMJH media supplemented with antimicrobial agents (5-fluorouracil, 200 µg/ml) and incubated at 30ºC in a shaker incubator. The presence of leptospires was examined under dark field microscope for their characteristic morphology and motility, daily for 28 days.

Culture purification

In an event of contamination, 1000 µl of contaminated cultures were transferred into fresh liquid EMJH media supplemented with sulfamethoxazole and trimetophrim (40/8 µg/ml), amphotericin B (5 µg/ml) and 5-fluoro-uracil (200 µg/ml). The cultures were examined under dark field microscope daily for 28 days. If the contaminants were still present, the cultures were diluted in sterile distilled water using a serial dilution technique and then transferred into solid EMJH media. The diluted culture was incubated for 3 weeks or until the leptospires colonies were observed on plates.

2.3 Molecular characterization of the isolates

DNA extraction was performed on isolates by using Qiagen DNeasy® Blood & Tissue Kit (Qiagen, USA) according to the manufacturer's protocols for Gram negative bacteria and stored at 20°C until use. A 20 µl-PCR reaction mixture containing was used in all PCR amplifications. Bak2 primer pair, targeting 16SrRNA gene, was used for species identification. The PCR product was purified using QIAquick PCR Purification Kit (Qiagen, USA) and subsequently sequenced using Sanger sequencing kits and instruments supplied by Applied Biosystems®, U.S., performed by First Base Laboratories (Selangor, Malaysia). The DNA sequences were edited in BioEdit and compared against the Genbank database using BLAST. The 16S rRNA gene partial sequences of all isolates were aligned with the 16S rRNA sequences of the types strains obtained from GenBank by using Multiple Sequence Comparison by Log-Expectation (MUSCLE) in MEGA 6 software.

3.0 Results and Discussion

A total of 90 samples comprised of 45 water and 45 soil samples were collected. Based on dark field microscopic observations, 42.2% (n=38/90) cultures were positive for leptospires. The positive cultures showed the typical morphology and characteristic motility of *Leptospira* genus. Partial sequences of 16S rRNA revealed that 34.4% (n=31/90) were identified as *Leptospira* spp (Table 1). They were isolated from water and soil samples in 31.1% and 37.8% respectively. Our findings were comparable with previous studies from other Asian countries with positivity rate of *Leptospira* isolation in water and soil samples ranging from 10.3% to 42.5% (Saito *et al*., 2013, Ridzlan *et al.,* 2010, Benacer *et al*., 2013).

Manik Urai market, as one of area severely affected by flood has lower isolation rate for *Leptospira* spp (n=2/9). Since recent heavy flood that affected the whole Manik Urai in end of December 2014, no market activity was held at Manik Urai market as the only concrete bench left. The lower isolation rate could be due to less attraction for the rodent animals to go to that site as no leftover food or rubbish present.

Table 1: Culture positivity rate for *Leptospira* spp

Sampling sites	Culture positive for *Leptospira* spp	
	Water	Soil
Jeram Linang (n=18)	3/9	7/9
Jeram Pasu (n=18)	8/9	4/9
Wakaf Che Yeh market (n=18)	0/9	0/9
Siti Khadijah market (n=18)	3/9	4/9
Manik Urai market (n=18)	0/9	2/9
Total (n=90)	31.1% (14/45)	37.8% (17/45)
	34.4% (31/90)	

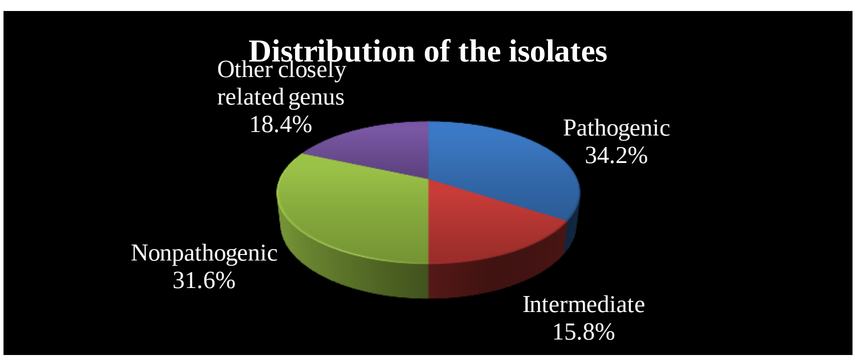

Figure 1: Predominance of pathogenic species based on partial sequences of 16S rRNA

In this study, pathogenic species was the most predominant isolates (34.2%) among *Leptospira* spp (figure 1). Compared to a recent local study, pathogenic species was isolated in only 3% of the isolates (Muhammad *et al*., 2016). The presence of pathogenic species especially after flood event was probably due to increased environmental exposure to the contaminated urine from infected animals that affected by flood water. The occurrence of outbreak of leptospirosis among human cases in Kelantan post flood in 2015 would suggest that higher exposure to the contaminated environment plays a major role (http://www.nst.com.my/news/2015/09/floods-126-leptospirosis-infections-recorded-flood-hit-states). A previous study reported in their systematic review that most reported outbreaks of *Leptospira* spp. following extreme water-related weather events, heavy rainfall and flooding were by far the most commonly reported (Cann *et al*., 2013).

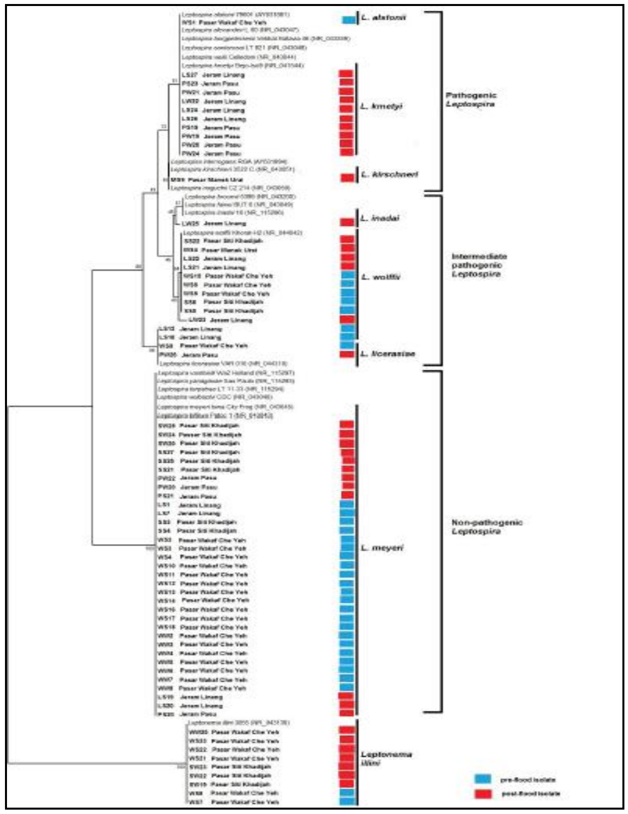

Figure 2: A phylogenetic tree generated by the Neighbour-Joining method using MEGA 6, based on 16S rRNA gene sequence of the *Leptospira* isolates and the selected strains

Based on partial sequences of 16S rRNA gene, pathogenic *Leptospira* comprised of three strains, *Leptospira kmetyi, Leptospira interrogans* and *Leptospira kirschneri* which were detected in 26.3% (n=10/38), 5.3% (n=2/38) and 2.6% (n=1/38) of the isolates respectively. Two intermediate strains, *Leptospira wolfii* was identified in 13.2% (n=5/38) and *Leptospira inadai* in 2.6% (n=1/38) of the isolates. A non-pathogenic strain, *Leptospira meyeri* was identified in 31.6% (n=12/38) of the isolates. The remaining isolates were identified as species from other closely related genus, *Leptonema illini* in 18.4% (n=7/38) of the isolates.

In this study, according to the phylogenetic tree generated by Neighbour-Joining method based on 16S rRNA gene sequences (figure 2), *Leptospira* spp was clearly segregated into three clades, namely pathogenic, intermediate and nonpathogenic groups. Intermediate groups were closely related to the pathogenic rather than nonpathogenic group. Isolates in the non-pathogenic group were closely related to *L. meyeri* and *L. yanagawae*. *Leptonema illini,* other closely related genus formed another clade that clearly separated the species. Comparing with the pre flood *Leptospira* spp isolated by Muhammad *et al*., 2016, the current study showed the predominance of pathogenic strain. All species were not able to be genetically differentiated because single locus 16S rRNA gene sequences has not allowed for intra species differentiation (Morey *et. al*, 2006). In order to demonstrate intra-species genetic variations, the use of other gene loci is necessary, either singly or in combination.

4.0 Conclusion

Important findings of the study are summarized as follows:

4.1 This study demonstrates the predominance of clinically significant pathogenic *Leptospira* in the environments which could pose health risks to the community.

4.2 Necessary precautions for early prevention of the diseases and outbreak should be taken to reduce the risks of infection amongst the population.

4.3 Manik Urai market, as one of area severely affected by flood has lower isolation rate for *Leptospira* spp.

4.4 *Leptospira* species were not able to be genetically differentiated between pre- and post-flood because single locus 16S rRNA gene sequences has not allowed for intra species differentiation.

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A GIS-BASED APPROACH ON FACTORS ASSOCIATED WITH LEPTOSPIROSIS INFECTION AMONG RESIDENTS IN FLOOD-PRONE AREA, PAHANG

Project Information

Project Leader	: Dr Hayati Bte Kadir @ Shahar
University	: Universiti Putra Malaysia
Address	: Department of Community Health, Faculty of Medicine and Health Sciences, UPM Serdang, 43400 Serdang, Selangor
Contact number	: +60129533071
Email	: hayatik@upm.edu.my
Project Members	: Dr Salmiah Bte Md Said, Dr Sharifah Norkhadijah Bte Syed Ismail Dr Edre Mohd Aidid

1.0 Introduction

Leptospirosis infection is common in rainfall during the Southwest Monsoon and Northeast Monsoon in Malaysia. When the disaster like flooding comes in, the number of leptospiroses can be increased to the epidemic level because rats have been known to swim great distances when dislocated by storms or flooding. Rats will also go to great lengths to survive, including making their way through drains and other plumbing apertures, thus increases the close contact between bacteria and animal hosts (Lau, 2010). Additionally, climate conditions, land elevation, waste disposal management, and other environment conditions also play a big role in the transmission of leptospirosis infection (Chan, 1997;Ikawati & Widiastuti, 2012).

There is a large volume of published studies describing that the study on knowledge, attitudes, and practices related to leptospirosis was limited in Malaysia. Previous studies had only focused on leptospirosis infection among the certain high-risk population (Sakinah SN, 2015; Mohd Rahim, 2012). Whereas, to date, there has been no study to assess the level of knowledge, attitude and practice (KAP) among the general population in Malaysia. Therefore, this study aims to determine the risk factors associated with leptospirosis status and spatial mapping of the environmental risk factors among the residents in Pahang.

2.0 Methodology

The study was conducted in Pahang. In 2014/2015, flooding in Malaysia hit the Pahang state involving 200,000 people while 21 were killed in the floods. The worst areas were Kuantan, Maran, Jerantut, Lipis, and Pekan. A population-based matched case-control study involving residents in Pahang was conducted from April 2015 to December 2015. The confirmed and probable cases of leptospirosis were defined according to the standard case definition in Malaysia and notification lists from Pahang State Health Office and government and private hospitals. The control group was selected from residents who resided within 500 meters and to the right of the cases' houses. The cases and controls were Malaysians, aged 18 and above. 1 case to 2 controls was matched by gender.

A pre-tested questionnaire (Cronbach's alpha of 0.7) was adapted from previous studies Mohd Rahim et al. (2012) and Araújo et al. (2013) and reconstructed based on standard guideline (MOH, 2011; WHO, 2003). It consists of 4 parts: Part I on sociodemographic factors, Part II on knowledge on leptospirosis, Part III on attitude towards leptospirosis infection and Part IV on practice towards leptospiral infection. The data were analyzed using IBM SPSS version 22. Chi-square analysis was used to determine the frequency of the cases and controls. Simple conditional logistic regression using Cox Reg was used to determine the association between the variables while Multiple Conditional Logistic Regression was used to determine the risk factors. Spatial mapping was used using ArcGIs version 9.3 (Environmental Systems Research Institute, USA).

3.0 Results and Discussion

There were five variables such as age, ethnicity, education, income and occupation in sociodemographic factors. The majority of the cases were 40 years and above followed by age between 18 years and 39 years. Most of them were of Malay ethnicity and involved in the low-risk level of occupations (unemployed, non-agricultural based, students and self-employed). Most of the cases attained no formal education or primary level of education. The majority of respondents earned RM1000 and above. Amongst these factors, only ethnicity and education were significantly associated with leptospirosis infection. Regarding the knowledge of leptospirosis infection, only one variable "knowledge of rat urine diseases which can be transmitted by germs" was found to have significantly associated with leptospirosis infection. At the same time, it was also reported that the respondents who believed that flooding is not the risk factor for leptospirosis were significantly associated with leptospirosis infection. However, five variables were found to have significantly associated with leptospirosis infection. They were "poor practice on cover minor wounds with plaster", 'poor practice on leave the food open on the table for a long time', 'poor practice on leave the garbage inside the house for a long time', 'poor practice on washing hands thoroughly with soap', 'poor practice on health seeking behaviour'.

The conditional logistic regression analysis was computed to identify the predictors of leptospirosis infection. From simple logistic regression, several variables that were less than 0.25 were included and analyzed using Forward LR method. Eight factors were determined to be the risk factors for leptospirosis infection (Table 1.). It was noted that Malay ethnicity had twice more likely to have leptospirosis infection than another ethnicity (OR= 2.008, 95%CI: 1.081-3.729) and respondents who were working in high-risk occupation such as army, agricultural based workers, waste collectors, health-care workers had 1.6 times (OR=1.62, 95% CI: 1.038-2.532) more likely to have leptospirosis infection than those with low risk occupation. Respondents who had poor practice on PPE and hygiene had 2.5 times (OR=2.50, 95% CI: 1.50-4.1) more likely to have leptospirosis infection while respondents who could not give importance to flu-like symptoms were 1.7 times (OR=1.66, 95% CI:1.10-2.51) more likely to have leptospirosis infection. It was also found that respondents who did not have knowledge about rat urine disease can be caused by germs were 1.8 times (OR=1.83, 95% CI:1.09-3.08) more likely to have leptospirosis infection. Surprisingly, food exposed on the table for a long time and did not wash hands thoroughly with soap were found to be the protective factors of leptospirosis infection (AOR= 0.27 versus AOR= 0.34).

Table 1: Adjusted odds ratio and 95%CI of determinants of leptospirosis: using conditional logistic regression

Risk Factors	**Cases n (%)**	**Control n (%)**	**β**	**Adjusted OR (95%CI)**
Malay ethnicity	96 (80.7)	207 (88.1)	0.69	2.01 (1.08 – 3.73)*
High risk occupation	30 (25.2)	57 (24.3)	0.48	1.62 (1.04 – 2.53)*
No formal education & Primary education	55 (46.2)	72 (30.6)	0.71	2.04 (1.06 – 3.91)*
Poor practice on PPE & Hygiene	54 (45.8)	49 (20.8)	0.92	2.50 (1.50 – 4.18)*
Poor practice on rush to the hospital when I have flu-like symptoms	59 (50.0)	63 (26.7)	0.51	1.66 (1.09 – 2.51)*
Poor practice on leave my food open on the table for a long time	12 (10.2)	20 (8.5)	-1.31	0.27 (0.12 – 0.64)*
Poor practice on wash my hands thoroughly with soap	16 (13.6)	23 (9.7)	-1.08	0.34 (0.17 – 0.67)*
Poor knowledge regarding rat urine disease is a disease caused by germs	21 (17.6)	37 (13.2)	0.60	1.83 (1.09 – 3.08)*

P < 0.05 – significant *

Figure 1 to 8 depicted the cluster analysis of cases according to their spatial environmental distribution. It was noted that the majority of cases were more prominent in the areas of flood hazard areas and river sites, high temperature, heavy rainfall, high humidity, low elevation, surrounding the legal dumping sites and located in areas with poor soil drainage.

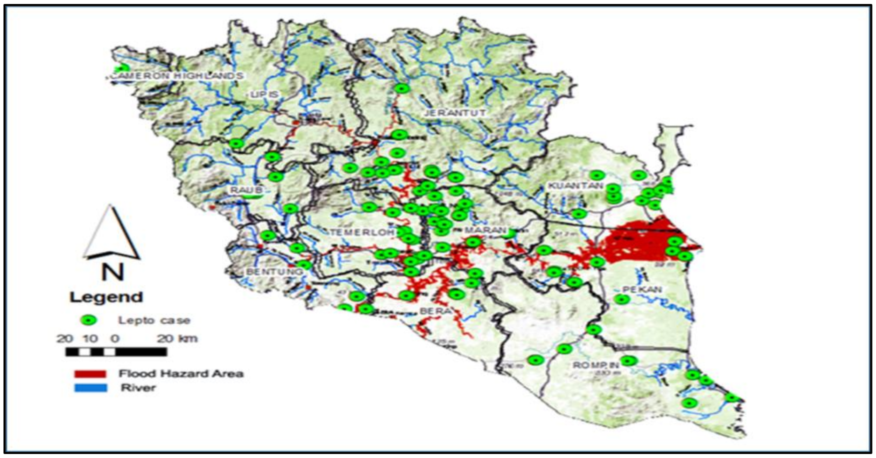


Figure 1: Distribution of cases by flood hazard area

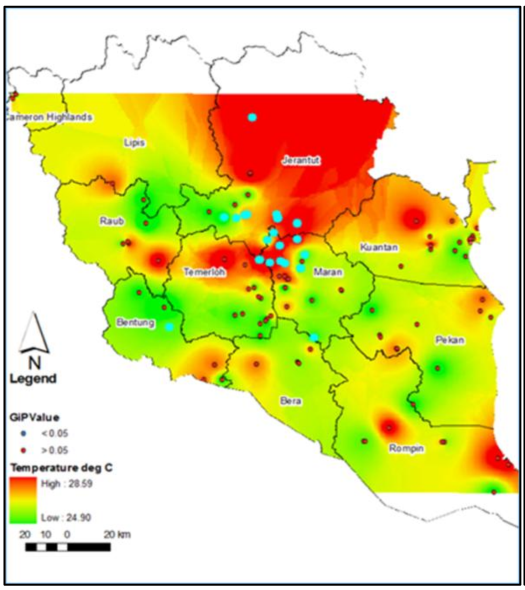


Figure 2: Distribution of cases by temperature

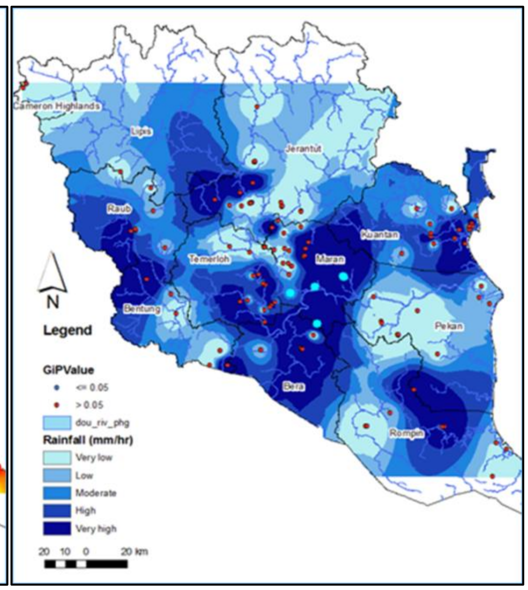
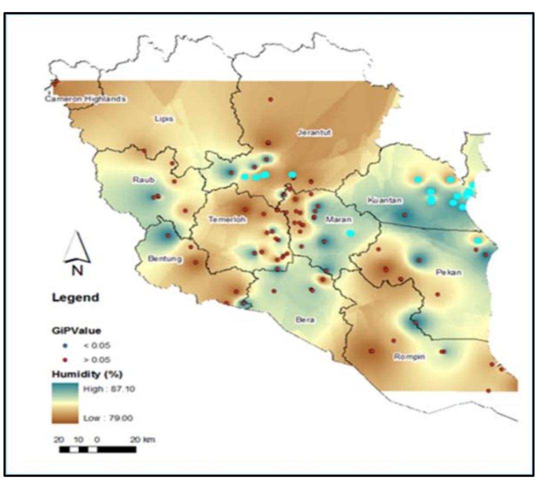


Figure 3: Distribution of cases by rainfall



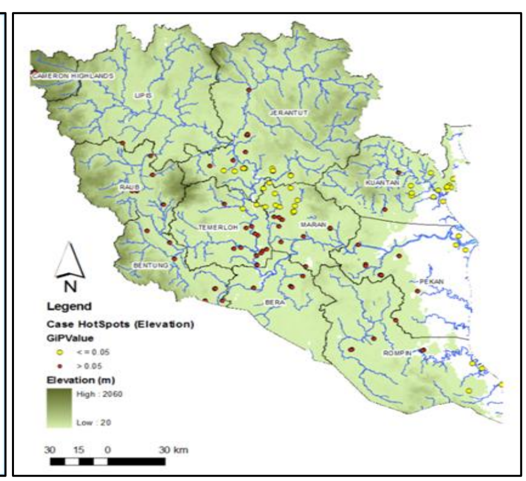


Figure 4: Distribution of cases by humidity
Figure 5: Distribution of cases by land elevation

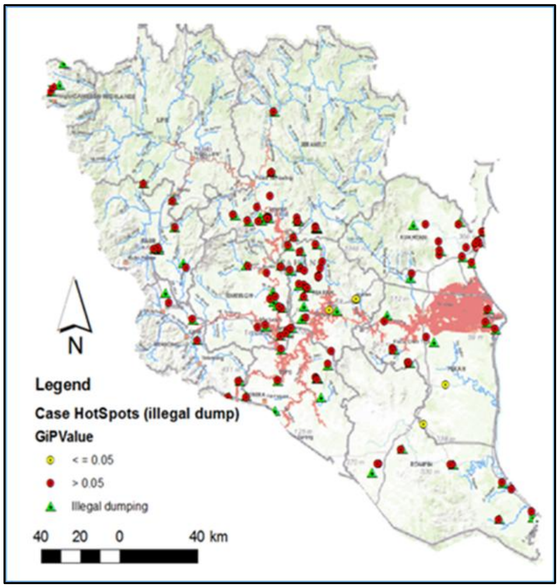


Figure 6: Distribution of cases by illegal dumping sites

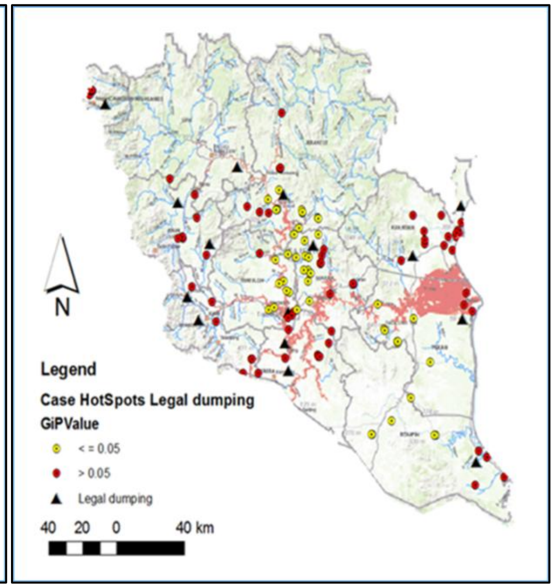


Figure 7: Distribution of cases by legal dumping sites

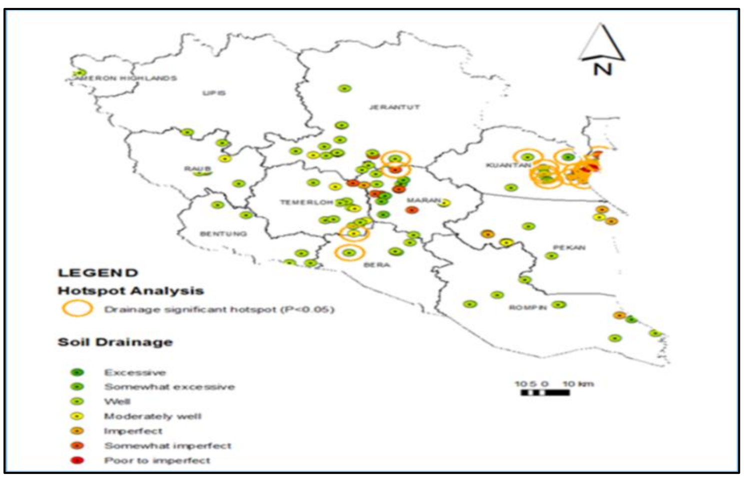


Figure 8: Distribution of cases by soil drainage

4.0 Conclusion

4.1 It can be concluded that more than half of the respondents still have a lack of awareness of leptospirosis infection (poor knowledge and poor practice)

4.2 Maran is the most likely area to be infected with leptospirosis if flooding occurs because of its environment suitability.

4.3 It is recommended that health education program and intervention programs towards zoonotic infection should be carried out in order to increase the awareness as well as providing prompt treatment for those with flu-like symptoms during flooding It is also suggested to train the public regarding how personal hygiene and the importance of using personal protective equipment.

4.4 Disaster preparedness training should be offered to the residents living in flooding prone areas

4.5 During a disaster such as flooding, GIS maps would help to identify the locations where the infection affected or infected by finding the association with other factors such as temperature, rainfall, humidity, land elevation and waste disposals. It also helps in finding the better routes to shelters and important locations while flooding

4.6 It is also suggested to coordinate multi-agency collaboration which includes health professionals, municipal authorities, and other global agencies.

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END OF REPORT

(**Maximum 5** Pages Of End Report)

Porject Title : The adaptation of Australian Community Disaster Resilience scorecard & self-assessment of community disaster resilience (CDR): Kelantan's flood affected communities **(FRGS15-170-0411)**

A. Project Information

Start Date : 1st April 2015

End Date : 30/3/2016

Extension Date : 31/03/2016

Project Status : Completed

Project Leader : Assistant Prof. Dr. Salizar Mohamed Ludin.

I/C Number : 710302-08-5078

Univ ersity : International Islamic University Malaysia

Address : Kulliyyah Of Nursing, Critical Care Department,
International Islamic University Malaysia, Kuantan
Campus, 25710, Kuantan, Pahang.

Contact number : 019-2229942

Project Members : Mohd Khairul Hasyimi Firdaus (iium), Dr. Dariah Mohd Yusoff (USM)
Prof. Paul Arbon (Flinders Uni, Aust)

B. Project Achievement

Project Progress : 100% COMPLETED

Research Output : Indexed Journal (2 - Revising For Resubmission For Publication), Non-indexed Journal (__), Conference Proceedings (1), Book Chapter (__),….

Talent : RA (_1_), PhD student (_-_), Master student (_-_)

C. Expenditure

Budget Approved	: RM 89,000
Amount Spent	: RM 89,000
Balance	: RM 0.00
% of Amount Spent	: 100%

Summary of Research Findings

1.0 Introduction

Community disaster resilience is the community abilities to adapt to the changes at their living place caused by any hazards exposure using its own personal and environmental resources. In the face of the need for Malaysia to re-look and develop the country's sustainable disaster recovery policies and rebuilding post-disaster, the level and how to measure our community disaster resilience and the impact of social cohesiveness is unknown

2.0 Methodology

This study aims to evaluate and adapt the use of Australian community disaster resilience balanced scorecard, assess community resilience factors and it association with social cohesion.

This mixed method design study through participatory discussion; the key persons from the six (6) Kelantan communities 2014 flood affected area. Following that communities were surveyed on their disaster resilience status within 6 month period in 2015. Australian Community Disaster balance scorecard, CCRAM28, Buckner's Index of Cohesion and Index of Perceived Community Resilience were use. Data were subject to thematic and SPSS analyses.

3.0 Results and Discussion

In total, 32 key people involve in adaptation and self-ass TRI scorecard and 386 communities involved in survey (100% returns rate, CI 95%). Positive resilience scorecard adaptation was seen by the key persons. The self-assess however shows that their communities' resilience was at "caution zone" (require improvement). The community demographic characteristics were significantly related to their disaster resilience ($p = 0.001$), except for educational level. Five resilient factors identified shows positive and strong correlation to the communities to leadership ($r (95) = 0.690$, $p = 0.000$), collective efficacy ($r (95) = 0.740$, $p = 0.000$); preparedness ($r (95) = 0.669$, $p = 0.000$); place attachment and social trust also has a strong relationship with community disaster resilience at $r (95) = 0.619$, $p = 0.0001$ and $r (95) = 0.534$, $p = 0.000$ consecutively. Social cohesion shows significant correlation with community resilience despite the strength of the relationship varies. Findings also shows that place-specific differentiation in the mean intensity of both cohesion and resilience scores; temporal phases of disaster recovery for each community are also noted.

4.0 Conclusion

4.1 Adaptation of resilience balance scorecard is a bottom up initiative for the key people involves disaster management to evaluate the community resilient status before the disaster event occurs. It can be used to inform the government of the communities' readiness or preparedness.

4.2 This study shows discrepancies between the key people involves in flood disaster management and communities perceived disaster resilience status. Despite the scorecard confirmed the 'caution zone' of community disaster resilience, the survey finding shows otherwise- The communities may not be aware of their resilience or they only accept the disaster as 'the challenge from Allah'.

4.3 From the response, there were so many aspect of disaster management that we incomplete or requires improvement.

4.4 A consistent evaluation of resilience and social cohesion status and resilience awareness programs or activities to build resilience should be organized in regular and structured manner by the government (responsible agencies) throughout the country to ensure the communities are prepared and able to cope with any disasters that may occur.

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Lampiran 2

END OF REPORT

Project Title : Development of a Collaborative Decision Making Model for Flood Disaster Management using Structural Equation Modeling

A. Project Information

Start Date : 01/04/2015

End Date : 31/12/2015

Extension Date : 31/03/2016

Project Status : Completed

Project Leader : Sivadass Thiruchelvam

I/C Number : 770925075989

University : Universiti Tenaga Nasional (UNITEN)

Address : Universiti Tenaga Nasional (UNITEN)
College of Engineering
Civil Engineering Department
Jalan IKRAM-UNITEN,
43000 Kajang, Selangor.

Contact number : 0193367990

Project Members :
1. Zakaria Che Muda
2. Normy Norfiza Abdul Razak
3. Izawati Tukiman
4. Hasril Hasini
5. Norhayati Mat Husin
6. Azrul Ghazali
7. Mohd Ezanee Rusli
8. Khairul Salleh Mohamed Sahari
9. Rahsidi Sabri Muda
10. Lariyah Mohd Sidek
11. Hidayah Basri
12. Siti Nur Aishah Zubir

B. Project Achievement

Project Progress : 100%

Research Output : Indexed Journal (1), Non-indexed Journal (0), Conference Proceedings (2), Book Chapter (0), Poster (2)

Talent : RA (1), PhD student (0), Master student (1)

C. Expenditure

Budget Approved	: RM 57,300.00
Amount Spent	: RM 57,300.09
Balance	: RM 0.00
% of Amount Spent	: 100%

Summary of Research Findings

1.0 Introduction

Flooding is a common natural hazard in Malaysia in terms of populations affected, frequency, area extent, flood duration and social economic damage. The recent flood devastation in Peninsular Malaysia towards the end of 2014 witnessed a displacement of 250,000 people. Evacuation of victim to evacuation centers has to be quick with effective and efficient flood disaster management to assure non-futile efforts for life-saving. Effective flood disaster management requires collective and cooperative emergency teamwork from various government agencies. Collaboration between government agencies at different levels have become part of flood disaster management with the need for coordinating efforts and sharing resources. Hence, collaborative decision making during disaster is an integral element in providing prompt and effective response for evacuating the victims. Collaborative decision making process could be jeopardized due to the absence of an adequate shared mental model between the players in the domain of disaster management. This study aims to examine the factors affecting decision makers in the lead agencies during the recent flood events as they are characterized by high uncertainty, time pressure and high stakes. The study also intended to capture the drivers of successful collaborative decision making for evacuation of victims during disaster using Structural Equation Modelling (SEM). This research contributes in the development of an intergovernmental collaborative decision making model

2.0 Methodology

2.1 Data Collection

A mixed methods approach comprising qualitative interview and quantitative survey will be utilized to achieve the project objective. Operations of lead agencies such as National Security Council, Fire and Rescue Department, Royal Malaysian Polices, Department of Irrigation or Drainage, Health Department, Social Welfare Department, Public Works Department, Malaysian Armed Forces and Civil Defence Department during the recent flood disaster from Kelantan State and Pahang State formed the basis of the study. The targeted participants were among key decision-makers. The sampling strategy adopted in this study is simple random sampling. The targeted respondent for this study amounted to 273 respondents with 22 participants selected for semi-structured interview.

2.2 Data Analysis

The survey data was examined using Statistical Package for the Social Sciences (SPSS). Data from the conducted interviews were analyzed using NVivo. Both findings was then triangulated to provide a deeper understanding of both the quantifiable and qualitative drivers of evacuation decision making with regards to the Malaysian disaster management context. Lastly, Analysis of Moment Structure (AMOS) was used to establish confidence in the measurement model which states the hypothesized relationships of the observed variables to the underlying constructs.

3.0 Results and Discussion

3.1 Response Rate

A total of 391 questionnaires was distribute with 186 questionnaires from Negeri Kelantan, 153 questionnaires from Negeri Pahang and the other 52 questionnaires carried over from previous study. In the end, only 273 questionnaire were useful for analysis. 23 questionnaires were discarded because participants did not answer at least a minimum of 15% of the questions.

3.2 Demographic

3.2.1 Age

Of the 273 participants, 18.7% from them are less than 30 years old. 39.2% are at the age of 31-40, 23.4% are 41-50 years old and 18.7% are more than 50 years old.

3.2.2 Authorities

From the nine authorities, 3.3% from them are National Security Council, 21.6% from Fire and Rescue Department, 30.8% from Royal Malaysian Police, 4.0% from Department of Irrigation and Drainage, 11.4% from Department of Health, 1.1% from Department of Welfare, 8.4% from Public Works Department, 8.8% from Malaysian Armed Forces and 10.6% from Malaysia Civil Defence Department.

3.2.3 Working experience

From 273 participants, 17.2% has experience less than 5 years, 30.8% has experience of 6-10 years, 23.1% has experience of 11-20 year and the other 28.9% has more than 20 years working experience.

3.2.4 Past involvement

The percentage of no past involvements is 15.4% which falls on second highest percentage. However, more than 50% participants have 1-10 times involvement in disaster which is 65.2%. Of 273 participants, 11.7% from 11-20 times past involvement and another 7.7% from more than 20 times past involvement.

3.3 One sample t-test for dependent variable

Table 1 shows the summary ranking of important decision making factors during disaster events with approach being the most important among other metrics. Additionally, results shows that all metrics are in acceptable mean and are said to be important in decision making during disaster.

Table 1 Summary of T-test showing rankings

	M	SD	Ranking
Approach	4.26	.645	1
Result	4.19	.693	2
Quality	4.21	.715	3
Ethic	4.19	.719	4
Characteristic	4.05	.671	5
Human factor	4.12	.788	6
Impediment	4.00	.791	7
External factor	3.94	.811	8
Limitation	3.92	.774	9
Stress	3.80	.840	10

3.4 Initial Construct for Decision Making for Disaster Management

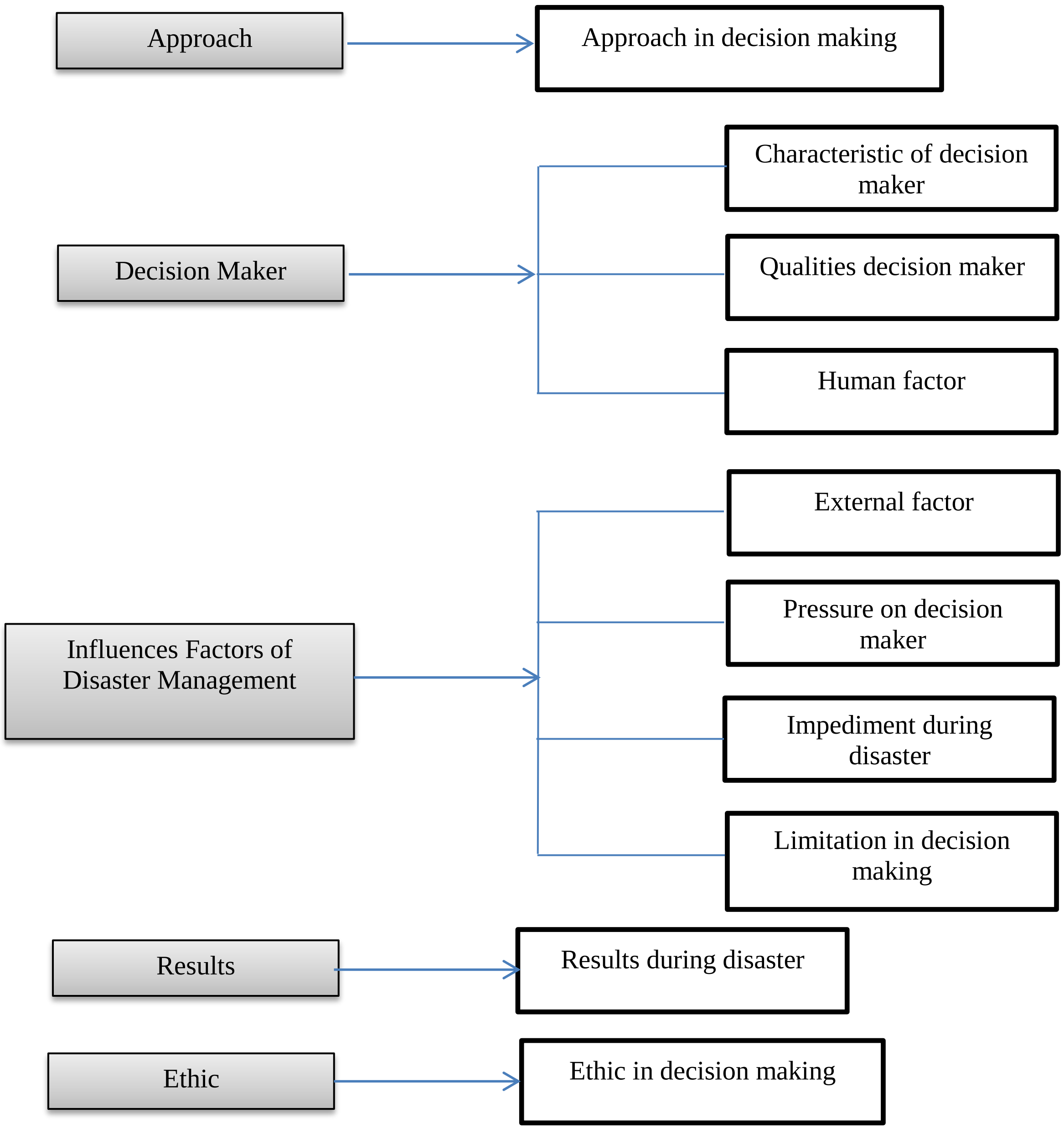

Figure 3.1 Initial Construct

3.5 Structural Equation Modeling

Table 3.1 shows the results of fitness indexes for Structural Equation Modeling do not achieve the required level. Some of items have low factor loading (< 0.6) (Awang, 2015) which are Q3, Q4, Q5, Q8, HF4, HF9, ad HF10. These seven "useless items" have caused the measurement of model for the construct to end up with a poor fit. Therefore, these items should be dropped and new measurement model should be re-run. The new measurement model was run and the results are shown in Table 3.2.

The fitness index in Table 3.2 is still below the required level even though the factor loading for all item are above 0.6. Thus, one might suspect that certain items are redundant of each other in the measurement model. The items redundancy can be examined through inspecting the Modification Indexes (MI).

Table 3.1 Goodness-of-Fit Indexes

Fit Index	Result	Evaluation
P-value	0.000	Good
RMSEA	0.081	Reluctant
GFI	0.444	Reluctant
CFI	0.558	Reluctant
TLI	0.545	Reluctant
NFI	0.450	Reluctant
ChiSq/df	2.775	Good

Table 3.2 Goodness-of-Fit Indexes

Fit Index	Result	Evaluation
P-value	0.000	Good
RMSEA	0.080	Good
GFI	0.487	Reluctant
CFI	0.597	Reluctant
TLI	0.583	Reluctant
NFI	0.487	Reluctant
ChiSq/df	2.723	Good

4.0 Conclusion

4.1 Research Objective 1

To understand the evacuation decision making process at intergovernmental level for flood disaster in Malaysia. This objective involved an in-depth analysis on the current practices of decision making processing.

Key finding included:

i. There is no fixed guideline in decision making process;
ii. The proposed metric is subject to individual perception;
iii. There is no consistency in applying standard metric between each agency
iv. Lacking of current policy to promote the agencies which has to be bounded by rational and unbiased decision making during flood disaster.

4.2 Research Objective 2

To establish that the five proposed construct (Approach, Decision Maker Influence Factors, Results, and Ethics) statistically distinct from one another as determined by factor analysis.

The second research objective addresses the way in which the five theorized constructs (Approach, Decision Maker, Influence Factors, Results, and Ethics) were statistically distinct from one another and investigate the relationship among them. An unconstrained factor analysis was conducted on the ten dependents variable.

Key finding included:

i. Five different construct were created with their sub-construct identified.

4.3 Research Objective 3

To measure the degree of importance the key stakeholders' (lead agencies) place on each criteria for decision support in evacuation decision making for flood disaster. This purpose is to explore metrics that influence decision makers in decision making during disaster.

Key finding included:

i. The decision making during disaster particularly in flood disaster was found to be highly influenced by five top factors: decision making approach, decision making results, quality of decision makers ethical in decision making and characteristic of decision maker (ranked in descending order).

ii. Other factors taken into consideration when assessing the decision making in flood disaster: human factors, impediment, external factors, limitation and stress listed in order of importance.

4.4 Research Objective 4

To provide the key stakeholders' perception on definitional dimensions of each criteria for evacuation decision making for flood disaster. In this exploratory study, the researcher gathered the information on the subject area before deciding which definitional dimension is important and which definitional dimension can be discarded concerning each of the top metric.

The key finding can be stated as follows:

i. Decision making approach, decision making results and the quality of decision makers are the dominant factors in disaster management.

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