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Engagement of Local Heroes in Managing Flood Disaster: Lessons Learnt from the 2014 Flood of Kemaman, Terengganu, Malaysia

Marini Othman, Aliza Abdul Latif, Siti Sarah Maidin,
Mohamad Firdaus Mat Saad and
Mohammad Nazir Ahmad

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Abstract

There were many lessons learned by the flood disaster that hit the peninsular of Malaysia at the end of 2014. Of particular interest was the success story of good flood management that emerged in Kemaman, Terengganu. This chapter sheds some light on the characteristics that contributed to this success. To enable appreciation of this achievement, a comparison between selected flood-inflicted areas is presented, pointing out the similarity between flood factors that, however, produced differences in flood impact. A post-disaster study, which included analysis of flood reports, site visits (which included the disaster site, flood command centre and relief centres) and interviews with those involved in the flood incident, was conducted. The findings revealed the use of technology, a good standard operating procedure and engagement of the local community to be key ingredients of its successful outcome. The study recommends the success of Kemaman to inspire flood management practice for other non-urban flood districts in Malaysia.

Keywords: flood, community engagement, standard operating procedure, district disaster management

1. Introduction

Climate change has brought extreme and uncertain global weather conditions. For Malaysia, this means worsening and hard-to-predict flood disasters. When flood disaster strikes, one

can only hope that rescue and relief aid arrive quickly, therefore reducing the impact of the situation. In the 2014 flood incident, impacts were seen to be comparatively less serious for areas where preparation was heightened before, during and after the flood event.

This chapter investigates flood preparation and management of the major flood event that struck the country in December 2014. Interest lies in gaining an understanding of why and how the district of Kemaman was able to report a less serious impact despite undergoing weather conditions similar to other flood-plagued districts. Findings point to the use of technology, procedures and processes, and the engagement of locals during the response and relief phases. The management of flooding in Malaysia typically goes through the following phases: prediction – warning – emergency relief – rehabilitation – reconstruction. The study shows how the local community was involved in making significant contributions in providing prompt responses during a flood, which in this study is based on the case of Kemaman, Malaysia.

Section 2 of the chapter explains the formulation that led to the “worst” flood – the super-moon, monsoon, shoreline and rivers. This is important to establish that the flood districts within the states of Kelantan, Terengganu and Pahang have indeed shared similar flood factors. Then, comparisons of impacts experienced by selected districts are highlighted. Recounts of the events are collected from site visits, reports by the Malaysian National Security Council, news media and social media.

In Section 3, the success story emerging from the flood management (FM) practice in Kemaman is presented. Central to the story is the active and positive roles of local leaders and people from the district. A post-disaster investigation to probe into the engagement of the local community found that early engagement, which started with FM awareness and training, helped empower the locals, who have the advantage of speaking the dialect and understanding the topographies, making them ideal flood emergency responders and volunteers.

2. The 2014 flood

The Peninsular of Malaysia has a long shoreline with its east coast facing the South China Sea, and most of its major cities located near the coast. In addition, there are at least 26 major rivers from 3 states in Malaysia, namely Kelantan, Terengganu and Pahang, flowing from the east coast into the South China Sea, as seen in **Figure 1**.

Frequent flooding over extended periods is considered to be the most natural hazard in Malaysia and affects a large number of the population over a wide area, causing socio-economic damage. Based on the information published by the Ministry of Natural Resources and Environment, Malaysia, in June 2007, Malaysia has experienced major floods since 1920, especially in the years 1926, 1963, 1965, 1967, 1969, 1971, 1973, 1979, 1983, 1988, 1993, 1998, 2005, December 2006 and January 2007, 2010 and the most recent one in 2014 [1]. These flood events occurred in various states, including Terengganu and the capital city of Malaysia, Kuala Lumpur. This can be seen in **Table 1**, which lists the date of the major floods and the losses incurred by them.



Figure 1. The three states affected by the 2014 flood.

Date/year	Incident	Property, materials, crops or other losses (MYR)	Number of deaths	Source
1926	Flood known as “The Storm Forest Flood”	Thousands of hectares of forests destroyed	N/A	Chan [2]
December 1996	Floods caused by Tropical Storm Greg in Keningau (Sabah)	300 million	241	
2000	Floods caused by heavy rains in Kelantan and Terengganu	Millions	15	
December 2004	Asian tsunami	Millions	68	
December 2006 and January 2007	Floods in Johor	489 million	18	
2008	Floods in Johor	21.19 million	28	
2010	Floods in Kedah and Perlis	8.48 million	4	
2014	Floods in Kelantan, Terengganu and Pahang	2.9 billion	21	The Star [3]

Table 1. Flood history in Malaysia.

The 2014 flood affected most of the states on the east coast of Peninsular Malaysia due to the northeast monsoon that occurs between October and March every year. These states receive heavy rainfall, which leads to severe flooding almost every year, including the months of November and December 2014. The flood that occurred at the Kemaman area of Terengganu was due to a combination of physical factors, including high tides and elevation. The flood factor of high tides in 2014 was also made worse by the supermoon phenomenon, which is known to change the level of sea tides. When the supermoon is combined with the topographic conditions of the east coast in Malaysia, which has several rivers along the shoreline of these states, it has the potential to aggravate the monsoon flood that occurs annually during the monsoon season. The supermoon effect that was compounded by the northeast monsoon impact in that year brought about a notably higher and prolonged tidal level. These three factors – (1) the supermoon phenomenon, (2) the topographic conditions of Malaysia and (3) the monsoon season – have formulated the worst flood Malaysia has seen in almost 100 years, which is referred to **Table 1**. The first flood was recorded in 1926, and the magnitude of losses can be seen to increase every year, especially the flood of 2014.

The basic cause of river flooding is the incidence of heavy rainfall (monsoon or convective) and the resultant large concentration of runoff, which exceeds river channel capacity [1]. Floods have resulted in huge losses of millions of dollars in Malaysia. For example, the 2014 flood that hit Terengganu and many other states caused more than MYR 2.9 billion (about USD 0.74 billion) worth of damage and hence was deemed the most expensive flood event ever to occur in Malaysian history. This included the cost of damage to infrastructures, property damage, crop loss, disruption to day-to-day services and healthcare expenses. During this flood event, 21 deaths were reported and around 200,000 people were evacuated from their homes and sheltered in relief centres.

The monsoon season of 2014 was marked by torrential rains that began on 17 December. It was followed by non-stop, heavy rain that lasted for three days, 21–23 December 2014, which charted a record-setting rainfall of 1295 mm, equivalent to the amount of rain usually collected in a span of 64 days. The three main rivers of Kelantan – Galas, Lebir and Kelantan – rose drastically above dangerous water levels, which can be seen in **Table 2**.

State	Victims	Area/location	Level during flood	Safe level
Kelantan	31,441	Tangga Krai, Sungai Kelantan	34.11 m	25 m
		Tambatan Diraja	6.88 m	5 m
		Sungai Golok, Rantau Panjang	10.41 m	9 m
Terengganu	32,736	Sungai Kemaman	37.6 m	36 m
Perak	7774	Tasik Temengor, Hulu Perak	247.69 m	Alert level
		Sungai Selama, Selama	14.86 m	Alert level
Johor	328		N/A	
Pahang	29,423		N/A	

Table 2. Report for December 29, 2014.

The rising water levels from the 3 main rivers in Kelantan caused 16 roads in 6 districts to be closed. While in Terengganu, 15 roads in 5 districts were closed. The closing of major roads slowed down the rescue activities because rescue teams had difficulty in reaching the victims due to limited access and resources (boats and helicopters). The main utility provider of Malaysia, Tenaga Nasional Berhad, also suspended the electricity supply because the flood might cause damage to, and it was dangerous to operate, electricity substations in affected states. The majority of properties were submerged by the flood waters in the three states. The second option of transportation to deliver relief was also affected because several Keretapi Tanah Melayu (KTM) intercity train services along the east coast route were interrupted due to the rising water levels on the train tracks. Based on the report by the National Security Council, Terengganu had the most evacuees estimated at 32,736 people, followed by the other states in Malaysia as shown in **Table 2**.

Flooding was the imminent impact for all the states that were situated in the northeast of Malaysia, along the shoreline of the South China Sea. Terengganu, however, reported a less serious impact despite being one of the states situated next to the shoreline.

The impact of the flood in Terengganu was much less notable compared to Kelantan and Pahang. The success of the milder impact in Terengganu can be attributed to two factors: the unique FM system that was implemented specifically in Kemaman and the standard operating procedure (SOP) that was used throughout the disaster. Both of these factors are the main difference between how Kemaman and the other states managed the 2014 flood.

The unique FM system in Kemaman relied on both technology and process to ensure an effective and efficient FM system that could be used by all disaster agencies as well as the public directly impacted by the flood. Kemaman also critically depended on its own SOP, which is annually refined and improved after every flood.

Kemaman flood's workforce starts as early as the first quarter of each year, and includes the establishment of a flood management committee and evacuation centres. Both the committees and the evacuation centres are being championed and joined by local people. The participation of these committees involves the district officer, the local head of the village, and the evacuation centres' chairperson. The creation of the SOP pertaining specifically to the flood, which includes roles and responsibilities of the members of the committee, is the collaborative effort of the local government and local people.

The establishment of the FM system and SOP has helped Kemaman to successfully manage its flood effectively compared with the other states.

3. 2014 Kemaman flood management: a success story

Kemaman is successful in FM plan implementation as compared to Kelantan. This is due to the engagement of local leaders in FM plan implementation. The FM plan is one of the outcomes from the established FM system in Malaysia that outlines the participation of multiple agencies with shared objectives, while performing different activities in managing floods. The FM plan consists of tasks, roles and responsibilities of each agency as well as types of information that

should be shared across agencies. Local leaders are considered as one of the entities in the FM plan that has been given its own set of tasks, roles and responsibilities and information, which is sent to the agencies to reduce the effects of floods in their areas or villages.

Section 3.1 provides an overview of the implementation of the FM plan in the state of Kelantan and the district of Kemaman, Terengganu.

3.1. The state of Kelantan

The 2014 flood, which affected 70% of the villages or nearly half of the state population [4], was claimed to be the worst flood recorded in the history of Kelantan [5]. This flood was known as *bah kuning* (yellow flood) due its high mud content [6, 7]. As reported by [8], Kelantan was the worst affected state, which recorded 14 deaths and more than 158,000 victims displaced. Sixteen roads in six districts were closed due to the uncontrolled water flowing from the rivers: Sungai Lebir, Sungai Kelantan and Sungai Golok. The torrential rain, which started on 17 December 2014, caused flash floods and affected 3390 people in Kuala Krai [6]. The continuous rain from 21 December to 23 December in Gua Musang resulted in a rise of water in three major rivers in Kelantan, Sungai galas, Sungai Lebir and Sungai Kelantan, to dangerous levels [8]

The aggravated flood was attributed to the change in climate pattern, adverse weather effects, uncontrolled land management and deforestation and exploitation of land resources [4]. Additionally, a government minister added that unsuccessful implementation of the SOP was the major contributing factor to the crisis in Kelantan [4]. **Figure 2** Shows one of the views of the Kelantan flood in 2014

3.2. The case of Kemaman

Terengganu, a south neighbouring state of Kelantan, despite suffering the same elements of nature, experienced a milder impact. Kemaman, a district in the state of Terengganu, due to its geographical location and landscape, has considered flooding as a common phenomenon.



Figure 2. View of Kelantan flood in 2014.

More than 34,000 victims in the district were evacuated during the flood of 2014. The milder impacts were partly attributed to having a good operating procedure and the involvement of the local community. **Figure 3** shows one of the views of the Kemaman flood in 2014.

3.3. Operating procedure

The SOP in FM, which was implemented by the district, was awarded a gold standard for acknowledging its success in organising and implementing FM plans during the 2014 flood [9]. The objectives of the SOP are to act as a main reference for FM in Kemaman, as a basis to improve the FM-related process and to create a system involving the public (including students) to play a role in assisting the victims and to identify resources and risks in FM. The SOP has outlined the organisational structures (membership) in FM from district officer level to committee level, workflow for each of the FM phases (before flood, during flood, after flood), clear roles and responsibilities for each of the committees, cross-agency coordination through well-defined relationships with other responding agencies, information sharing processes, resource management and risk management. The SOP elaborates the mechanism to respond to flood, which includes:

- i. Identification of places for the stranded community such as mosques.
- ii. Information sharing with the affected community through pamphlets, announcement at the mosque before prayer and displaying information on the community hall notice board.
- iii. Sharing of resources across agencies such as telecommunication devices (Government Integrated Radio Network (GIRN) and walkie-talkies).
- iv. Partnership with private telecommunication companies to elevate the communication equipment cabinet at the communication signal transmitter site.
- v. Information sharing across agencies using applications such as WhatsApp and Telegram.



Figure 3. View of Kemaman flood in 2014 (source: Astro Awani, 2014).

- vi. Well-planned measures to minimise the identified FM risk, for example, walkie-talkies and GIRN are used in case of disruption to the telecommunication signal.
- vii. Emphasis of community involvement in the document. The flood simulation activity includes the roles and responsibilities of the village development and security committee in FM.

3.4. People

According to Dr. Sharifah Zarah Syed Ahmad [10], Secretary at the Ministry of Communications and Multimedia, there were several contributing factors for the successful implementation of the FM plan in Kemaman. The success story of Kemaman was due to collaboration with the public such as local leaders. During the preflood preparation phase, a flood central committee, which comprises representatives from each of the constituencies in Kemaman, was deployed. The constituencies decided on the location of the main relief centre and have involved the public in the flood awareness campaign.

The people of Kemaman are well equipped with knowledge of how to respond to disaster. Information pertaining to the relief centre location, flood kits and actions in responding to disaster (before, during and after) was imparted to the people either verbally or via pamphlets. The address of the GPS coordinate to assist helicopters to land was identified based on the advice from local leaders. The helipad location is crucial to ensure the army can send and pick up supplies for victims. The rapid dissemination of information was aided by the utilisation of information and communication technology. The people are aware of the flood early warning routine and react quickly according to the plan. Text messages were sent to the people estimating the time that the flood would arrive at the identified locations. As such, the local community could respond to the effects of flooding by saving important documents and evacuating to the identified relief centre.

From the case of Kelantan and Kemaman, it can be noted that local leaders' enrolment is crucial for the successful implementation of the FM plan. The local leaders help to inculcate awareness among their community for timely response during flooding. The dissemination of information between local leaders and the community is essential for speedy action in the event of a flood.

4. The "local heroes" elements

The 2014 flood event was an unpredicted disaster. The fast rising water level claimed many acres in a matter of minutes. Orders soon came from officials regarding the evacuation of thousands of residents and the opening and closing of shelters as flood water inundated and ravaged towns, roads, villages and homes. In issuing directions to the mainly local people (villagers), someone who understands the local language and area would be the ideal choice. Apparently, in the rescue and relief of people in Kemaman, a number of heroes emerged: the assemblyman, the district authorities, the headman and the village community committee were all identified as local heroes.

Local heroes in the context of Kemaman would be persons with knowledge of the local areas and those who clearly understood the disaster situation as well as directly responding to the unpredictable conditions based on their experience. In the opinion of others, local heroes possess special achievements, abilities or personal qualities and are regarded as role models or ideal leaders to take charge during a flood. The involvement of local people along with the local authorities has established the Kemaman SOP as an outstanding procedure to be followed compared with other districts. **Figure 4** illustrates the information exchange and collaboration

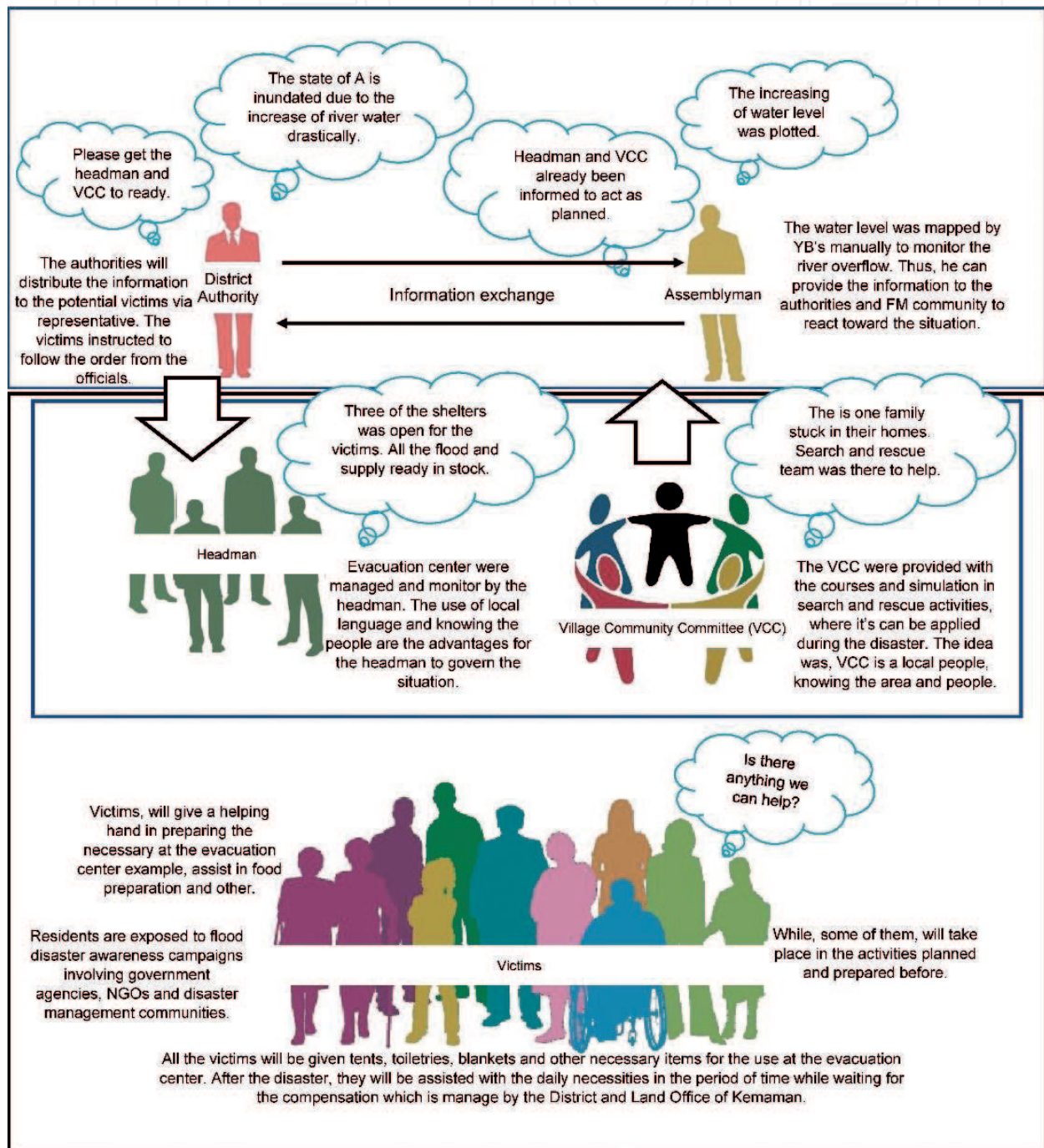


Figure 4. Information exchange and coordination between the local heroes in the case of the 2014 flood at Kemaman.

among local heroes, together with an explanation of the preparation and implementation of the flood event, that were championed by those at Kemaman, Terengganu, during the 2014 flood.

4.1. Local heroes

As mentioned earlier, a local hero is someone who has extensive local knowledge of the flood operating procedures. Evidence of this can be seen from the well-drawn map that was produced by the assemblyman, which was used to estimate the arrival of the flood. This map was produced based on his knowledge of and familiarity with the river basin, all of which has contributed to easier flood management in the Kemaman district. An assemblyman in Malaysia is an elected representative from single-member constituencies during state elections, voted by local people from their constituencies.

Figure 5 shows the assemblyman's personal sketch estimating the speed and arrival of the flood to the main road. The assemblyman drew the map as a guide in planning for the evacuation, rather than relying on technology because of inaccurate information provided by the system (inaccuracy may be caused by rapid changes in sedimentation or rate of rise of the flood water). The purpose of the sketch is to monitor the villages as well as the speed of the river water, which helps the FM agencies provide instructions to evacuate victims from flood areas.

FM also had problems in delivering food and supplies to the affected flood victims. The assemblyman believed that food and supplies should be ready in advance of the flood because it can be chaotic to deliver and distribute them during a flood. Thus, Kemaman District Office had reviewed the Kemaman District Disaster Management Committee by involving the headman in their process of managing the flood. In the engagement of local heroes during the flood in Kemaman, the headman of every village is considered to be the second most important leader after the assemblyman. The headman is responsible for monitoring the process in evacuation centres and food and supply depots.

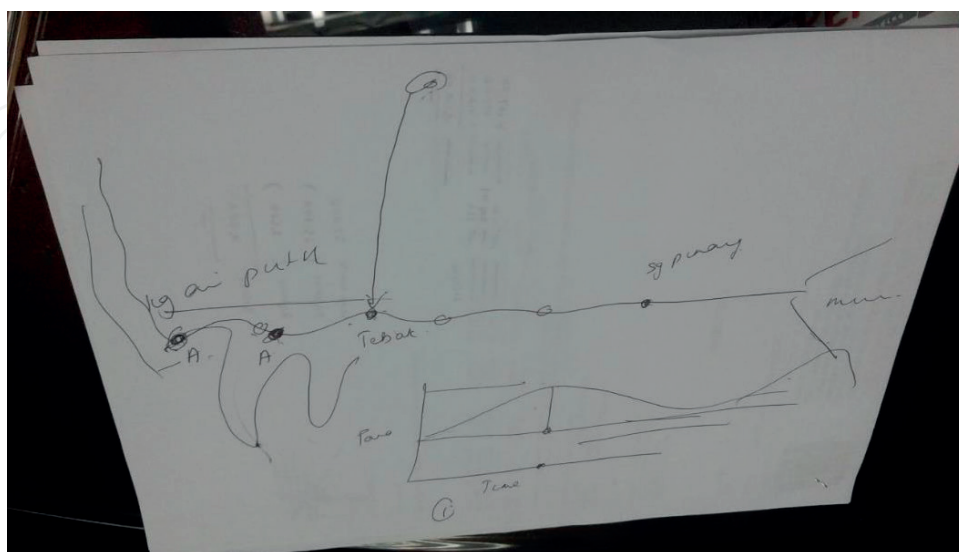


Figure 5. Assemblyman's personal sketch.

Figures 6 and 7 show the depot with the food and supplies prepared by the Kemaman District Office. The supplies collected were kept at the Air Putih depot and these must be ready before the flood so that the management can focus more on the search and rescue activities once the flood hits. The headman was considered as the leader in the evacuation centre since he understood and knew the residents, and this helped to ensure that the information was delivered faster and easier.

Figure 8 shows the involvement of headmen and the members from the village community committee in the Kemaman District Disaster Management Committee that was established by Kemaman District and Land Office in managing the 2014 flood. Disaster awareness and simulation programmes were provided to the headmen and members of the village community committee. The aim of this activity was to familiarise and prepare the headmen to manage the disaster and provide relief to the victims and others on how to respond to a disaster.

Involvement of headmen and members of the village community committee.



Figure 6. Air Putih food and supply depot.



Figure 7. Food and supplies were prepared at the Air Putih depot for seven days.

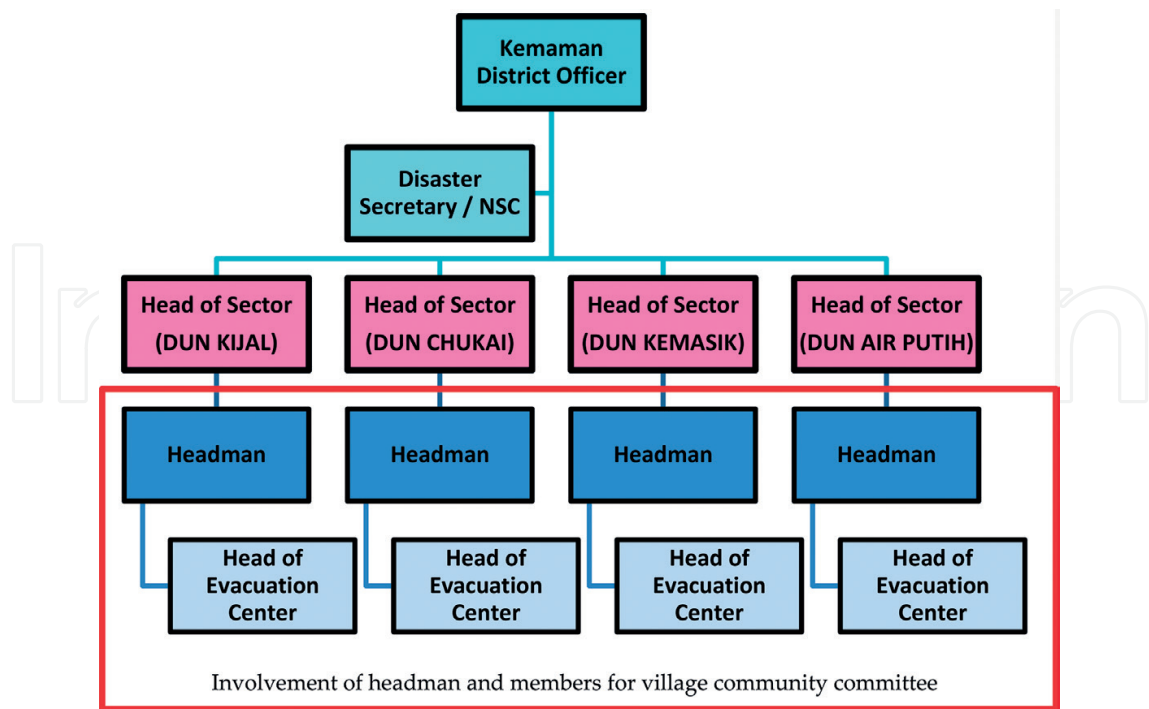


Figure 8. Kemaman District Disaster Management Committee. Note: National Security Council (NSC)

Figure 9 shows the boat operation course and water survival simulation conducted by Kemaman District and Land Office that involved the headmen, local people and government agencies. The simulation exercise aimed to provide exposure to the person responsible for the search and rescue of flood victims, which was the preliminary planning of the Kemaman authorities, in ensuring that pilot actions have been taken and prepared with any possible occurrence.

Kemaman also practises the concept of transformational leadership known as on-scene leadership, which allows the responsible person to spontaneously act as leader and give instructions



Figure 9. Boat operation course and water survival simulation.

regarding unexpected changes during the disaster due to rapid environmental changes. This strategy was aimed at reducing the impact of the flood, where any local leaders involved can become a leader for the district when the flood hits.

4.2. Benefits of having local heroes

By having local heroes to oversee the flood management activities, Kemaman SOP managed to obtain a “gold standard” as announced by the Malaysia Prime Minister and published in Bernama, December 31, 2014. Local heroes are at an advantage since they understand the problems of residents, know them personally and have great knowledge of the local area. Local heroes have better understanding and greater knowledge with a clear picture of problems that may occur due to heavy rains and flooding. Floods are sometimes accompanied by a number of problems that need to be solved by the leaders. Because a local hero is the most knowledgeable person to identify the problems that arise and the extent to which they can occur, they need to find solutions to all the problems and ensure that the flood can be managed efficiently.

Having knowledge of the culture of people and places was another advantage that Kemaman local heroes possessed in governing the 2014 flood. Kemaman District Disaster Management applied the concept of giving priorities to special people, which included any ailing person, disabled person orang kurang upaya (OKU), pregnant women and people living far away from the evacuation centre. These categories of people were prioritised during the evacuation process. Information regarding the victims that fit the categories to be prioritised was gathered from the information system used at the Kemaman District Office.

A high level of understanding of the dialects used by the locals was also an advantage in the management of the 2014 flood in Kemaman. The understanding of local dialects helps because information can be communicated easily, quickly and accurately to people who are exposed to floods. It also facilitates the population to act on the instructions issued by the authorities.

5. Conclusion

A warmer atmosphere brought by climate change will result in increased precipitation or water vapour. For Malaysia, which lies in a wet region, this means heavier rainfall rates. The growth in population (and development), which dictates changes in land use to support their needs, has also increased the severity of flood disaster. As such, improvement over methods for flood governance and management has become even more important. Lessons garnered from the big flood of 2014 must be quickly translated into actionable items for managing future floods, especially in the non-urban areas in Malaysia.

Use of information technology combined with mobile apps and social media for data collection and storage, information sharing and decision making by the Kemaman flood team have only become successful due to the commitment of everyone involved to diligently participate in the development, training and simulation of flood protection, and providing feedback for improvement. Likewise, in the development of the Kemaman SOP (dubbed the gold standard SOP), the SOP was successful partly due to the awareness programmes and training drills to ensure that it was understood and executable.

Last but not least, engagement of the local community was one of the key ingredients to success. Technological sophistication will not, at least in the near future, match the effectiveness of a familiar “local” hero – one who understands the local dialect, remembers the topography (landmarks and such) by heart when road signage becomes unreliable and knows the community members and neighbours.

Considering the above, it is suggested that the flood governance and management platform be developed to engage the local community.

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Author details

Marini Othman^{1*}, Aliza Abdul Latif², Siti Sarah Maidin³, Mohamad Firdaus Mat Saad² and Mohammad Nazir Ahmad⁴

*Address all correspondence to: marini@uniten.edu.my

1 Institute of Informatics and Computing in Energy, Universiti Tenaga Nasional, Kajang, Selangor, Malaysia

2 Department of Information Systems, Universiti Tenaga Nasional, Kajang, Selangor, Malaysia

3 ICT Department, International Islamic University, Malaysia

4 Institute of Visual Informatics, UKM, Bangi, Selangor, Malaysia

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