

Knowledge Integration Improves Flood Disaster Management: A Case Study of Kemaman

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ABSTRACT

This paper discusses the flood knowledge integration practices that have been applied in the flood management team of Kemaman District, Terengganu, Malaysia. The Kemaman District was announced to be the first district who had achieved a Gold Standard for flood disaster management practices. Accordingly, this study applies a case study approach by means of: interviewing key informants; studying archival documents; and conducting site visits to flood locations so as to better understand the achievement of the district's flood management team. The result shows the importance of knowledge integration as one of the factors contributing to the success of the district's flood management plan.

Keywords: Knowledge integration, flood disaster, flood management.

I INTRODUCTION

Persistent flooding has always been associated with the East Coast states of Malaysia, especially Terengganu and Kelantan. In 2013, the Kemaman District in Terengganu (as shown in Figure 1) was one of the worst-hit areas, suffering the worst flooding since 1971. More than 20,000 people were evacuated to relief centres when all roads were closed and communication with the outside was not possible. Such an unexpected situation resulted in the district becoming virtually an island after being cut off in all directions (The Star, 2013). As a consequence, the immense flooding literally paralysed Kemaman as power lines had to be disconnected for safety reasons (Daily Express, 2013). There was also an ensuing shortage of food and basic necessities.

Having learnt from this incident which caused utter chaos in 2013, the Kemaman District Office initiated a sort of systematic plan to prevent the situation from re-occurring. This then led the district's flood management team to achieve a gold standard as announced by the Malaysian Prime Minister in 2014. This paper aims to examine and ultimately understand just what is so special and unique about the Kemaman District's flood management practices that resulted in its earning the Gold Standard benchmark for

Malaysia. To achieve this intention, we specify our study on the knowledge flood integration perspective.



Figure 1. A Map of Kemaman District.

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II THE RESEARCH BACKGROUND

In December 2014, the Prime Minister of Malaysia announced that the Kemaman District's flood management plan would become the model for the standard operating procedure (SOP) for flood management in flood-hit areas.

Flood disaster management principles highlight the accuracy and speed that is required for a compilation of information to enable decision-making and forecasting purposes. From the disaster management point of view, knowledge management (KM) has been perceived as an important element for the procurement of disaster-related data (Seneviratne et al. 2010). Flood management processes in Malaysia are confronted with numerous challenges. Multiple organizations were engaged in the disaster

management process without having proper documentation as to how to determine the respective roles of cross-agencies and authorities. Up until now, there has not been any clarity with regard to the sharing and integration of knowledge between agencies and authorities.

The existing practice of flood management in Malaysia is generally weak in terms of information-sharing and lack of coordination between agencies (Mohd Rodzi, Zakaria & Ahmad, 2016). Realizing the importance of knowledge integration (KI) within the context of KM, this research proposes a KI for flood management in Malaysia, where the KI is identified as an important aspect in flood management.

Grant (1996) viewed KI within the lens of an organisation as a process of integrating knowledge of experts among the employees. From a different point of view, Enberg et al. (2006) explored the dynamism of KI from the perspective of acting and interacting in a team. Their approach emphasized the importance of the project management function in assuring KI by appreciating the learning dynamic with reference to the project context. In agreement with Mohd Rodzi et al. (2014), this research has established that KI is a process of combination by which to produce new knowledge. In addition, it includes the process of recognizing knowledge in comparative fields and incorporating this so as to create new knowledge. Thus, it is envisaged that a solution can be conveyed to solve problems and may subsequently reduce the complexity of tasks. Hence, we argue that integrated knowledge is highly valuable as a possible solution to any problems encountered by flood management teams in Malaysia.

III THE RESEARCH METHODOLOGY

This study entails a case study approach by means of: interviewing key informants from the Kemaman District Office; interviewing representatives of Committee of Community Development (JKKK) and the Smart Community team through open-ended interviews; and studying archival documents. In addition, the authors gathered observations through digital photographs, as well as site visits to three flood locations (examining flood sensors and flood telecommunication equipment at Kampung Air Puteh, relief centres and food depots). During these visits, the authors made observations and recorded them via file notes and digital photographs. Archival documents related to meeting agendas, planning of activities, procedures and letters provided further data. These methods have driven the authors to analyze actual situations and initiatives that have been implemented.

IV RESULTS AND DISCUSSION

Since April 2014, a flood disaster committee had been formed and 69 relief centres were identified. Preparation of an operation was set up by district authorities to be used in pre, during and post-flood event phases with regard to the worst case scenarios.

A. Pre-Flood Phase Plan

In the pre-flood phase, various flood awareness programs were conducted by local and national authorities. These included the district authorities, National Security Council (MKN), youth club, medical teams and logistics support respectively. The activities covered basic information such as: how to handle a flood crisis; assembling flood kits for victims and relaying of information regarding relief centres. Placement centres, cooking areas, food depots and places to store items donated by the public were also identified during this period. The level of readiness among the secretariat was tested through the flood simulation process, which includes: essential items receipt; registration of victims with the allocated relief centres; food management and distribution of victims' goods.

All required equipment items were identified and tested in order to facilitate the disaster management operations before the onset of the flood season. Those equipment items comprised generator sets and logistic equipment such as: boats; walkie-talkies and the portable mobile cellular sites that provide temporary network and wireless coverage in locations where cellular coverage is either minimal or compromised. The district authority works closely with telecommunications companies like Celcom Axiata Bhd, Maxis Bhd, DiGi.Com Bhd and Telekom Malaysia Bhd to ensure that the communications system remains effective during flood events. This required and up-to-date knowledge is planned to be well-shared and integrated among the affected victims and relevant agencies through WhatsApp and Telegram social media application software programmes.

Each flood relief centre is equipped with temporary clinics to check on the health condition of flood victims (NST, 2014). Hospital also list vulnerable patients including expectant mothers who are due to give birth during the flood season for contingency plans (The Star, 2015). In addition, the district has three helipads complete with global positioning system (GPS) coordinates that will help cut the time required to send food and other essential assistance to victims. These are located at Batu 14 in Kuala Taylor, Felda Seberang Taylor and Pasir Gajah respectively. Since every single thing related to flood management is now well-planned in the pre-flood phase, it is no wonder that the Kemaman District's flood

management plan has turned into a success story in Malaysia.

B. During The Flood Phase Plan

Over the duration of the floods, the main operations room was activated once the first relief centre was opened for the victims. All relevant agencies were then instructed to open their own operation rooms. Meetings concerning the coordination of the various operations among all related authorities and agencies were held daily at 8.00 pm at the main operations room to report on and synchronize plans and critical activities that needed to be taken on the following day.

Seven day supplies of food were also despatched to each relief centre and food depot. This was an improvement upon the three day food supplies of the standard operating procedure of MKN existing previously. Steps were taken to ensure the relief centres were equipped with necessary items for victims such as blankets, mats, sleeping bags, gas cylinders and power banks. However, among all of those stated, efforts to rescue flood victims were still given top priority.

C. Post- Flood Phase Plan

After the floodwaters receded, the extent of damage to public property such as bridges, buildings and roads, as well as private property including houses and cars was assessed. The various district offices were given the task of centralising and managing all the contributions and donated items, such as daily essentials.

One week after the last relief centre was closed, an investigation of the flood management operations was carried out and proposals were presented to bring about further improvements. As a result of the integration knowledge and plan among authorities and agencies, the authorities as a whole concluded that the floods that hit the Kemaman district in 2014 came within control, far better than in 2013.

	<ul style="list-style-type: none"> Victims' report (statistics)
 <p>Committee of Community Development (JKKK)</p>	<ul style="list-style-type: none"> Relief centres & locations Pre-registration & actual victims Flood drills Flood instructions for pre, during and post phases of flood event Flood early warning Flood voucher
 <p>Local People</p>	<ul style="list-style-type: none"> Relief centres & locations Pre-registration Flood early warning Flood voucher
 <p>Relief Centre</p>	<ul style="list-style-type: none"> Pre-registered victims Actual victims Food stock & meals preparation Flood relief items Required items
 <p>Community Welfare Department (JKM)</p>	<ul style="list-style-type: none"> Flood preparation Food stock Food relief items Registered victims Registration slip Relief centres & food depot
 <p>Flood Management System (FMS)</p>	<ul style="list-style-type: none"> Weather forecast Water levels Images (CCTVs, map) & flood sensors Flood early warning Relief centres Registered victims Flood donations Support ticket Flood voucher
 <p>Main Operation Room</p>	<ul style="list-style-type: none"> Coordination meetings Emergencies notifications Water level (JPS*) Closed/open roads (JKR*) Weather forecast (Meteorology) Flood actions by agencies Assets provided by agencies Victims' report (statistics) Instruction & information from MKN* (District & State)

*JPS: Department of Irrigation and Drainage

*JKR: Public Works Department

* MKN: National Security Council

Table 1. The Integrated Flood Knowledge.

 <p>District Office</p>	<ul style="list-style-type: none"> Flood preparation Pre-registration for victims Flood drills Relief centres & locations Assets movements Application for flood assets to agencies Flood instructions for pre, during and post phases of flood event Flood donations Food depot Flood voucher Instruction & information from MKN* (District & State)
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Table 1 exemplifies necessary flood knowledge that was shared and integrated among authorities and agencies of Kemaman's flood management team. The integration of flood knowledge has helped to improve flood disaster management strategies to enable them to better adapt to particular situations.

D. Integrated Flood Knowledge Management Activities

Flood knowledge was integrated in teams having a diversity of authorities, agencies, backgrounds and disciplines. The main integration management team consists of authorities and agencies as illustrated in Table 1. In order to have better knowledge integration, those authorities and agencies need to realize their different roles and responsibilities. Recognizing the fact that every function needs sufficient communication helps to combine knowledge for improving flood management in a team. For example, the input of both human and technology factors such as the Committee of Community Development (JKKK) and Flood Management System (FMS) reduces the vulnerability of victims by improving preparedness and early warning systems. This subsequently enables them to better adapt and respond.

The emergence of new innovations in social networks with communication instruments can ease the numerous processes involved in widespread distribution of knowledge. The most popular social networking sites such as WhatsApp and Telegram have been used as part of the communication tools for the Kemaman District's flood management team. This integration of knowledge which was provided by different actors has helped to develop successful strategies to mitigate the impact of flooding in that district.

Develop Strong Teamwork. To provide vulnerable victims with supports and strategies by which to cope with a flood disaster, a group of representatives from local people, known as the Committee Community Development (JKKK) have been working together with Kemaman District authorities and government agencies. These agencies include: National Security Council (MKN); Community Welfare Department (JKM); Fire and Rescue Department (JPBM); Royal Malaysia Police (PDRM) and others. This strong team was built after the 2013 flood tragedy in the district in response to suggestions and responses. Their resources were allocated as closely as possible to the point of delivery services. Each authority and agency in the team shared the same interests, vision, and objectives by integrating their knowledge in improving the procedures and plan for flood management. Adequate and sufficient arrangement was organized to provide accountability for every authority and agency. The created team is accountable for providing a rapid

response to any relevant necessary actions and tasks. By having frequent face-to-face meetings, this team actively tries to avoid the proliferation of misleading information.

Interestingly, the participation of representation by local people in the team is proactively encouraged. The Kemaman District Office has initiated small functional groups (known as JKKK) as one of its effective ways in strengthening flood preparedness at the community level. Each group represents a specific village or catchment area in the Kemaman district. This community involvement is significant for providing a bridge of knowledge from local people to authorities and agencies. This knowledge would generally encompass information such as incident reports in the community. Strong community engagement is required to produce long-term success of flood disaster management as it is the best way to enable communities to be more participative, cooperative and organised by linking them with the official flood disaster agencies.

Re-Structure of Normal Standard Operating Procedure (SOP) for Registration and Food Supply Processes. Subsequent to a considerably anxious moment during the flood incident in 2013, the Kemaman District Office has taken an initiative to expedite certain procedures in their flood management plan such as the normal process of victims' registration and food supply as stated in its Standard Operating Procedure (SOP).

A district office was opened to enable pre-registration of potential flood victims by involving the Committee of Community Development (JKKK) in the pre-flood phase. This pre-registration process was performed through filling out registration forms facilitated by JKKK. These are then forwarded to the district office to be confirmed and subsequently keyed-in into the Flood Management System (FMS). The pre-registration data will be used during the flood and post-flood phases by the district office, relief centres, Department of Community Welfare (JKM), JKKK and main operation room to validate the actual victims for flood support and voucher distribution. Surprisingly, this initiative shortened the flood time management process from one year to a period of only three months. This ultimately saved about nine months in the management process.

Further, an improvement was taken to ensure flood victims were given full and continuous meal support by supplying seven day food supplies ahead at food depots. This procedure saw an improvement in a further four days from the original three day food supplies of existing standard operating procedure that was stated by the National Security Council (MKN) and the Community Welfare Department (JKM).

The Flood Management System. Technical information alone without consideration being given to both technical information and local wisdom might result in the failure of the system that was being developed. In Kemaman, the flood management system (FMS) has been developed by the Smart Community Team for managing flood data of the district. This enables the system to produce, specifically: flood early warnings; flood forecasting; flood risks in catchment areas; flood reports and other necessary actions. This initiative is very useful for both contingency planning and immediate actions in responding to a flood crisis. When the river's water level reaches a certain point, a flood warning will be broadcast by the system to all registered local people in affected communities, as well as their JKKK. Two modules are involved in this situation, known as *Floodforecasting* and *My Alert*. *My Alert* module also distributes information concerning evacuation centres for the specific catchment area. In some cases, local people might not understand the distributed flood alert information. Thus, a combination of JKKK explanation and instructions help to facilitate the understanding of the community in terms of taking decisions on evacuation and preventive actions. It also serves to intensify efforts to assist flood victims, especially those living in areas badly affected by the floods.

V CONCLUSION

The flood management plan for the Kemaman District has achieved Gold Standard benchmark compared with other flood management teams in Malaysia. As discussed in this paper, KI has been found to be one of the factors contributing to the success of the district's flood management team. This has been achieved with facilitation by technologies such as FMS, social media applications of WhatsApp and Telegram, and flood sensors respectively. Indeed, leadership seems to play an important role in the whole situation.

However, future improvement still needs to be considered. Current lessons learned from the Kemaman District's flood management team triggers recognition of a few issues that need to be enhanced to provide a better flood management plan. First, we see

that the risk management aspect for the affected community is still limited. Second, a flood prediction data model from rainfall also needs to be included in the FMS, so as to assist with existing flood forecasting module of river water level measurement. Lastly, the measurement of river water level in the FMS needs to be improved so as to obtain an accurate result for flood prediction catchment areas and, accordingly, to advise local people to be prepared to face the possibility of floods as forecast by the system.

ACKNOWLEDGMENT

This research was supported by the Long Research Grant Scheme, funded by The Ministry of Education. The authors would like to thank the District Office of Kemaman, Terengganu and the Smart Community team for their support and for generously providing information.

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