

# Critical Success Factor of Information Management and Governance: A Case from 2014 Flood in Kemaman, Terengganu

Mohamad Firdaus Mat Saad  
Lim Kok Wing University  
Cyberjaya, Selangor  
6013-2923225  
firdaus.saad@limkokwing.edu.  
my

Aliza Abdul Latif  
Universiti Tenaga Nasional  
Kajang, Selangor  
016-2184564  
aliza@uniten.edu.my

Marini Othman  
Universiti Tenaga Nasional  
Kajang, Selangor  
6013-3931111  
marini@uniten.edu.my

## ABSTRACT

The worsening flood condition in Malaysia has motivates researchers in identifying new ways in handling the disaster. The success of 2014 flood in Kemaman district has showed that their flood management procedures was effective in reducing the impact of the flood. This paper aim to identify the critical success factors (CSF) of the Kemaman practices that has made it successful in managing the flood. The field study conducted at Kemaman included interviews with the actual person instrumental in the execution of the Kemaman Standard Operating Procedure (SOP). The interviews helped to identify factors, characteristics and practices being implemented in planning and preparation at district area. Document study and article reviews had supported the finding and have provided direction to further improve the existing Standard Operating Procedure. As the result from the success story, critical success factors of 2014 Kemaman flood management was identify.

## CCS Concepts

• Applied computing → Decision analysis

## Keywords

Standard Operating Procedure; Fixed Regulation Operation; flood management; flood management system; critical success factor.

## 1. INTRODUCTION

Heavy rainfall brought by the Northeast Monsoon through mid-December 2014 until early January 2015 has recorded a high of 255mm and inundated several states throughout Malaysia: Terengganu, Pahang, Kelantan, Perak, Johor, Selangor, and Perlis [1]. Source indicated this flood as being worse than the notorious floods of 2004 and 1967 and is probably the worst in the history of Kelantan [2]. Land access were closed, compounded by limited number of transports such as boats and helicopters, have hampered rescue activities [1]. According to [3] 20 deaths were reported, nearly 250,000 people were evacuated, and an estimated property loss of RM1 billion [2, 4].

However, in the midst of the extreme flood conditions, the district

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of Kemaman Terengganu, despite sharing the similar disaster, has reported a milder impact. The preparations for the flood were executed according to practices outlined in the Standard Operating Procedure (SOP) flood management, and it has managed to alleviate the impact. The improvement can be seen in a well recorded database of flood victims and stakeholders; clear roles and responsibilities of the community leaders; and well-stocked relief centers. Due to the milder impact experienced by Kemaman, it was regarded as an exemplary standard that could be adopted by other flood-prone areas in Malaysia [5].

Therefore, this study aims to gain insight on the Kemaman SOP as to how it was able to minimize the impact of the flood disaster of December 2014. The results from interviews and site visits will be reviewed in identifying the critical success factors of a successful flood management. The interview aimed to establish problems and incidents faced during flood, and looked into how the existing practices of Kemaman was able to reduce the flood impact compared to other districts.

This paper is organized in five main sections. The immediate section that follows, review significant articles and documents regarding Malaysian flood practices in the recent years. Next, the approaches used in investigating the Kemaman case are explained. Followed with a discussion that focuses on governance and management of resources as well as the identification of critical success factors for Kemaman flood management.

## 2. BACKGROUND STUDY

The occurrence of the 2014 flood that had caused significant losses of live and property close up to RM 1 Billion [2], had saw the government of Malaysia, with Non-Government Organization (NGO) and other private organization to react seriously with better planning to address the flood problems. These includes development of several flood mitigations under the Department of Irrigation and Drainage (DID) and the implementation of the Directive No.20.

Flood disaster on December 2014, are monitored and managed by all levels as highlighted in Directive No.20. However, managing flood is chaotic, and it required a dynamic planning since each disaster is unique in nature [6, 7]. Directive No.20 and Fixed Operation Regulation or 'Pelan Tindakan Operasi' (PTO) are the main instruments focus on managing the disaster generally [8, 9]. However, according to [8], the Directive No.20 is classified as not a comprehensive instrument in managing flood. This is due to simplification of the content which may not suit with disaster that occurred and there is no specific role assigned to every disaster agency. The execution of Directive 20 need to be implement

together with agencies PTO in managing the flood. The PTO outlined their specific roles, responsibilities and tasks to be carried out for the entire phases of flood management.

Flood management is one of the major concerns in governing the disaster as it requires an improved governance instruments and effective flood plan for better execution of the existing SOP and PTO in dealing with the flood.

## **2.1 Standard Operating Procedure (SOP) and Fixed Operating Regulation (PTO)**

A SOP is a detailed, written instructions used to achieve uniformity in the performance of a specific function [10]. Malaysia National Security Council (NSC) is the lead agency that coordinate and ensure the execution of flood mechanisms are implemented at all level according to disaster management SOP as outline under Directive No.20 which directly reports to the Prime Minister [8, 11]. In 2015, The National Disaster Management Agency (NADMA) was established by the government to act as the coordinator of government agencies involved in the managing disasters including floods, in replacing NSC.

Primarily, Directives No.20 acts as policy and mechanism in handling national disaster management and relief activities. It also establishes a systematic coordination among the agencies involved. It is designed to provide clear guidelines and compliance on disaster management practices including the responsibilities and function of the various agencies involved in the disaster [9, 11].

In addition to the main document, all agencies involve in flood management in Malaysia have created their own Fixed Operating Regulation (PTO) with the specific planning and activities for every phases. PTO served as guidelines on managing the flood in specific. Every PTO created has outline the steps that should be implemented at every level, which is the preparation of the Local Disaster Response Plan at the district and state [12]. Similar as the SOP, PTO were also prepared to handle different phases of flood which are before, during and after with person in charge assigned to ensure all the activities are being carried out according to both policies.

## **2.2 Technology and Human Factor**

Referring to Hyogo Framework for Action (2005-2015), priority action 2: identify, assess and monitor disaster risk and enhance early warning is one out of five priorities that been highlighted for better disaster plan. In addressing this priority, Malaysia had built several forecasting warning systems to predict flooding instances, such as flood maps, telemetric rainfall stations, telemetric water level stations, flood warning boards, flood sirens, weather radar, satellites, and real-time flood forecasting warning system [3].

Consequently, early warning system is one important factor in disasters management, especially floods. The importance of early warning system are to monitor rainfall and river flows that may lead to flooding, to predict flood severity and the onset time of particular level of flooding. The systems are also equipped with functions to interpret the prediction to determine the potential flood impacts to the community, the construction of warning messages describing what is happening and will happen, the expected impact and what actions should be taken, and dissemination of warning messages [13].

The use of systems in disaster operations is mainly to help the responders in providing relief to the victims. In some part of the world, canines have been used as a way to detect victims. However, major weakness in the use of canine is that it cannot work independently, and require assistance (dependent) of humans [14]. Thus, the human sensor or the involvement of human can help to expedite the search and rescue mission for flood victims. It had been proved thru the study conducted by [15], in her discussion on Human respond to Natural Disaster focusing on recognizing the human role in disasters.

The element of human sensor in flood operations can relate to the reliability of a person to predict what will happen, how deep it (flood level) will be, what preparations are required, what action/plan to be executed, who will be involved and any related questions that seek for answers in managing the flood. In addition, the human sensor is also very important because many-a-time, the existing systems are flawed and inaccurate in its rainfall reading [16]. Hence, human experience needed to be consulted [16] to enhance the resilience of individual, group, community and national.

## **2.3 Governance Structure**

In any disaster operations, it required a leader to manage and be responsible for activities before, during and after the disaster. [17], has emphasized the importance and necessity of effective leadership in emergency management system. Directive 20 have assigned leader(s) that will lead the activities in the disaster operation as outlined in its SOP. A good leader will take lead and be responsible for the proactive and reactive generic plan in prevention, preparedness, and, response and recovery process. Thus, in his [17] study, a theory of transformational leadership was proposed that fosters systemic collaboration, strengthens emergency prevention, preparedness, response and recovery, and encourage proactive strategies in facing the threat of an emergency.

Transformational leader is a leader who engage and motivate professionals and communities to integrate their efforts that lead to increased systemic in emergency management [17]. [18], stated that transformational leadership is a blend of mutual encouragement that converts followers into leaders and possibly, leader into moral agent. Thus, the leader plays an important role in the operation of a disaster management especially on search and rescue as the characteristics of a leader can vary according to the circumstances, which a leader can be a victim who have experienced the disaster. The change can be contributed from the knowledge, skills and experience exist in the victim that allow it be used as a guideline to help manage disasters such as flood.

## **3. METHODOLOGY**

In this research, identification of gaps was first made through review of literature related to flood in Malaysia, which includes practices in governing and managing the recurring and worsening condition of floods in Malaysia. The review was aimed to establish a baseline for the Malaysian flood disaster practices. A field investigation was carried out to understand how Kemaman, Terengganu was able to minimize the impact of flood despite the unprecedented condition of the disaster in 2014. The factors and characteristics of the Kemaman successful practice was identified from onsite interviews with key people involved in the flood incident, coupled with post-disaster visits to relief shelter, command center and locations badly ruined by the disaster. Analysis from research was founded the critical success factor

that contribute to the success story of 2014 Kemaman flood management.

In understanding the formal and informal governance, authority and leadership, three important officers were interviewed: The District Officer of Kemaman, the Assemblyman of Air Putih, Kemaman and coordinator from district office of Kemaman who experienced 2014 Kemaman flood management. Interviews were conducted at their formal workplace while more discussion and questions took place at incident sites.

Observation method was used to gain better understanding the scenario of Kemaman flood management. Several selected places including the site of where the flood started, the Kemaman District and Land Office where river water level is monitored, the evacuation center and the flood watershed.

Document study on flood management SOP was conducted and best practices in managing flood was acknowledged. All the data gathered was to explain the implementation of the SOP and any related practices that are used in Kemaman, Terengganu. The suggestions from Kemaman will be used as references and knowledge sharing for any future flood areas in managing the flood operation before the disaster. A disaster management system used by District and Land Office was presented to show the collaboration among the agencies involved in disaster and how it was used to update on the current information regarding the disaster in Kemaman as well as information about the Kemaman residents.

The factors identified from the interviews was analyzed by using discourse analysis in order to establish the critical success factors of managing 2014 flood in Kemaman, Terengganu.

## 4. FINDINGS

The success story of 2014 Kemaman flood management was recognized as the gold standard and to be used as SOP for all other flood area due to the application of critical success factor at the district level on managing the flood [19]. The important of “awareness on management and knowledge” in flood are biggest advantages toward flood management at Kemaman, Terengganu. Hence, the responsiveness of each leader accountable for the issues is greatly contributing to the appropriate action and was able to solve the unexpected issues. On the other hand, well developed SOP, systematic planning and structured implementation, and importance of technology support contributed to the success of flood management at Kemaman. Key aspects of implementation that lead to critical success factors are discussed below based on information gathered during the interview and field study at Kemaman.

### 4.1 Pre-Planning and Preparation at District Area

Directive No. 20 has facilitated Kemaman to plan for better strategies in dealing with the three stages of flood; before, during and after. This paper focused on the first stage which was planning before a flood hits. Kemaman District Disaster Management meeting was carried out to establish main committee and the Head of sector in aligning all agencies at Operational Room and to collect logistic data as well as development of Flood Disaster Committee which involve the Villages Community Committee. On top of that, the authority will ensure all the supply of daily necessities are sufficient for 7 days including the asset such as engine boats, lorry and mobile toilet is well prepared and delivered early at evacuation centers and designated areas. Safety training and disaster management simulations was carried out to

the agencies and resident leaders were involved in order to make sure they are well prepared to face the unexpected flood consequences.

Kemaman also has prepared a specific and strategic evacuation center at Kampung Air Putih which is located at a high ground within the district and considered as a safe area. The center, in preparation of the flood has been prepped to accommodate 3000 victims. Supplies of food, clean water, and other sanitary goods are prepared in advance. Other form of aids such as tents and blankets are on standby to be allocated according to family.

Leaders at the evacuation center was tasked with monitoring of activities which was pre-planned during the pre-disaster stage to ensure its alignment to the SOP and PTO used. However, according to the Assistant District Officer at the Land and District Office, the main issues was ensuring the SOP and PTO are well carried out by the person in-charge during the flood. Besides, the SOP and PTO might not support some unexpected issues arising during the disaster, such as continuous increase of the water level (which may compromise the safety of the center) that may require spontaneous decision-making.

## 4.2 A Flood Management Systems

The use of flood management systems in Kemaman was one of the primary factors that contributed to the lesser impact of flood experienced by the district. The system is placed under the control and custody of the Kemaman District and Land Office.

The system named District of Kemaman Integrated Flood Disaster Management Portal, is a complete system which was developed by the Communications and Multimedia Commission (MCMC). The system includes a main function that allow the Kemaman residents to pre-register their family members’ information such as name, address, telephone number for the purpose of management and preparation of evacuation center, locating victims and preparation of food supply after floods. This information has facilitated many parties in managing and controlling the evacuation during floods and at the same time, in monitoring of family members who have lost contact during the flood.

Apart from that, the authorities had set up Flood Insurance Protection Scheme which allows victims (based on the pre-registered details to the system) to receive compensation up to RM1000 with premium payments as low as RM70 to all residents whose areas are prone to flood [20]. This insurance will be arranged after the disaster, in which all registered residents will receive monetary compensation to reduce the burden resulting from the flood.

The system helped Kemaman in managing information required before, during and after the flood. However, the system is not capable to identify roads that can be used as evacuation route due to the fast increase of water level. Table 1 below described the functions of the system.

**Table 1. List of the Kemaman Integrated Flood Disaster Management functions.**

Functions	Descriptions
Data of Kemaman Residents / Population	All population information of the district are recorded into system including head of house, number of household and any related information such as name, IC number, working

	status and other.
Data of Evacuation Centre & Food and Supply Information	List of the various evacuation centers stating details such as its capacity, assemblage of necessities and food, with the inclusion of the list of goods and quantity for at least 7 days.
Data of NGO and other Organization	NGO and organization involve either providing service involve with flood or providing support including food and supply, moral support and others were recorded into system for easy monitor and organize. Detail information was keep into system for easy manage if the information required during the flood occur.
Data of GPS	GPS data from the camera located at selected locations to help predict impending disaster.
Data of Helipad	Helipad data was keep into the system for the helicopter to land and provide the support such as food and supply or facilitate as well as rescue

### 4.3 Clear Authority and Leadership

Besides having a good computerized system, good leadership is also one of the factors that has positive influence in flood management in Kemaman. It is an advantage to have a leader that have good background and knowledge regarding flood and able to understand the scenarios of the disaster. The leader may know and understand how to interpret the rainfall rates to the increasing water level and a good mapping of river overflow to the main road in monitoring the situation of the flood.

The operational leader is very important in ensuring the need of people during disaster such as evacuation centers, depository of food and supplies are well planned. Leader should have the background and knowledge of the flood disaster since the flood disaster is a critical process that required discipline and agility in managing the flood through the history and experience of dealing with the phenomena [19]. Hence, leader should be someone who can be categorized as “Transformational Leader” to react and adapt, to take the advantages of unexpected opportunities accordingly [20] to the level of flood hits. Kemaman has practiced this by involving the local people who had experienced in managing the flood and taking the responsibilities by instructing the daily operation activities. Since the local people widely understand flood situation and serious extent to which it would be dangerous based on the experienced, the search and rescue activities are more organized and manageable.

### 4.4 Community-based and Culture

One of the strategy used by the District and Land Office of Kemaman in disseminating flood-related information to the community is to include head of village in the flood management activities. Head of villages are invited to pre-disaster activities that may include briefing on flood disaster, and also joining the preparation activities in the conducted at the village or residential level. Some of the information passed to the head of village during the briefing include the portal used in the flood management, which was developed by MCMC, the planning and preparation activities that District and Land Office had planned for the community.

Head of village is also required to be involved in evacuation center activities and this help the flood management activities easier to be governed as the head know the resident better and information can be relayed faster and easier. Selected head of village plays a key role in ensuring their people safe from disaster and to get sufficient supplies before, during and after the flood. The establishment of Village Community Committee (VCC) which consists of residents of flood-free area can be seen as a good move because indirectly it can help victims or potential victims respond to disasters [21]. Flood simulation, such as rescuing the flood victims in the water, training for those involved to assist the process when the floods hit, and other flood management campaigns, help expose and prepare flood community member to undergo the disaster. Thus, minimizing the impact and promoting better relief for the disaster.

The community involvement with a clear role are not fully implemented throughout Malaysia and in most countries. New Zealand, on the other hand, has set a good example which could serve as reference for other countries to follow, which has defined clear roles for community involvement in its National Disaster Plan [22].

## 5. DISCUSSION

From Kemaman experience in the event of 2014 flood, the main centralized system implemented at the base is the main success factor that strengthen three critical success factors that have brought about positive outcome in reduce disaster impact and promotes better relief. The strong communication, established collaboration and solid coordination (3Cs) among the agencies and parties via the support of technology are the biggest advantages of the success story of Kemaman SOP as resulted from the finding. Using technology in anyhow, it provides advantages toward the management. The critical success factors as identify in Kemaman success story are:

### 5.1 Communication

A good communication can reduce the possibility of hazard from becoming a disaster where among the important information conveyed during a disaster is warning of upcoming hazard or threat, which should be delivered immediately to the population at risk [7]. The simplest way to do so, is by using Short Messaging System (SMS). However, the issues is responsibilities to transmit and acting out on the information to be delivered to the possible victims.

The used of SMS in deliver information to the possible victims are being used in the case in Air Putih, Kemaman, where Assemblyman of Air Putih, took the accountabilities to distribute the upcoming disaster information to the population at risk by using local dialects. The use of the common language (dialects) was an important element to convey the precise and correct meaning (of a message) to the victims. This is turn, partly contributed to the reduction of casualty and damage cause by the disaster.

Instead of using the medium of communication that are understood only by certain people or local authority, the local dialect is easiest means understood by the majority of the affected community members. The used of labeling such as “Green line = Safe level, Yellow line = Alert level, and Red line = Danger level” to deliver information to the possible victims on the danger level of the flood are wasted since the resident did not understand the labeling concept. This was also partly due to the lack of training provided to the community with regards to labels used by the

authorities. Information pertaining to status of flood and road closures were communicated to the flood community using the local dialects.

## 5.2 Collaboration

The collaboration between all the stakeholders in managing the flood that hit Kemaman through the District of Kemaman Integrated Flood Disaster Management Portal is another key factor that led to successful management of the flood operation. Flood agencies, victim and management team are collaborated through the use of the system. The specialized flood portal provided information regarding the number of victim, details of Non-Government Organization (NGO) and private company which are crucial to provide assistance and support (such as foods, counseling, moral supports and other related supports) to the victims. All the support must go through center in ensure that execution was in place and correctly execute at right time, to the right person. Collaboration among agencies are crucial since they are the backbone in proving help and assistant toward main agency (Land and District Office) and victims. Kemaman has practice to involve and collaborate with all agency in a long term practice where during the drill, agencies involve should play their responsibilities as how it going to look like during the real flood event.

## 5.3 Coordination

Flood management requires a systematic coordination among the people, planning, and process. All the aspect must be properly addressed in making sure activities of search and rescue, and the entire activities are well carried out. Coordinating are the biggest issues that need serious attention where in Kemaman, all agencies involve in managing the flood should be based at the Land and District Office that also serve as Center of District Disaster Management (CDDM) during the flood. All the operations activities must go through the authorized officer stationed at CDDM.

On top of that, Kemaman had practices Individual Management Victim, where the focus is to bring out ailing person, disable person (OKU), pregnant women or people living far away from the more populous areas to the evacuation centers first before addressing the others based on the information key in by the resident through the portal.

## 6. CONCLUSION

Learning from the success story of Flood Management in Kemaman, December 2014, the discussion above described all the relevant input that can be adopted by other districts prone to flood. Factors highlighted in this paper were compared with the literature review in making sure points discussed are within the scope field of the study. Planning and preparation, flood management system, clear authority and leadership and community-based and culture are the main issues found during the interview and discussion session with all the person involve in managing flood in Kemaman.

Conclusively communication, collaboration, and coordination were identified as factors that have led to the success of Kemaman flood management. The identification of these critical success factors can assist the agencies in doing a better planning and effective procedure of flood management. The exploration regarding the practices of flood management in other areas, may help government, NGO and private organization to develop well SOP and PTO in managing the flood in details.

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