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POST-DISASTER SHELTERS: A REVIEW OF STRATEGIES AND DESIGN FRAMEWORK

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Abstract

Currently, more rampant and severe natural disasters have increased the threat of displaced population and refugees requiring relief shelters, not only during the catastrophe but also in the aftermath, for permanent replacement of damaged homes. In Malaysia, flood accounts for 62% of all-natural disasters and had increased in severity over the last decade. This paper aims at examining the milieu on the threats of flood disaster, policies and strategies, and recovery process focusing on post-disaster shelters for victims. An in-depth systematic literature review data shows that efforts by the relevant agencies are geared towards the disaster response and the recovery on infrastructure itself without proper strategy and provision on designated relief shelters (temporary or permanent) as a crucial part of Disaster Risk Management (DRM). Victims are often placed in temporary shelters in school and community buildings on higher grounds over the critical flooding period. These measures are insufficient for more severe scenario, where massive damage to houses occurred, requiring longer recovery periods disrupting the function of schools and community buildings. For long term solutions, more cohesive efforts by the agencies are essential to include post-disaster shelters as a critical part of disaster relief strategies learning from the global counterparts. From the review of global solutions and adapting from models from other countries, this paper proposes the design and management framework for efficient temporary and permanent post-disaster shelters to offer acceptable standard of living for displaced victims.

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Keywords: Post-disaster shelter, disaster recovery, post-disaster framework, flood recovery strategies.



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1. Introduction

The world population is estimated to reach 9 billion by 2050 resulting in the increase of urban inhabitants struggling for shelter and amenities (IFRC & OCHA, 2015). Global warming and its effect on climate change such as the rise of sea level had brought about rampant threats of floods, storms, droughts and typhoons over the recent decade and this phenomenon is predicted to escalate in the future (Schilderman & Lyons, 2011; Schilderman, 2014). This increasing severity of natural disasters coupled with the growth of population will subsequently result in continual increase in disaster casualties hence a large number of displaced people and refugees (Perrucci, Vazquez, & Aktas, 2016). It is caused by the loss of homes and properties and need for temporary or permanent massive shelters programmes depending on the severity of incidents. This scenario will have more serious impact to the poorest and most vulnerable communities in developing countries, unless preventive measures can reduce losses (Bashawria, Garritya, & Moodley, 2014). Malaysia is also a country that is exposed to myriad of potential threats from the effects of climate change in the form of more rampant disasters affecting its population health and the country's development. They mainly affect the coastal regions, where communities are more prone to the threat of flooding due to the rising sea-level (Shaluf & Ahmadun, 2006; CEDMHA, 2016).

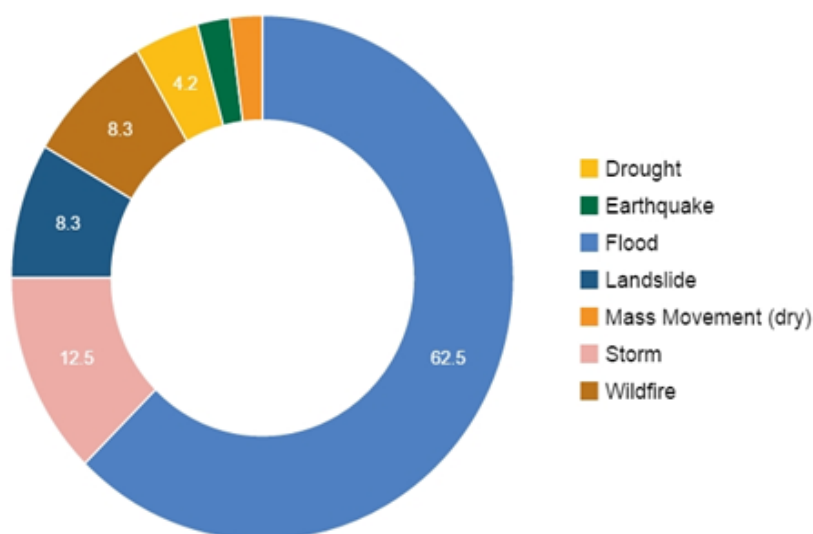


Figure 01. Frequency of Disaster Event in Malaysia 1994- 2014.

Source: CEDMHA (2016)

Figure 1 shows the 1990-2014 record on 'Frequency of Disaster Event in Malaysia' for the last 15 years, whereby flood is identified as the highest occurring disaster reaching 62.5% of natural disaster, followed by Storm (12.5%) as the second largest threat. Landslide and Wildfire disaster amounts to 8.3% respectively. Earthquake accounts about 2.1% of the total disaster recorded. Flood incidents had increase in occurrence and magnitude over the last decade in Malaysia. The most recent and damaging, was the 2014 flood causing massive destruction to Kelantan, Terengganu and Pahang causing 250,000 victims evacuated from their homes (Sukeri & Shazwani, 2015) The total loss of damage is RM2.58billion mainly

to infrastructures (CEDMHA, 2016). The displaced victims not only suffered during the flood incident but more critical over a longer period due to the permanent damage to their homes (Karim, Noon, Diah, Tajuddin, & Mustari, 2016; Sukeri & Shazwani, 2015). Other states in Malaysia had also suffered from more severe storm and flash floods with colossal damage in recent years. The loss of housing/shelter following a disaster leads to other problems such as loss of security, economy, effects on health as well as disruption to education for the families of victims (Potangaroa, 2015).

2. Problem Statement

According to Roosli and O'Keefe (2013), Malaysia Management Disaster Policy is adequate and at par to a developing nation, but the implementation has many loopholes due to lack of integration and confusion of procedures. Moreover, it is also highlighted that Malaysia has no specific guidelines on post disaster temporary or permanent housing implementation (Roosli & Collins, 2016). There is also evidence of inadequate relevant national and state policies; particularly planning and environmental regulations on flood mitigation and recovery (Shazwani & Sukeri, 2016; Roosli & Collins, 2016; Isahak et al., 2018).

Under the National Security Council Act (Act 776), the Malaysian National Security Council (NSC) Directive 20 contains the 'Policy and Mechanism of the National Disaster Management and Relief' focusing mainly on disaster management to alleviate the effects of various hazards; 'in preserving life and minimizing damage to the environment' (NSC, 2012). Although the policy goals include establishing a recovery strategy to assure the displaced communities return to normal however there is a lack of initiatives on the criteria of disaster shelters that offer prompt, economical, sustainable and appropriate design criteria for the disaster victims. Karim et al. (2016) had highlighted that the massive flood incident in Kelantan in 2014, severely impacted the victims irrespective of their socio demographic background in terms of destruction to their homes, lack of drinking water and food, and loss of mobility in terms of transport.

The planning and design of post-disaster shelters are crucial to alleviate the above-mentioned risks for displaced victims from climate threat and to ensure safety, security and health (Bashawri et al., 2014). Consequently, there are various factors to be considered in designing shelters (temporary or permanent) as a vital part of recovery and reconstruction in the aftermath of a disaster. Perrucci et al. (2016) emphasize on the sustainable approach to include interconnected consideration on users need, including the culture, location, climate, affordability, constructability, etc. to ensure its success (Perrucci et al., 2016). From various world natural disasters such as Hurricane Katrina in New Orleans, 2005, it is highlighted that main issues in recovery and provisions of shelters especially permanent homes are logistic, contractual, late delivery and lack of suitability to users' needs (Patel & Hastak, 2013; Perrucci et al., 2016; Sukeri & Syazwani, 2016).

3. Research Questions

This research aims in identifying the Malaysian strategies tool and recovery provisions focusing on post-disaster shelters for flood victims. Therefore, the research questions that arise are:

- How are the post-disaster recovery shelter delivery implemented?
- What are the policies, strategies, tools and criteria on post-disaster relief shelters?

- Who are the key players involved and what are the integrated initiatives towards the disaster recovery systems?
- What are the problems faced by relevant agencies in implementing the shelters?

4. Purpose of the Study

The aim of this paper is to identify the current strategies in place and propose a framework that will offer an integrated approach within the existing set up to avoid delays in providing shelters to displaced victims. The main objectives of this research, in satisfying the research purpose and fulfil the above research questions are:

- To investigate on the implementation of the flood post-disaster shelter provisions in Malaysia
- To formulate an integrated post-disaster framework and recovery procedure checklist involving national agencies and key players

5. Research Methods

To achieve the above-mentioned research aims and objectives, the research is based on a Systematic Literature Review (SLR), is a useful method to link many diverse studies to interconnect and reinterpret them as part of theory building. It is hence a research in its own right and by its stature, is able to deal with a much wider enquiry than one empirical research is capable of, in investigating connections on various empirical findings (Baumeister & Leary, 1997). It is a preliminary part of a more focused research in this area. From the SLR, on current local scenario of threats, strategies, policies and implementation, it also draws on comparative studies from other countries to form a proposed framework in improving the delivery of post-disaster shelters in Malaysia. The investigation for this research mainly looks into the four phases of disaster management stages and role of agencies involved as well as how the relief and recovery plans are executed and can be exploited to include a planning, design and implementation of post-disaster shelters and if temporary or permanent shelters are appropriate or deemed necessary for the situations.

6. Findings

6.1. The Malaysian Scenario: Policies and Key Players

Malaysia has a five yearly plan document to underline the country's economic direction and in the 11th Malaysian Plan covering 2016 to 2020, Chapter 6 of the document stated that: 'Pursuing green growth for sustainability and resilience focuses on and one of the strategies, Strengthening resilience against climate change and natural disasters includes a comprehensive disaster risk management (DRM) framework' (EPU, 2016). The strategies outlined in Chapter 6 of the document are shown in Table 1.

Table 01. 11th Malaysian Plan (2016-2020): Chapter 6: Strategies and Objectives

11th Malaysian Plan (2016-2020): Chapter 6: Strategies and Objectives	
1. Strategy D1	Strengthening disaster risk management by establishing DRM policy and institutional framework, improving disaster detection and response capacity, incorporating DRM into development plans and creating community awareness;
2. Strategy D2	Improving flood mitigation by generating new investments from flood mitigation projects, enhancing long-term planning and strengthening flood forecasting and warning systems
3. Strategy D3	Enhancing climate change adaptation by developing a national adaptation plan, and strengthening resilience of infrastructure, natural buffers including water and agriculture sector as well as creating awareness on health impact.

Furthermore, similar to many other countries, the Malaysian National Security Council strategies towards disaster management are based on four phases of Disaster Management and Relief efforts as shown in Figure 2, with mitigation, preparation, response and recovery strategies (NSC, 2012). The disaster relief are tackled at three different levels according to the severity of the disaster, i.e. at the federal, state and district levels as shown in Figure 3 (NADMA, 2015). Many government and private agencies such as local authorities, Civil Defence Department, Armed Forces, Royal Malaysia Police, Ministry of Health and many other organisations (Sarkar, Begum, Pereira, & Jaafar, 2013). Chong and Kamarudin (2018) highlighted a total of 79 agencies involved in DRM process of any disaster. In 2015, in lieu of the 2014 flood, the National Disaster Management Agency (NADMA) was formed under the Prime Minister Department which held accountable in executing the Directive 20 responsibilities taking over from the National Security Council.

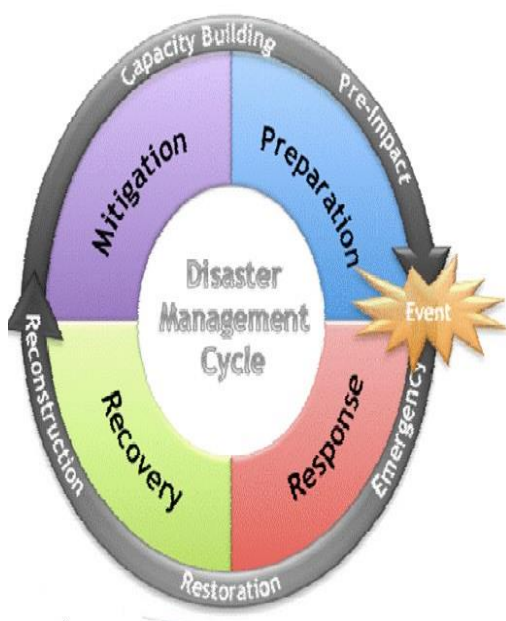


Figure 02. The Malaysian National Strategies

Source: NSC (2012)



Figure 03. Disaster management platform

Source: National Disaster Management Agency (NADMA) (2015)

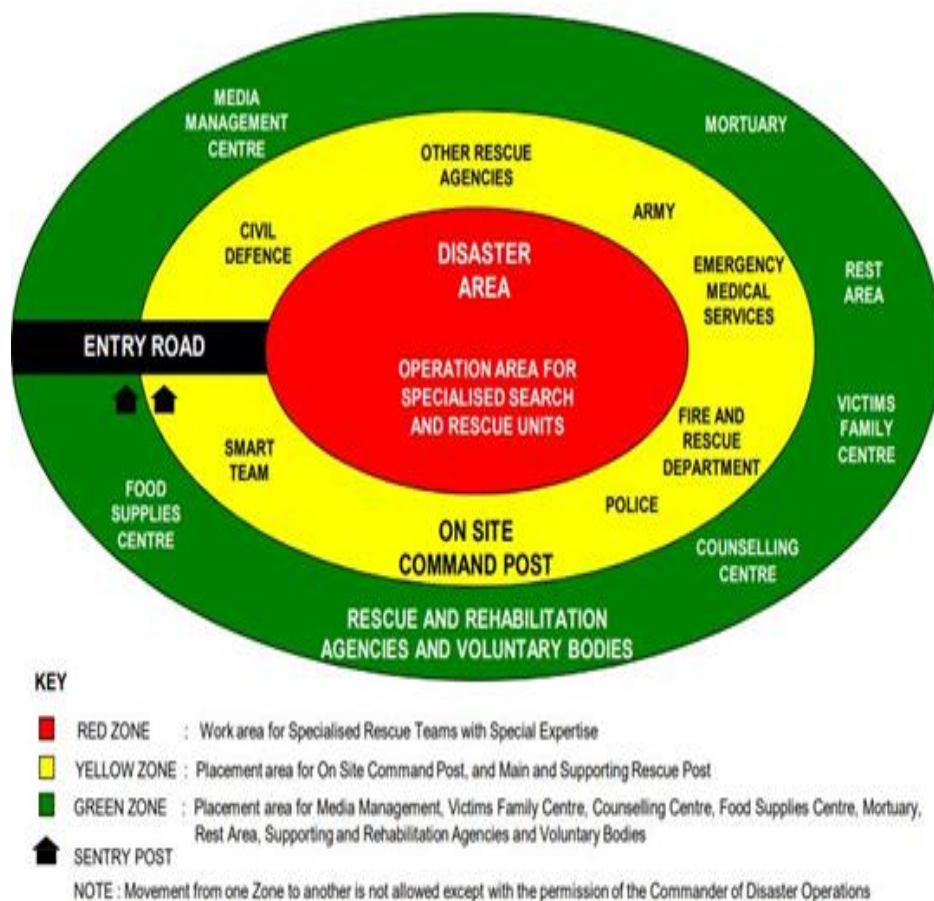


Figure 04. Disaster Management at the Scene of Incident According To Zones.

Source: NADMA (2015)

Figure 4 shows the rescue and rehabilitation structure in the response stage which should include relief shelters planning, provisions and erection as a vital part of the operation to ensure the safety and wellbeing of displaced victims.

6.2. Current Issues and Problems

The DRM of Malaysia had been put on test especially during the biggest flood in a decade in 2014. The problems and issues regarding the relief operation during the disaster had been revealed by many researchers. Shafiai (2016) indicated that the government only acted after the disaster occurred and did not foresee in the policy an adequate preparation for the future. It is also uncovered that the assistance provided to the victims was irregular, inadequate and delayed, especially in the aid distribution of food, water and other basic necessities (Karim et al., 2016; Nurumal, Aung, & Yusoff, 2017). Padlee, Razali, Zulkiffli, and Hussin, (2018) studied the issues on the quality of services provided in evacuation centres in East Coast of Malaysia and the management of those services, he revealed that the evacuees are generally satisfied by the services provided.

The temporary relief shelters were located in community halls and schools and were chosen based on their location and relative safety. The factor they were most satisfied were the health care by doctors and nurses and the least on telecommunication services (Padlee et al., 2018). The issue of mobility during

a disaster is also a critical factor, where Zahari and Hashim (2018) highlighted that victims may have to be relocated in the critical flooding stage to elsewhere due to relief centres submerged in flood water. This condition raises problems of relocating the evacuees, transportation issues and exposure to risk from the rising flood. According to Shazwani and Sukeri (2016), albeit the numerous policies instigated for every stage of the disaster, there are still problems encountered at the response and recovery stages in providing assistance and rehabilitation programs for victims, which consequently impacted their quality of life. On the same note, Roosli and O'Keefe (2013) recommended a re-evaluation of the current policy implementation.

It is evident from Figure 5, that not many agencies are responsible in the prevention and mitigation stage, albeit a crucial process of planning for the design and logistics of shelters should be focused. The attention is mainly placed on the response stage and even the recovery stage does not involve many key players as highlighted by Shazwani and Sukeri (2016) that there is a lack of post-recovery plans and infrastructure to handle post flooding catastrophes. Although, plans are devised for various stages and budgets allocations are apportioned but there is lack of actions in preparation until in the aftermath of the disaster. Consequently, the floods victims are left vulnerable and suffer from long term effect of losing their homes and business premises (Karim et al, 2016; Shazwani & Sukeri, 2016). The need for low-cost temporary shelter is expected to escalate due to the combination of increase in urban population and natural disasters due to global warming. Even though recovery is an important part of the cycle however the actual reconstruction process is lacking due to constraint in funding and lack of support from other agencies (Shazwani & Sukeri, 2016).

The designated Department of Welfare offer limited assistance in one off aid to the victims. MERCY Malaysia, an NGO organization had also played a crucial role in the recovery of shelters by assisting evacuees in rebuilding temporary homes in the recovery stage where the homes cost between RM10,000 to RM15,000 and took 5 to 6 days to build using materials from local supply with support from donations (MERCY, 2015).

The efforts by MERCY is commendable but raise the issue of ad-hoc solutions with problems of suitability, constructability, environmental and other issues which the government should tackle effectively. Subsequently, from the various issues emphasized based on the 2014 flooding experience, there is a need to formulate strategic planning and management implementation blueprints to reduce the disruptions and risks significantly for flood disaster victims (Zahari & Hashim, 2018). Chong and Kamarudin (2018) highlights three major problems in the effectiveness of the DRM process, firstly an imbalanced planning between top-down and bottom-up aspect, the focus mainly at response stage with little integration in other segment of the cycle and lastly insufficient long-term recovery planning.

List of agencies	DRM cycle				
	Pre-disaster		Post-disaster		
	Prevention	Mitigation	Preparedness	Response	Recovery
Agencies at Federal Level					
1. Malaysia Armed Force (ATM)			✓	✓	
2. Royal Malaysia Police (PDRM)			✓	✓	
3. Ministry of Finance			✓	✓	✓
4. Ministry of Women, Family and Community Development			✓	✓	
5. Ministry of Communication and Multimedia				✓	
6. Ministry of Tourism and Culture				✓	
7. Ministry of Health Malaysia			✓	✓	
8. National Disaster Management Agency (NADMA)	✓	✓	✓	✓	✓
9. Fire and Rescue Department Malaysia (JPBM)			✓	✓	
10. Malaysia Civil Defence Force (APM)			✓	✓	
11. Malaysian Maritime Enforcement Agency (MMEA)				✓	
12. Federal Department of Town and Country Planning Department Peninsular Malaysia			✓		
13. Department of Broadcasting				✓	
14. Department of Information				✓	
15. Public Works Department	✓	✓	✓	✓	✓
16. Department of Environment			✓		
17. Department of Social Welfare			✓	✓	
18. Department of Meteorology Malaysia (METMalaysia)			✓	✓	
19. Department of Civil Aviation Malaysia				✓	
20. Department of Irrigation and Drainage (JPS)	✓	✓	✓	✓	✓
21. Atomic Energy Licensing Board				✓	
22. Mineral and Geoscience Department Malaysia			✓		
23. Volunteers Department of Malaysia			✓	✓	
24. Department of Occupational Safety and Health Malaysia				✓	
25. Department of Water Supply				✓	✓
26. Attorney General's Chambers of Malaysia				✓	
27. Malaysian Communications and Multimedia Commission				✓	

Figure 05. Summary of the roles and responsibilities of agencies according to DRM Cycle– Federal Level. Source: Chong and Kamarudin (2018)

6.3. Learning from the International Experiences

The International Federation of Red Cross and Red Crescent Societies (IFRC) (2013) identify post-disaster shelters by several definitions: temporary shelter, transitional, progressive and core shelters based on the needs of victims in various stages of post-disasters. In the UK, BREEAM (Building Research Establishment Environmental Assessment Method) has developed a tool called QSAND (Quantifying Sustainability in the Aftermath of Natural Disaster), a sustainable yardstick towards setting

humanitarian aids to provide shelter and settlement after natural disasters for IFRC (QSAND, 2014). According to Potangaroa (2015), QSAND tends to devalue design and focus on sustainable coordination of issues. Studies across the globe shows that shelters meant for temporary usage ended up as long term structures for years or even decades after the disasters (Zhang, Setunge, & van Elmpt, 2014). The design of the shelters has to consider the lifespan of the structure from selection of the types of materials and sizes as well as the environmental impacts of the temporary shelters in the design phase (Perrucci et al., 2016).

According to the Sphere Project (2011), an adequate shelter has a significant impact on human survival in the initial stages of a disaster. Also called as evacuation centre, it is one of the important elements to have in place whenever a disaster happens and a place for the community to assemble (Somasundaram & Davies, 2014). The Sphere Project was instigated as a humanitarian venture by the International Red Cross and Red Crescent and the non-governmental organizations (NGOs). The purpose was to produce a set of universal minimum standards to assist humanitarian aid during a disaster (Zahari & Hashim, 2018), to include the following services: “type of shelter, sanitation, water availability, health facilities, food and nutrition, non-food items, accessibility, transportation, climate and environmental conditions, education and activities”. Temporary relief shelter or emergency shelter is the most basic shelter designated for short term use for life-saving purposes (IFRC, 2013) as an alternative to relief centre permanent building (used as a temporary centres) from an overnight stay to several days during an emergency (Quarantelli, 1991; Wu & Lindell, 2004; Johnson, Lizarralde, & Gonzalo, 2006; Johnson, 2007a; Johnson, 2007b). These temporary shelters usually discourage or prohibit self-food preparation or lacking in extensive medical support.

The United Nations High Commissioner for Refugee (UNHCR, 2007) – Handbook for Emergencies also spelled out the minimum standard of relief shelter also aimed to provide protection and ensure necessary needs of the refugees are met effectively and appropriately (Zahari & Hashim, 2018). Bashawria et al. (2014) studies on disaster relief shelters, ascertained that the provisions on disaster shelters are insufficient in tackling particular design issues to make them sustainable and to ensure their suitability for varied contexts and conditions. Patel and Hastak (2013) studied the scenario in the USA and emphasize that for effective solution in post-disaster housing, there should be four phases of strategies framework i.e. (i) pre-disaster planning, (ii) relationship between entities of players (iii) post disaster process and (iv) real implementation of the strategies.

Learning from Japanese experience after a massive earthquake, tsunami and nuclear meltdown in Tohoku, 2011, the *Machizukuri* planning concept, where local residents working closely with the government to achieve a livable city, fail to resolve bigger issues in various aspect i) the recovery effort headed by Architecture Institute of Japan bringing together architects, engineers, landscape architects with the community showed a slow result in recovery ii) the government efforts focusing on engineering solutions such as building gigantic seawalls raise concern on marginalising local community recovery process and iii) the planning regulations practice in Japan focus mainly on urban regions but the Tohoku disaster affects many rural fishing and ageing communities to be relocated to higher land raise issues on land acquisition and problems in planning on high topography as well as placing the fishing communities away from their livelihood (Murakami & Wood, 2014). It is highlighted that the recovery requires a long-term collaboration between all stakeholders. Two big hurdles were identified in solving the issues, firstly

the lack of planning framework and funding programs for a comprehensive redevelopment involving whole fishing communities and secondly, the challenge of design and massive structure such as giant seawalls , which will disturb the coastline and natural landscape (Murakami & Wood, 2014).

6.4. Proposed Post-disaster Framework

From the various literature and study on the scenario of flood post-disaster shelter it shows that the issue requires early planning in mitigation and preparation stage to integrate actions by relevant agencies towards a holistic approach. Exploiting on NADMA’s phases of DRM, the inclusion of relief shelters (temporary, transitional or permanent) is a critical aspect to be planned, designed and manufactured. Critically, a proposed set of strategy and criteria on delivery of shelters at the various DRM stages is shown in Table 2 which should involve more government agencies, NGOs and other stake holders.

Table 02. Proposed Framework on Post Disaster Delivery

FRAMEWORK ON POST-DISASTER SHELTERS DESIGN AND PLANNING STRATEGIES	
1) MITIGATION STAGE	<ul style="list-style-type: none"> ▪ The strategies already formed should not only focus on mitigation on disasters but also include a comprehensive approach on shelters planning and design, key players involved and their roles. ▪ There should also be a recommended resilient design criteria for flood and recommendation of actions by vulnerable communities ▪ Investigate alternatives solutions other than relief shelters using institutional building, with the idea of retrofitting those building with all essential and equipment for disaster preparedness or where designated shelters are vital
2) PREPARATION STAGE	<ul style="list-style-type: none"> ▪ Design and production of prototypes shelters suitable for Malaysian conditions for temporary as well as permanent types. ▪ Criteria for design: <ul style="list-style-type: none"> ○ Local, sustainable and available materials ○ Easy to construct with less machinery ○ Suitable for climatic and cultural conditions ○ Modular and prefabricated units ○ Flexible for other disaster besides floods ○ Strong to withstand heavy rain/storm ○ Self-generating electricity and access to water supply ○ Cost effective ▪ Agencies other than those agencies in place in NADMA DRM e.g. Public Works Department, others should be included such as: <ul style="list-style-type: none"> ○ CIDB for Quality Control ○ Ministry of Housing (for the permanent shelters) ○ Suppliers ○ Consultants ○ Contractors ○ Local communities prone to flooding ○ Expertise from Higher learning Institutions ○ NGOs ○ Mercy Malaysia, Red Crescent Society other charity organisations and volunteers ▪ Financial Aid in the production ▪ Designated Custodian of Shelters and project managers ▪ Procedural guidelines on shelter erection ▪ Identify the transportation Mode ▪ For scenario where prototypes are unnecessary the temporary relief shelters are using institutional building, the idea of retrofitting those building with all essential and

	equipment for disaster preparedness is essential and relevant.
3) RESPONSE STAGE	Phase 1- Pre-Disaster - Prediction on the magnitude of flooding and planning for predicted scenario, access situation if designated prototypes Phase 2- 0 to 5 days (Immediate Relief) - Transporting units to suitable sites-according to suitable mode - Erection of temporary shelters, active role by key players as identified in previous stage if temporary relief shelters (schools or community hall) are unsuitable for long period of stay for massive damages to avoid disruption if school resumes - Other vital aids- food, clothing, medicine
4) RECOVERY STAGE	Phase 3- 5 to 3 months (Rehabilitation Period)- - Managing the displaced victims return to original site, aid needed in rebuilding for worst case scenario Phase 4 – 3 months onwards (Reconstruction Period –permanent structures) - Assessment of recovery plans - Planning for long term recovery ‘building back batter - Concerted efforts both top-down and bottom-up approach

6.5. Key Issues to be Identified and Resolved

Although the framework is formulated to resolve on shelter provisions but there other related concerns surfaced from the studies and literatures, which necessitate a requisite study and tackled by the stake holders and key players to ensure that the framework can be implemented with less hurdles. The issues are as below:

- How disaster aid and help are distributed (should they be dispensed, subsidised or as grants?)
- How can local community play their roles to achieve balance between aid and self-help?
- How do the government control the reconstruction process?
- How to settle land issues (for temporary shelters on higher ground and reconstruction of permanent shelters if away from displaced victims’ original sites (IFRC & OCHA, 2015)?)
- An assessment guideline for various phase of disaster to identify the problems, the source of problems and course of actions which should be linked to roles by various agencies clearly defined to ensure swift actions in response and recovery stages (IFRC, 2013)
- A balance between building speed in recovery to reduce disruption of lives, business and other economic issue involving the communities against ‘building back better’ with proper planning as a window of opportunity from a disaster (Platt & So, 2014, UNISDR, 2015)
- The development of a model to accommodate the best practice of a temporary relief shelter with the adaptability via retrofitting the institutional building is in urgent need where currently there is no attempt to the development of such model in Malaysia. Since most of the temporary relief shelter are using institutional building, the idea of retrofitting those building with all essential and equipment for disaster preparedness is seem sensible and relevant.
- Funding programmes to ensure economic sustainability

7. Conclusion

By looking at the issues and problems related to disaster relief shelters from the previous literatures, it is essential for the government to take proactive actions especially on the disaster

preparedness in planning and designing for the shelters utilising the current policy already in place to counter any loophole in the existing system. The approach must be a collaborative and rigorous effort not only from top-down as a policy but should also stem bottom-up bringing all parties such as NGOs and volunteers and flood communities' active participation to achieve the best solution. This ongoing dialogue and participation should not be reactive when a disaster strike but as an important agenda for the country to be better prepared for the future as other countries with more common disasters such as Japan, which has a long ongoing DRM in place still encounter several difficulties dealing with massive destruction from their latest natural disaster threats. This proposed research is expected to fill the gap in the area.

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