

Effective Emergency Management: Scrutinizing the Malaysia Lead Responding Agency Planning and Information Management Approach During Disaster Exercise

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ABSTRACT

The impact of a disaster is closely related to the response and recovery of the lead responding agency in managing the disaster effectively. Malaysia has established the MNSC20 policies for managing disasters. Unfortunately, the implementation of MNSC20 can only be evaluated through lead responding agency disaster exercises. Each responding agency's responsibility is to identify and record the information as required to ensure effective emergency management; however, problems in terms of inaccurate and/or incomplete information may be many challenges that need to be addressed. Hence, this paper aims to propose several areas for improvement for planning and information management elements

in effective emergency management theory by identifying its challenges through the FRDM, which may benefit Malaysia's overall emergency management process. Four disaster exercises at the state and federal levels were observed using a structured checklist. The result indicates challenges were found in terms of proactivity in gaining information, disseminating critical information during emergencies, developing a specific incident action plan, and media management. A good area of improvement is

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suggested based on the evaluation. It is hoped that this paper could contribute to developing better disaster management by the lead responding agency in Malaysia.

Keywords: Emergency exercise, disaster management, information management, planning

INTRODUCTION

For successful implementation, disaster management should encompass vulnerability assessment, planning (incident action plan), training or exercise, logistic capability, and financial capacity, which are the opposite scopes of preventing disaster (Bullock et al., 2020; Sandler & Schwab, 2021). As an emergency happens and the severity has caused a disaster, minimizing the losses from the direct impact of the disaster is critical, hence indicating the importance of the response and early recovery phases in the process cycle of disaster management (Bullock et al., 2020; Samsudin et al., 2018). The process cycle of disaster management includes the overall response in reducing the losses during the disaster and possible losses that arise from the immediate disaster impact.

It is also important to understand that the overall response process includes the early recovery phase (Samsudin et al., 2016c). Single or multi-entity command structure during the management of emergency, management of planning and information coming in and going out from the emergency site, matrix of communication and notifications, current situational awareness of single or multiple situations at the site, and capacity and capabilities in managing emergencies are five of the main elements in managing emergency effectively (Kamarudin et al., 2016; Hussin et al., 2018; Samsudin et al., 2016c). In an emergency, each responding entity's responsibility is to identify and record the information as required appropriately. However, Bharosa et al. (2010), Jiang and Yuan (2019), and Waring et al. (2020) mentioned that problems regarding inaccurate and/or incomplete information between entities are not to be neglected due to possible additional losses.

Hence, Disaster Planning and Information Management will affect the outcome of the disaster (Kamarudin et al., 2016; Jiang & Yuan, 2019; Waring et al., 2020). These problems include the differences in terminology used in information sharing, inability to understand other agencies' information, lack of information management, and lack of an appropriate common operational picture as the information management limiting factor during disaster management (Lestari et al., 2019; Salmon et al., 2011; Samsudin et al., 2020d). The disaster management environment in Malaysia is outlined in MNSC20, which mentions that the response and early recovery phases shall be led by specific lead responding agencies (MNSC, 2012). For physical-based hazards such as floods, fire, transportation accidents, chemical releases, and more, it shall be led by the Fire and Rescue Department Malaysia (FRDM), hence the main source of data later for this paper (Samsudin et al., 2018; MNSC, 2012).

Experts are crucial in providing views, analyses, and solutions during disasters, as presented in earlier studies towards FRDM personnel (Samsudin et al., 2016b). Moreover, data and information need to be analyzed objectively to provide the most effective ways of managing emergencies, indicating the importance of experts in assisting the responding agency in the overall and specific planning and information during the response and early recovery phases of disasters. Unfortunately, to the authors' discernment, no studies have been made on planning and information management in effective emergency management towards lead responding agencies in Malaysia. Thus, this paper aims to use six disaster exercises at the federal and district level to propose several areas for improving the planning and information management elements of an effective emergency management theory that could benefit Malaysia's overall emergency management process.

METHODOLOGY

As part of a larger disaster management research study in Malaysia, the methodology used has been validated in previous publications (Hussin et al., 2018; Samsudin et al., 2017a; Samsudin et al., 2017b). Two methodologies were used in this paper: the systematic observation and survey questionnaire towards the subject matter experts. Both methodologies have been validated in previous studies and published (Samsudin et al., 2020c; Samsudin et al., 2020d) as part of the larger research scope. The subject matter experts for this study are the officers from the lead responding agencies responsible for the decision-making process during emergencies (Fire and Rescue Department Malaysia) (Samsudin et al., 2020a; MNSC, 2012). The systematic observation was conducted during disaster exercises, namely the EXSTORM. As with any federal level exercise conducted in the country, EXSTORM is a bi-annual disaster exercise effort outlined by the Fire and Rescue Department of Malaysia (FRDM) originally to train the FRDM Special Tactical Operation and Rescue Team of Malaysia (STORM). Due to the dynamic scenario and the exercise scale, EXSTORM has gained cooperation from primary and secondary agencies in Malaysia, as outlined in MNSC20 (MNSC, 2012). Six EXSTORM exercises were observed during this research. EXSTORM is selected as one of the primary sources of data for this study due to several reasons:

- based on Malaysia's disaster management policy, the disaster level will be declared as state or federal;
- the emergency drill or exercise provides excellent opportunities for observation;
- the exercise is orchestrated with multiple events and casualties so that real situation scenarios and worst-case scenarios.

The exercise was orchestrated to involve multi-agency to increase the coordination and cooperation of multi-agencies in Malaysia. The first methodology is the qualitative observation of the disaster management process as published in earlier studies (Samsudin

et al., 2020c; Samsudin et al., 2020d). Observing a real disaster might be challenging compared to disaster exercises that can be done more frequently (Samsudin et al., 2017b). Furthermore, the exercises can provide researchers with a rich data source as EXSTORM is conducted bi-annually and provides excellent opportunities for researchers (Jiang & Yuan, 2019; Lestari et al., 2020). Even though the scenario, exercise venue, and time are different for each exercise to ensure the best possible near to real-life scenario, it is negligible as the research concentrates on the emergency management process. Hence any tactical actions by responders are not part of the collected data. A structured observations checklist aided the observation process of all EXSTORMS exercises to ensure systematic data collection. This validated checklist was developed via document review methods involving procedures, reports, guidelines from Malaysia lead responding agencies, and international standards containing an element of effective emergency management and ensuring the reliability of the results (Samsudin et al., 2020b; Samsudin et al., 2020c; Samsudin et al., 2020d). It is validated through the content and face validity method (Hussin et al., 2012). Hence the following three validation approaches were used: the verifications from lead agency officers at the site who act as exercise observers and controllers, exercise logs recorded by both exercise controller and the observed exercise participants, and finally, the emergency exercise reports by FRDM published after each EXSTORM exercise combining views from all participating entities (Samsudin et al., 2017b; Samsudin et al., 2016c; Samsudin et al., 2020d).

The second methodology involves quantitative data extracted from questionnaires published in earlier studies (Samsudin et al., 2020c; Samsudin et al., 2020d). It is a survey where the subject matter experts (FRDM officers) were required to answer sets of structured questionnaires to obtain quantitative data on the knowledge and practice of managing emergencies (Samsudin et al., 2020b; Samsudin et al., 2016b; Samsudin et al., 2020d). This survey is conducted via an online platform where the FRDM Headquarters requested participants. All respondents were decision-makers during disasters from districts, states, and federal levels as categorized in MNSC20 (MNSC, 2012). The survey questionnaire is designed to engage the respondent to provide their knowledge and practice in managing operations during disaster situations and their needed support. As mentioned earlier, the respondents for this study are the subject matter experts from FRDM who have the authority to make decisions during disasters. Cronbach Alpha statistical test conducted on the questionnaire indicates a fair value of 0.91 (Samsudin et al., 2020c; Samsudin et al., 2020d). Earlier studies concluded that an estimated total number of 2000 FRDM officers involved in the decision-making process (inclusion criteria), and by referring to the standards population sampling of 95% confidence level with a 5% margin of error, a total number of 323 respondents shall be needed to ensure the reliability of the results (Samsudin et al., 2017b; Samsudin et al., 2020c; Samsudin et al., 2020d). Therefore, it is advantageous for this study as the total recorded respondent exceeded the minimum

requirement, with an additional 26% more respondents totaling 407 views from subject matter experts recorded.

The total respondent numbers are contributed mainly by the implementations of digital surveys using Google Forms, as Google Forms provide the ability to provide users with ease of response and portability of access. Furthermore, some research has recognized Google forms as survey tools (Khan et al., 2021; Samsudin et al., 2020d; Shoaib & Abdullah, 2020; Travis, 2010). Google Form can provide multiple question formats, including checkbox, close-ended, matrix, open-ended and more, record logs of the respondent, compiling the respondent data in providing basic descriptive (Samsudin et al., 2017b; Khan et al., 2021; Shoaib & Abdullah, 2020).

For the specific purpose of this study, other elements of effective emergency management shall not be discussed, and the author shall focus on the elements of planning and information management (Kamarudin et al., 2016; Hussin et al., 2018).

RESULTS AND DISCUSSION

Bharosa et al. (2010), Cruz and Ferenchak (2020), and Sardi and Razak (2019) stated that during disasters, pertinent information is sometimes not identified, causing delays in response operations. Samsudin et al. (2016d) and Samsudin et al. (2020c) supported this, where planning and information management are critical elements in managing disaster effectively and need the expert's assistance. Similar issues were observed during the EXSTORM exercises where pertinent information was not identified, causing delayed planning and response.

Throughout the observation process during the EXSTORM exercise, non-standardized forms are used to manage the whole operation. Most of the forms were developed on sites during the operations, depending on the on-site officer experience. This practice has caused inaccurate and/or incomplete information recorded from the activity. Nevertheless, even if one agency has recorded information, the information gained will then be manually recorded by another agency officer rather than disseminated to every agency on-site. This practice is causing inaccurate and/or incomplete information received by agencies due to the difference in the terms used and delays in disseminating pertinent information such as hazards involved, victims list, and action log. In addition, during the EXSTORM exercises, it is observed that improper documentation has caused lessons from past experiences to be hard to learn and improve, adding to the information dissemination issue (Kurita et al., 2006).

It is widely understood that during emergency response and early recoveries, the priorities of any entities responding to the emergency are to minimize the loss and protect the people, assets, and the environment (Haddow et al., 2017). It can be accomplished by properly implementing appropriate emergency response and planning (Shaluf, 2008).

Experts or professionals should always be involved in any emergency planning process. However, during the exercise, it is observed that planning is mainly based on the experience of the commanding officer rather than referring to any written roles and responsibilities, supporting documentation, or even information gained during disasters. The absence of strategic planning expertise introduces limitations in managing the disaster (Moynihan, 2009; Samsudin et al., 2017a). MNSC20 stated the importance of external entities involved in managing disasters aside from leading responding agencies (MNSC, 2012). It is noted that both the external entity and lead responding agency involved in the EXSTORM exercise is inefficient. Some even missed sharing and obtaining pertinent information regarding the incident involved. In one of the exercises observed, the lead responding agency overlooked the information provided by an external entity participating in the exercise.

Quarantelli (1997) and Waring et al. (2020) stated that continually updating information during a disaster will effectively increase the effectiveness of the planning process in managing disasters. One of the exercises observed a lack of current information feeds, causing multiple incident responses to be conducted in series rather than parallel responses. Therefore, it affects the overall disaster response and recovery when dealing with the incident in series, increasing the duration of the overall operations. It is supported by Cruz and Ferenchak (2020), Reid and Van Niekerk (2008), and Sardi and Razak (2019), whereby the lack of pertinent information available and delivered on time is causing delays in response and recovery efforts. Therefore, information management is considered one of the elements of effective disaster management during the response and early recovery phase (Samsudin et al., 2016b).

Challenges and Improvement

Effective disaster management during the response and early recovery phase consists of five major elements and timeframe parameters (Kamarudin et al., 2016); this point is mentioned by Hussin et al. (2018), which summarized that the most crucial elements are planning and information management.

This paper found five major planning and information management challenges found during the observation of EXSTORM's exercises. First, the information management is based on the officer's experience managing it, causing non-standardized forms used by the responding agencies. Therefore, all planning and information management are based on the responder's experience and expectations. Standardized forms will eventually assist responding entities in managing key and pertinent past, current, and future information. The emergency can be managed more effectively via proper standardized records, including a written incident action plan that plays a significant role in recording the strategic path of the disaster operations (Samsudin et al., 2020b; Samsudin et al., 2020d).

Secondly, the dissemination of information is only done upon request from other entities, causing the strategic planning and abundance of information that came through

the command post to be not properly disseminated. Occasionally during the observations of EXSTORM, other entities manually record all the information gained by FRDM and vice versa. Without proper dissemination platforms, it is proven that records are only kept at the site of the operations before being discarded.

Thirdly, the non-availability of an incident action plan for the overall disaster management adds to the effectiveness of a written incident action plan to be prepared for each minor incident (Madigan, 2017). Recorded and managed incident action plans will eventually strategize the whole operations and eventually will be a pertinent record (IAP reference) for lesson learning (research and development) and training exercises for new responders.

Fourthly, information identifications are based on current needs only without identifying the future possibility of disaster events which can cause a possible unexpected escalation of events contributing to more losses and damages managed (Sardi & Razak, 2019; Waring et al., 2020).

Finally, the media are managed based on officer experience rather than a written guide that should be made available and easily accessible. This challenge is supported by a study indicating that poor media management is part of human factors for effective emergency management (Hussin et al., 2018).

Planning and Information Management

Planning and information management play an important role in managing disasters effectively during the response and recovery phase. The objective of emergency management is to bring the response time as early as possible, and this can be achieved with proper planning and information management (Subramaniam et al., 2012). Proper planning and information management include the time taken for initial size-up and dissemination of size-up information. The survey indicates that 92.1% of respondents conduct an initial size-up within 30 minutes with a maximum of two hours. Regarding the dissemination of the size-up information, the survey indicates that 88.4% of respondents disseminated the information to other agencies involved during the disaster within two hours, with a maximum of six hours. This survey result shows that dissemination of information, especially towards other agencies, is not prioritized, as proven during the EXSTORM's observation.

Size-up from responders will lead to the attainment of additional information regarding the disasters. Surveys result indicates that responder prioritizes their method of acquiring information from victims (82.7%), representatives (81.9%), and witnesses (77.3%) compared to other sources, such as academic references (73.6%), paper data (70.1%), and information technology (69.9%). Survey results support that 82.8% of respondents agree that attained information is recorded. Although 84.7% of respondents state that they need

to know the other agency’s information, only 56% of respondents disseminate information to another agency. At the same time, other respondents distribute the information to another agency when ordered or requested (21.6%) or never disseminate the information to another agency (22.4%). It is proven when only 59.4% of respondents agree that information acquired is accessible to another agency.

Compared with the dissemination of information and accessibility of information within an agency, survey results show that 72.3% of respondents disseminate it internally, and 73.8% agree that this information is readily available. Unfortunately, the survey questionnaire did not indicate the depth of the information that can be accessed internally. Therefore, the information that can be accessed internally is the only summary of the disaster and not the detailed information. Table 1 shows the respondents’ responses to information management.

Table 1
Survey on single agency and multi-agency information management

Information management	Yes (%)	Order/ Request (%)	No (%)
Recorded	82.8	9.4	7.8
Disseminated internally	72.3	11.1	16.6
Accessible Internally	73.8	14.1	12.1
Disseminated to another agency	56	21.6	22.4
Accessible to another agency	59.4	24.5	16.1

The method of information dissemination was also surveyed, and multiple modes of information dissemination can be used to disseminate the same information depending on the type of information. As indicated in Table 2, it is found that for single agency response, the method of information dissemination is mainly through the GIRN (MNSC, 2012) system (81.1%) followed by a face to face communication (80.3%), information technology (73.1%), audio communication (71.2%) and finally through papers (69.3%). The results are different when looking at the response for the multi-agency method of information dissemination, where the priority is given to face to face (80.1%), followed by paper (67.3%), information technology (65.9%), audio (62.6%), and finally GIRN system (59.9%). The survey results indicate that paper documentation is the least used method compared to the face-to-face method in disseminating information, as observed during EXSTROM’s exercises. EXSTORM’s observations supported these findings, where minimum use of paper records was observed. At the same time, although the survey indicates the use of information technology as a method of information dissemination, unfortunately, the responders only use social media to disseminate their information which is also observed during the EXSTORM.

Table 2
Surveys on the method of information dissemination within a single agency and multi-agency

Method of information dissemination	Used (scale 4) and most used (scale 5) by Single Agency (%)	Used (scale 4) to most used (scale 5) by multi-agency (%)
Face to face	80.3	80.1
Papers	69.3	67.3
Information technology	73.1	65.9
Audio	71.2	62.6
GIRN	81.1	59.9

The use of standardized forms in recording disaster planning and information, such as incident action plans, meteorological data, area mapping, and victim information (Samsudin & Hussain, 2016), will eventually assist responders in managing planning and information.

It is important that during the response and the recovery phases of disasters, planning and information be managed, as stated by Kamarudin et al. (2016) and as discussed during the observation of EXSTORM. As presented in Table 3, the survey questions result indicates that 86.1% of responders agree that standardized forms within the agency are used during disasters. However, only 58% of respondents agree on the easy accessibility of the forms during disasters, and 64.9% agree on the easy availability of the forms after a disaster. As discussed earlier, the responders understand that the information recorded on the forms is only the summary of the disaster and not the detailed information. Regarding standardized forms used during a multi-agency response, only 56.1% of respondents stated that standardized forms are used. However, to the researcher’s discernment, there are no standardized forms mentioned in any multi-agency response as there is a Frelack of supporting governance for MNSC20 (Samsudin et al., 2016d).

During the observation of EXSTORM, it is summarized that one of the challenges in managing disaster is near to no existence of standardized forms used either by the single agency or multi-agency response. Hence, the survey results show that 89% of respondents stated the importance (important and very important) for responders to have a digital form to assist them in managing planning and information during the response and early recovery phase of disasters, as illustrated in Figure 1. The importance of having digital forms is supported by descriptive statistics indicating the mean at 4.47 and a standard deviation of 0.75.

Table 3
Survey on standardized forms used in managing disasters during responses and early recovery phase

Standardized forms	Yes (%)	No (%)
Used within agency	86.1	13.9
Used during multi-agency	56.1	43.9
Accessible during disasters	58	42
Records accessible after disasters	64.9	35.1
Accessible to another agency	59.4	16.1

Types of planning and information management that are deemed to be important (scale 4) and very important (scale 5) by respondents include victim’s information (68.6%), hazards involved (72%), workforce availability (69.5%), logistical capability (69.8%), location blueprints, (65.9%), surroundings information (64.3%), communication matrix (60.2%), area maps (55.3%), and meteorological data (54.1%). Other respondents (below 10%) stated either information might be moderately important (scale 3) to not important (scale 1). These results indicate that responders’ planning and information management needs are prioritized as follows:

- What can be seen at the site of the disaster: hazards involved and victim’s information
- Offensive and capability at disasters site: workforce availability and logistical capability
- Community information: surroundings information
- Supporting information: communication matrix, area maps, and meteorological data

It is also observed during EXSTORM that media release by responders was not prepared and was not supported by any documented records. However, as indicated in

Table 4, survey results indicate differently, with 79.4% of responders stating that there are guidelines for media release and the media release is initially prepared (78.6%) and recorded (72.1%). Researchers assume this response is based on what should have been done rather than responders’ practice during the actual situation.

A survey on planning and information management also shows that multi-agency roles and responsibilities are known by other responders (88.6%), and these roles and responsibilities are clear to another agency (82.7%). In addition, 74.9% of respondents know other agency actions, are well informed of supports needed (85.8%), and know what support needs to be given to another agency (87.3%). These statistics are believed to be based on respondents’ understanding of MNSC20, as the document indicates the roles and responsibilities of all agencies involved during disasters, hence showing the above response (Samsudin et al., 2016a; MNSC, 2012). Furthermore, EXSTORM

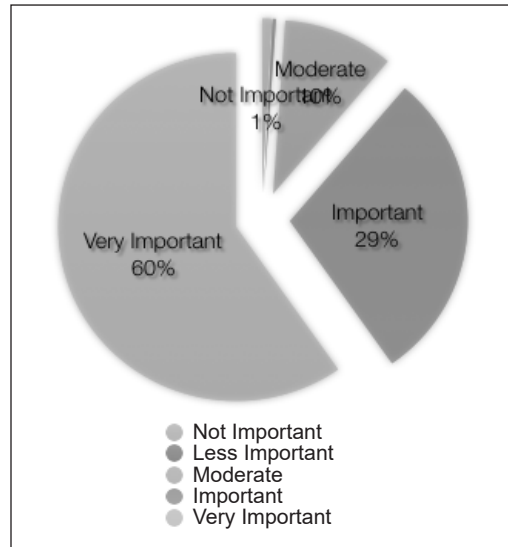


Figure 1. Survey on the importance of digital forms in planning and information management

Table 4
Survey on the media release

Media release	Yes (%)	No, and not sure (%)
Guidelines	79.4	20.6
Prepared	78.6	21.4
Recorded	72.1	27.9

found that some actions by other agencies are not supported by other agencies involved in disasters. These findings suggest that a system that records and manages all agency actions during disasters will eventually inform the other agency of the support they need. Table 3 shows the survey on the multi-agency response. The system should also be developed based on the needs and requirements of the Malaysian disaster management environment (Samsudin, 2018; Samsudin et al., 2020c).

CONCLUSION

An overall observation of the six EXSTROMS indicates challenges in three major areas. First is the heavy reliance of emergency managers (lead responding agency officers) on experience without much support from pertinent information in the analysis and decision-making process during the response and early recovery phase. Secondly, the effectiveness in managing information that comes in and goes out from the designated lead responding agencies command post is lacking. Finally, unavailability of experts in analyzing and managing information hence missing important responses and early recovery process. The authors also concluded that, from the observations of EXSTORM, effective emergency management could be further improved, especially if the elements of planning and information management are further focused on. Firstly, officers in the command post need to have clear written roles and responsibilities, which can be easy to refer to during single or multi-agency emergencies to ensure comprehensive planning and information management. Secondly, it is crucial to have and implement standardized forms and records throughout the emergency management process to ensure effective and comprehensive records and dissemination of information, especially during multi-agency responses. Finally, as each emergency has its unique challenges, the authors believed that third parties subject matter experts should be identified (Samsudin et al., 2016b; MNSC, 2012), especially for identifying and analyzing critical pieces of information and records. The involvement of third parties subject matter experts can also ensure the safety of on-site emergency responders. All the mentioned recommendations in this article were also supported by Samsudin et al. (2020d). Although the novelty of this research is the method and tools used for the observations during disaster exercise, the specific sections of the observation checklist have made it possible to identify the challenges and actively propose the area for improvement. The authors believe that a better disaster management process can be achieved in Malaysia by further improving the planning and information management approach.

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