



MAKALE / ARTICLE:

A UNIFIED APPROACH FOR ENHANCING EARLY WARNING SYSTEM IN THE UNITED ARAB EMIRATES

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ABSTRACT

Natural Hazards can be unpredictable in their occurrence and impacts. Uncertainty such as this has emphasised the importance of preparedness measures and activities. But it can be challenging to coordinate resources, manpower, equipment and all emergency preparedness elements in an effective manner before the occurrence of any natural hazard. This study examines elements of Early Warning System, and application of unified approach informed by coordination theory and collaborative principle. The potential benefits of using a unified approach formulti-agency working for the deployment of early warning system are evaluated using the current practice of early warning system in Abu Dhabi and the multi-agency working in preparing for and responding to natural hazards in Abu Dhabi. Literature that explains concept of coordination and collaboration is examined, and cases of incidents in Abu Dhabi were also evaluated. Semi-structured interviews were conducted in six organisations involved in natural hazard early warning, preparedness and response in Abu Dhabi Emirates. The result showed limitedrisk knowledge, and fragmentedpractice in the way early warning, dissemination, communication and response capacity for natural hazards is conducted. The outcome emphasises the need to adopt coordinated and collaborative principles for the deployment of effective early warning system, preparedness and response to occurrence of natural hazards in Abu Dhabi, and UAE in general. Limited risk knowledge, and disjointed practice will also be improved as a result of using a unified approach.

Keywords: Early Warning System (EWS), Preparedness, Natural hazards, Response, Unified approach

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1. INTRODUCTION

The United Arab Emirates (UAE) faces natural hazards such as earthquakes, tropical storms, sand storms, landslides to mention a few (Dhanhani et al., 2010). While the accurate prediction of natural hazards continued to pose a challenge (Grasso, 2014), it is acknowledged that certain level of preparedness and rapid response to their occurrence can mitigate the impacts of natural hazards on people, environment and development (Matthew and Kapucu, 2008). Despite the awareness and global emphasises on preparedness, focus on disaster risk reduction (UN, 2006) and equipping for rapid response (Comfort and Kapucu, 2006), events of natural hazards in the UAE in recent years have shown weakness of early warning deployment and response with limited coordination. UAE has experienced Cyclone Gonu in Fujairah in 2007, floods in Sharm in 2009, Al Samkha floods in Abu Dhabi in 2013, and storm in Ruwais, Abu Dhabi in 2013 (ADP reports, 2013). The occurrence of these events interfered with economic activities and livelihood (Momani and Fadil, 2011). Beyond this, they exposed the lack of Early Warning System (EWS), ineffective deployment of EWS and problems with multi-agency working for preparedness and response to natural hazards in the country.

Established agencies that are responsible for emergency management activities in the country seem to be competent in responding to human induced hazards, but struggle with dealing with natural hazards. The impacts of the above-mentioned events have also motivated the need for this study as well as investigation into the causes of lack of EWS deployment or ineffective EWS. This paper aims to examine elements of EWS, and application of unified approach informed by coordination theory and collaborative principle. The current deployment of EWS in Abu Dhabi is examined against the four inter-related elements recommended by the United Nations (UN) for effective deployment of EWS. The plan of this paper is to examine the elements of EWS, and to discuss methods used for conducting the study presented in this paper. Other sections are; results and discussions, implications and recommendations, and the conclusion which summarises the main findings and contributions of this paper.

2. ELEMENTS OF EARLY WARNING SYSTEM

The UN (2006) states that an effective EWS must consist of four inter-related elements which are also crucial for the effective deployment and these elements are outlined in Table-1.

<p>Risk Knowledge</p> <ul style="list-style-type: none"> - Data collection - Risk Assessment 	<p>Monitoring and Warning</p> <ul style="list-style-type: none"> - Hazard monitoring - warning generation
<p>Warning Dissemination and Communication</p> <ul style="list-style-type: none"> - Communicate Risk information - disseminate early warning 	<p>Response Capability</p> <ul style="list-style-type: none"> - Build community response - capability for preparedness and awareness

Table 1: Four elements of effective EWS (Adapted from UN, 2006)

The table shows that risk knowledge, monitoring and warning, warning dissemination and communication, response capability are all main elements required to deploy effective early warning (UN, 2006). It can also be inferred that these are the elements required for collaborative approach in developing effective EWS in the United Arab Emirates (UAE) or any context. Collaborative approach which is a major key word in this study refers to one of the principles of emergency management recommended by FEMA in 2007. The International Association of Emergency Managers (IAEM) states that collaborative principle which informed the collaborative approach helps to create and sustain broad consensus which facilitates communication. Therefore, collaborative approach as inferred in this paper is the ability to create, and maintain relationships among organisations and individuals, with the view to encourage trust, facilitate communication and build consensus (IAEM, 2007)

For instance, the sub-elements in table 1, provide detailed description of minimal activities that must be carried out under each element. Combined elements as outlined in the table further emphasise the importance of developing capacity for managing risks of natural hazards and for collaborative approach to incorporate;

- data collection and risk assessment
- hazard monitoring
- warning generation
- communication of risk information
- dissemination of warning message
- building response capability for preparedness and awareness (UN, 2006)

It is rational to imply that, collaborative approach is essential within the context of developing and deploying EWS, since different organisations and emergency agencies are responsible for implementing the element mentioned in the UN model. The duties and responsibilities of these organisations are divided between the preparedness phase and the deployment of EWS during the response phase based on capacities (Wenzel and Zschau, 2014). However, past natural hazards have shown that EWS in Abu Dhabi require better resource allocation and maintenance, coordination, communication as well as timely decision making. Factors that are needed in order to enhance multi-agency working for EWS (Horan and Schooley 2007). Janssen et al. (2010) argue that concept of collaborative approach is capable of enhancing response to natural or human induced hazard through information sharing, and interactions between actors in complex and uncertain environment. Janssen et al. (2010) further emphasised that network of agencies formed for the purpose of emergency management are saddled with the responsibility of sharing information across strategic, tactical and operational echelons across agencies. Multi layered and cross agency responsibilities such as these align collaborative approach with effective development and deployment of EWS.

Communication and information sharing prior to, during and after incidents are key to the development of EWS element. Beyond this, the process of information sharing provides an enabling environment for better understanding among agencies and opportunity to develop agreement for managing identified risk (Villangran de Leon, 2012). Regardless, good coordination and collaborative working between networks of agencies is not immune to external factors or dynamic disaster conditions (Comfort and Kapucu, 2006). This is because information sharing and coordination between agencies or organisations involved in emergency response can be hampered by time pressure under dynamic conditions in which emergency occurs (Comfort and Kapucu, 2006). Despite this, Faraj and Xiao (2006) argued that such disruption can be reduced

through better coordination prior to the occurrence of any disruptive event. This explanation is supported in the publication by Green (2000) who argue that good emergency plan and joint preparedness activities such as training and exercise promote better response.

Exercise is not sufficient in itself as preparedness measure, but it is crucial to communicating risk information, and as well as encouraging risk assessment; both which are elements of the UN EWS. For instance, Phelps (2010) explained that exercise is the aspect of emergency preparedness measures that focuses on equipment testing, resources, and tools management between organisations / agencies who will be responsible for dealing with actual emergency situation. The explanations provided by Comfort and Kapucu (2006), Green (2000) and Phelps (2010) identify the link between preparedness activities and response, and that collaboration and coordination between organisations are important. The IAEM however explains that the coordinated principle ensures that all activities of all relevant stakeholders are synchronised to achieve common purpose of emergency management. This infers that it is not only the collaboration that matters in emergency preparedness and response, but the coordination of all activities for a common purpose. Despite this, Faraj and Xiao (2006) argue that limitations of the coordination is that dynamic situation of emergency often warrants varied needs and response arrangements which still frustrate the process. As noticed, the limitations of coordination are identified in the response phase during dynamic emergency situation, and not during the preparedness phase. Thus, inferring the importance of fusing collaborative principle and coordination mechanisms rather adopting them individually so that the unified principle is flexible enough to support EWS development and deployment. Mendoca (2007) already revealed the ability and benefits of unified approach which combines coordination and collaboration as having potential to help improvise response arrangement where needed during emergency response. Since literature in this study area supports the feasibility of unified approach enhancing emergency management activities, the unified approach is adopted to explain the application of the four elements of EWS to natural hazard response. Establishing this premise provides a benchmark for evaluating the current deployment of EWS elements in Abu Dhabi. The evaluation aims to identify factors that contributed to lack or limited EWS deployment in the past, and the level of coordination and

collaborative (if any) between emergency organisations for developing elements of EWS in the Emirates.

3. METHODS

This study used semi-structured interview and document review as the data collection techniques. These techniques facilitated the collection of rich and valid data through primary and secondary sources. The secondary sources data were from reports from Abu Dhabi Police which presented information about previous incidents, risk knowledge, monitoring and warning procedures, warning dissemination and communication as well as response capability. The primary sources data were from semi-structured interviews sessions conducted in different organisations in the UAE. A total of six agencies responsible for emergency planning and response to natural hazards were interviewed in order to identify the problems with deployment of EWS. The participating agencies or organisations and their responsibilities are outlined in Table-2.

Agencies/Organisations	Responsibilities
1. National Centre for Meteorology and Seismology(NCMS)	For monitoring of natural hazards and disseminating warnings to other organisations
2. Abu Dhabi Municipality	To support public education and information regarding EWS and advise and clean-up after event of natural hazard
3. National Media Council	Communicating warning messages to the public and emergency agencies
4. Abu Dhabi Civil Defence	Pre-event warning, public education, awareness and information
5. National Crisis & Emergency Management Authority (NCEMA)	Planning arrangements and developing capabilities of emergency agencies
6. Ministry of Education	Facilitate public education and early warning messages in schools

Table 2: Agencies interviewed and their responsibilities for EWS

The study used non-probabilistic sample method to determine and select the interview participants. The convenience method was useful in choosing the experienced participants who are able to provide quality answers to the questions asked by the researcher (Podsakoff et al., 2012). One person each at tactical level with over six-year experience were interviewed from the organisations/agencies listed in table 2. Each interview session lasted for 45 minutes, but some lasted as long as 90 minutes depending on the level of explanations provided by interviewees. For example, some of the interviewee answered the questions using examples of past incidents, while others mere provided concise answers to the questions. To ensure critical comparison of results, EWS elements, collaboration and coordination principles informed the research questions.

The four EWS elements were classified as themes which facilitated the data analysis. The interview data were analysed using content analysis which is the technique used for analysing qualitative or text data (Silverman, 2013). This analysis method made it possible for data from the interview to be classified into their respective themes and analysed accordingly. Although Nvivo 10 software was also used, it was used mostly for coding, managing and merging themes from the primary data with the secondary data.

4. RESULTS AND DISCUSSION

The semi-structure interviews were key in investigating the situation and existing practice of EWS in Abu Dhabi. The deficiencies in the practice of emergency preparedness appeared to have rendered the current deployment of EWS in Abu Dhabi ineffective. The lack of emergency preparedness system, model or cycle that guides the preparedness activities have hindered the EWS coordination and collaboration. The results are presented and discussed using the themes or the four elements of effective EWS to expose gaps in the current practice in the UAE.

4.1. Risk Knowledge

No structured EWS in place and therefore the risk knowledge of natural hazards varied from agency to agency. The agencies also had limited knowledge about the imminent risks of natural hazards despite the series of flooding, storms and cyclones which had affected Abu Dhabi. Although the agencies seem clear about individual duties of their

organisations, they seem unclear about any form or level of collaboration or / and coordination on EWS for natural hazards. The findings reveal that in principle, the ministry of education, NCEMA and Civil Defence are responsible for educating the public on public safety, risk and hazards in schools. However, the results from the interview showed that the civil defence is only organisation carrying out public education especially in schools. But gap exists, because the public education is limited to fire hazards, road safety and general safety for human-induced hazards or risk and not natural hazards. This leaves no agency responsible for identifying and monitoring risk of natural hazards, nor is any agency or organisation responsible for communicating risk information and capability for natural hazard risk awareness.

4.2 Monitoring and Forecasting

According to the interviewees, there is limited information about which agency is responsible for monitoring natural hazards. While the National Centre for Meteorology and Seismology claims to be responsible for monitoring weather and atmospheric conditions, other agencies claimed they are not equipped for monitoring and forecasting natural hazards. The pattern of responses provided shows that limited monitoring and forecasting in other agencies is due to lack of resources, and equipment to monitor and forecast natural hazard from emergency management perspective. However, it is unclear who is responsible for monitoring natural hazard risks before their occurrence. Lack of risk knowledge has created gaps and problems for risk management which involves hazard monitoring, collaboration of efforts and coordination of resources and decision making for risk assessment, mitigation and management (Horan and Schooley 2007).

4.3. Warning Dissemination and Communication

Dissemination of warning and communication is the element which should demonstrate any form of collaboration and coordination between agencies and organisations. However, the results show that the media is responsible for disseminating warning messages but merely by way of informing the public. In addition to this, reports of past incidents show that community have taken initiative to use loudspeakers in mosques to warn residents of imminent risks of natural hazards. While the municipality acknowledged the efficiency of this mechanism for warning the public, it has limited

capacity to create awareness and communicate risk in Abu Dhabi since many foreigners who are neither Muslims nor Arabic-speaking live in the city. This result also showed lack of collaboration and coordination for warning dissemination since only one organisation is actually issuing information about looming natural hazards and not necessary issuing warning messages with instructions about necessary actions that need to be taken by the public.

4.4. Response Capability

The interviews reveal that each agency has sufficient resources, training and exercise to carry out response activities for dealing with any hazard when required. However, it is unclear which organisation is working with the community at risk to build response capability to natural hazards and to prepare the community in collaboration with other emergency agencies to respond accordingly to the onset of any natural hazard. While the interview with all six organisations fail to provide information about the level of engagement, and involvement with agencies and community for developing and deploying EWS, the agencies seem to have scheduled arrangements to test and train equipment and knowledge, and to collaborate where possible for preparedness activities.

The results indicate that there is minimal knowledge of all the four elements for effective EWS. Lack of collaboration and coordination were evident from all answers provided by all interviewees. The results clearly show that gaps exist in the system and there is lack of understanding of EWS for natural hazards despite its severe impacts in Abu Dhabi in recent years. The implications of this result are discussed and inferences drawn to provide recommendations for improvement through a unified approach that truly mirrors collaboration and coordination of all early warning activities.

5. IMPLICATIONS AND RECOMMENDATIONS

The analysis of police reports on past natural hazards and the result of the semi-structured interviews revealed the specific problems with EWS in Abu Dhabi. It is evident that there is no level or form of collaboration or coordination for EWS between emergency agencies. Elements such as risk knowledge of natural hazards amongst agencies were low. Even though agencies were well informed about risks of human induced hazards, there seems to be limited understanding or expertise in the area of

preparedness and response to natural hazards and its impacts. The same pattern of results was evident for all the four elements for effective EWS which were recommended by the UN. Monitoring and forecasting element seem to present a complex scenario in which the meteorological centre plays a major role in forecasting and disseminating information about natural hazard to the public, media and Civil Defence.

However, the warning messages disseminated are during emergency events to the public without any form of public education and warning during the preparedness phase which are important elements of effective EWS (Villangran de Leon, 2012). This gap emphasises the need to develop monitoring and forecasting element and other three elements, and to do so using a unified approach that involves all agencies. While monitoring and forecasting seems to operate in the most minimal way, the impact of previous natural hazards such as cyclone, storm, flooding has shown that minimal function of an element of EWS is insufficient to mitigate the impacts of natural hazards. Therefore, mechanism for disseminating warning, forecasting and monitoring needs to be better coordinated and activities need to be done in collaboration with all stakeholders (Tang et al, 2012; Faraj and Xiao, 2006) in a unified manner. This recommendation is key to improving warning dissemination and communication elements, thereby translating to enhanced response capability for dealing with natural hazards (Janssen et al, 2010).

The implication of the outcome of this study means that the severe impacts of natural hazards in Abu Dhabi will persist, threatening and destroying the infant development in the city. The obvious lack of risk knowledge in the area of natural hazards causes a ripple effect which affects ability to monitor and warn, communicate risk, disseminate early warning and build response capacity through preparedness between all agencies, and with the society at risk. Such that while monitoring seems to be functioning in some capacity, its impact is not strong enough to mitigate the severe impacts of natural hazards. Implication is also that, not developing and deploying elements of effective EWS in an inter-related manner as recommended by the UN, have resulted in the problems experienced till date in Abu Dhabi Emirates. The interviewees claimed the ineffective practice of EWS in Abu Dhabi is due to lack of expertise and awareness in the area, and limited allocation of resources. While these are major factors to take into

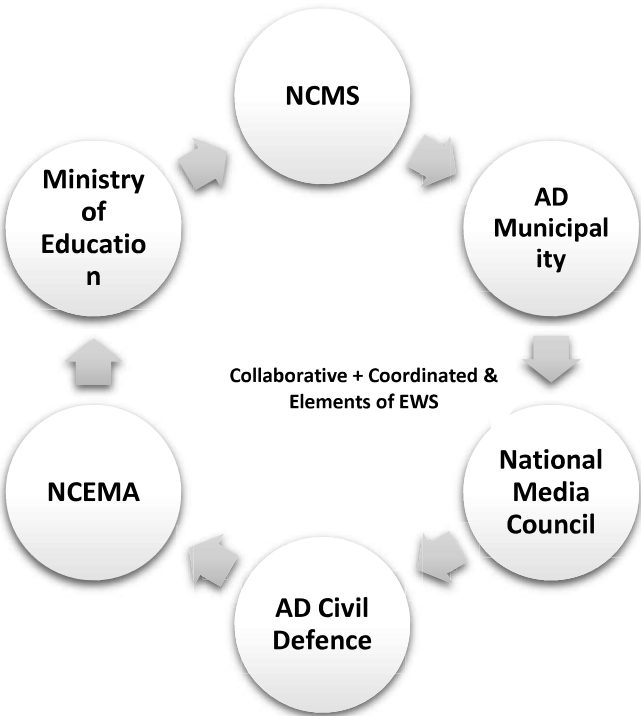
account in forging ahead in the emergency management sector, it is equally important for emergency agencies in Abu Dhabi to adopt a unified approach in order to develop and improve elements of EWS.

It is recommended based on the results of this study that Abu Dhabi and all the agencies responsible for emergency management adopts a unified approach as a driver for improving EWS. A unified approach to EWS in Abu Dhabi as recommended has the potential to improve outcomes EWS activities through joined-up services, support, sharing of resources and expertise and risk knowledge available to each agency (Phelps, 2010). Adopting a unified approach for emergency preparedness and response activities especially as it relates to EWS can be strategic in strengthening partnership(Comfort and Kapucu, 2006), multi-agency responsibilities and demonstrate good practice in mitigating the impacts of both natural hazards and human induced hazards (Mendonca, 2007).

According to Janssen et al. (2010), collaborative working facilitates joint planning for developments of preparedness and response which is required for improving EWS in Abu Dhabi and UAE as a whole. While challenges abound in adopting this approach, a commitment and shared objective for enhancing EWS based on the understanding of the implication of lack of effective EWS can be sufficient for managing challenges and retaining focus on enhancing EWS. Figure 1 illustrate how a unified approach may facilitate the necessary interaction required for developing and deploying effective EWS in Abu Dhabi.

The unified approach recommended by this study emphasises the importance of continuous work, and collaboration between all agencies responsible for emergency preparedness and response in Abu Dhabi Emirates. Beyond this, figure 1 shows how all agencies need to ensure that collaborative and coordinated work arrangements influence the development and deployment of elements of EWS at all times.

Figure 1: Unified approach for multi-agency for enhancing EWS in Abu Dhabi



The central and critical role of unified approach is illustrated in Figure 1 which places elements of unified approach as central to partnership and continuous interaction for preparedness and response arrangement between agencies. It is envisaged that this continuous process influenced by the benefits of collaborative and coordinated principles will eventually enhance the development, improvement and effective deployment of EWS in Abu Dhabi. While this process is not without its challenges and limitations, most challenges associated with collaborative working can also be resolved in this instance through coordinated activities; ensuring that the common goal of effective EWS for natural hazards remains the focal point of interaction.

6. CONCLUSION

This study has examined the current practice of EWS in Abu Dhabi in order to identify the problems associated with EWS and its deployment. The continued and overt display of uncoordinated response to any natural hazards has motivated the investigation into the root causes of EWS deployment. As a starting point, the role of unified approach in enhancing EWS was explained in relation to how it can be adopted to enhance and facilitate effective EWS in Abu Dhabi. The recommendation provided by the UN for effective EWS was examined, which further emphasised the relevance of collaborative and coordinated principles as a unified approach to this study. Using the UN

recommendation and principles of coordination and collaboration as a benchmark for evaluating the current practice of EWS in Abu Dhabi proved useful. The evaluation revealed that risk knowledge, monitoring, warning, dissemination and communication of warning were problematic and lacking in most of the organisations interviewed.

The primary data analysis also shows how insufficient, and low risk knowledge in most organisations influence the ability to deploy other elements of effective EWS. Therefore, adopting a unified approach which fuses the coordinated and collaborative principles is a much-needed recommendation in order to avert the implication of ineffective EWS in the Emirates. The unified approach model which emanated from the outcome of this study is recommended for use by the designated agencies responsible for managing natural hazards. If adopted, the unified approach is positioned to progress through governmental and policy support, so that the dynamic developmental activities in Abu Dhabi can be set on a sustainable path for years to come.

In conclusion, this paper has contributed to literature by revealing that elements of EWS are more likely to be well developed and deployed through a unified approach. This study contribution is an improvement on the recommendation provided by the UN in literature. While the effectiveness of EWS recommended by the UN is not disputed in this paper, it is evident that the dynamic environment in which natural hazard manifest can frustrate and limit the development of EWS elements, as well as abort the process before deployment of EWS prior to, and during the occurrence of natural hazard events. Therefore, a unified approach for EWS as recommended in this paper is crucial to ensuring that all emergency agencies are able to commit to effective EWS despite the dynamic, uncertain and complex environment in which natural hazard occurs.

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