# Insights into Public Early Warning Systems in Developing Countries: A Case of Jordan

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**Abstract:** Public early warning systems have the capacity to save lives. These systems, which are becoming increasingly important, have the ability to deliver customized information based on the affected areas and direct to the citizen during a crisis, complementing the work of traditional warning media like television and radio. Several countries around the world have implemented or started to look into implementing their national early warning systems. This paper reports the findings of a qualitative inquiry involving in-depth interviews with five key informants, officials, and expert in the domain of emergency management regarding the efforts of the government of Jordan in considering future early warning systems within its emergency management arrangements. Findings show the stressing need for a public early warning system in Jordan but that several impediments exist in the face of the development and deployment of such a system. These mainly include the absence of substantial finance, lack of citizen awareness and readiness for these systems, and cultural misconceptions about the role of the early warning systems in saving lives. Findings also indicate several recommendations to realize these systems in Jordan, principally soliciting support and fund from international donors, and establishing proper education and awareness campaigns to resolve the cultural issues concerning early warning systems. Implications for government policy and practice are also discussed.

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## 1. Introduction

A main reason for the loss of life in emergencies and disasters is the lack of early warning notifications to people of affected areas by such extreme events (United Nations' International Strategy for Disaster Reduction Platform for the Promotion of Early Warning 2005). Many nations around the world have accordingly been exploiting various types of early warning systems (EWSs) in order to disseminate notifications and pertinent information to people when and where information is needed most and in regard to impending or unfolding events (Aloudat et al. 2007,Aloudat et al. 2011,Fernandes 2008, Samarajiva, Waidyanatha 2009). Several countries, such as Japan, South Korea, and Israel, have integrated several types of public EWSs into their emergency management arragements covering key national sectors such as tourism, argriculture, industry, socio-militry, and ecnomomic and social infrastructures (Aloudat et al. 2007,Lappin 2009, Coyle, Meier 2009,McGee 2008). Other countries however are still struggling to find the right tone and balance of a public EWS within their emergency management arrangements (Aloudat, Michael 2010a). The Hashemite Kingdom of Jordan (or simply Jordan) is of no exception as the development and deployment of a fully functioning public EWS is still waiting to be realized.

Accordingly, the main aim of this research is to provide timely insights into public EWSs in Jordan to improve our understanding of the impediments and success factors of these systems in the developing countries. Due to the shared developmental challenges that are rather similar among many of the less developed countries (Das 2009), findings regarding a solution or system in one developing country can fairly be put forward for consideration in other developing countries.

Jordan is a country that lies in the heart of the Middle East, Southwest Asia. With the majority of its population (around 6.5 million) live in urban areas the country is classified as a modern, low-middle income country, with limited or unexploited natural resources, and a semi-arid climate (The United Nations Office for the Coordination of Humanitarian Affairs 2012). Several types of hazards are identified as potential threats to Jordan, but according to the United Nations Development Programme (2010), the economic, social, and state structures of the country are most vulnerable to flash floods, earthquakes, epidemics, and drought. Other hazards also include extreme temperatures, windstorms, locusts, man-

made emergencies such as terrorist attacks, arsons, chemical dangers (transportation accidents, industrial releases, hazardous materials, etc.), chemical, biological, and radioactive contamination, armed conflict, as well as mass population migrations (The United Nations Development Programme 2010).

The rest of this paper is organized as follows. Section 2 describes the research design and methodology applied in this study. Section 3 reports the findings and data analysis. Section 4 rounds out the discussion and implications of the findings. The paper concludes in Section 5.

## 2. Literature Review

Very few studies have explored the development and deployment of early warning systems in Jordan. However, almost all of these studies did not investigate future EWSs that aim toward notifying the general population in the case of an emergency, but narrowly proposing the use of the EWS either for a specific sector, such as for industry or agriculture to provide workers or farmers with weather, climate, or crop risk information, see for examples: Salman and Al-Karablieh (2001) and Verner et al., (2013), or for the specific use of a particular government ministry or agency, such as the EWS proposed by Claussen et al., (2004).

One of the studies that investigated the potential utility of a public EWS in Jordan was conducted by the United Nations Development Programme (UNDP), in which an assessment was made for the country's readiness for a system that is capable of strengthening the national capacity in avoiding a large-scale emergency or disaster, or, at least, mitigating its impact (Gotchev 2005). The study concluded that the development of such a system cannot be realized in Jordan unless a number of ingredients exist, which unfortunately do not, including full sponsorship and support from the international donor community, broad acceptance from Jordan's government institutions to future early warning systems initiatives, as well as the need to have a highly qualified and motivated group of professionals at the center of these initiatives (Gotchev 2005).

Another study was conducted by Momani and Alzaghal (2010)in which the researchers discussed the current and future trends of implementing EWSs. They proposed an integrated early warning system for Jordan (called JoEWS) to enhance the mitigation and response capabilities of the country in the face of any future extreme event. Nevertheless, a point that should be clarified here is that it might not be feasible or even possible to deploy an EWS that take into consideration all known types of natural- and man-made emergencies and disasters. Seismic activities and flash flood are the two dominant sources of hazard to Jordan (Momani, Alzaghal 2010) and, therefore, are the two most types of emergencies that are worthy of attention. Indeed, severe earthquakes have occurred in 1927, 1969, 1995, and 2004, along the Dead Sea Transform Fault System, west of Jordan, where 75 percent of the population lives within around 30km of that Fault (The JTI Foundation 2013), and flash floods in 1963, 1965, 1966, 1987, 1991, and 2006, with the maximum number of casualties of 295 persons recorded in the 1966 floods (The United Nations Office for the Coordination of Humanitarian Affairs 2012). Although no major casualties were inflicted from earthquakes on Jordan, except from the 1927 earthquake that took the lives of 242 people, panic and confusion an earthquake triggers suggest that earthquakes should be seriously taken into consideration in any future EWS arrangements. However, due to the bitter fact that predicting earthquakes, in order to notify the people about it in advance, is still far away from being achieved, if not impossible (Kossobokov 2012), more attention needs to be placed in future EWSs on other types of emergencies and disasters which can be fairly predicted in their timing, impact, or intensity. Accordingly, the most feasible dominant type of hazards that would make a conceivable candidate in Jordan's public EWS is flash floods. Without a doubt, this fact has been clearly identified in the findings of this research as will be discussed later.

## 3. Research Design and Methodology

A qualitative approach mainly using semi-structured interviews was adopted as the main data collection tool for this research. The use of qualitative methods, such as in this research the interviews, has been suggested for exploratory research when little is known about the area of study and when there is a need to identify unanticipated or new issues in regard to the phenomenon of interest (Cecez-Kecmanovic 2001,Hennink 2008). Five full-length interviews were conducted with key informants who were members of operational and non-operational stakeholder entities within the Jordanian landscape of emergency management and early warning systems initiatives. Each interviewee was specifically approached because of his or her wealth of knowledge and expertise, with the intention to end up with a good cross-section of diverse profiles that provides a holistic yet detailed view of Jordan's current trajectory and future potential of its national EWSs. An independent academic expert in emergency management, policy makers from Jordan Civil Defence, and a representative from the United

National Development Program in Jordan were approached to participate in the study.

Table 1. List of interviewees

| ID | Interviewee/ Pseudonym | Full title | Interview date | Duration |
|---|---|---|---|---|
| 1 | CivDef Officer | A field operations lieutenant with Jordan Civil Defence. | Oct 7, 2012 | 30 min |
| 2 | JSAT representative | A representative from Jordan Search and Rescue Team (JSAT) of Jordan Civil Defence. | Nov 5, 2012 | 45 min |
| 3 | RSD Director | The director of Rescue and Support Department (RSD) at Jordan Civil Defence. | Nov 5, 2012 | 60 min |
| 4 | UNDP Official | The director of the floods early warning system project, at the United Nation Development Programme (UNDP) in Jordan. | Nov 19, 2012 | 75 min |
| 5 | EM Expert | An independent emergency management expert. | Jan 24, 2013 | 40 min |

An interview protocol was prepared to guide the interviewing process. Data collection took place between October 2012 and January 2013. The interviews lasted between 30 and 75 minutes. See Table 1. All data were audio recorded with the consent of each interviewee. Data was then transcribed, proof-read, and then analyzed using content analysis techniques as described by (Miles, Huberman 1994).

In the analysis, open coding was used to identify and extract the main ideas in each transcript. As list of ideas emerge, ideas were grouped based on significant headings to forms the concepts. Next, related concepts were aggregated in categories to form the themes that constitute the results of this research. The results are presented in a narrative form granting detailed insights into the current status and future prospects of Jordan's national public early warning systems.

Supplementary documents were also collected to serve as a secondary source of information in this study. These documents include, among others, review of the previous literature on early warning systems in Jordan and other developing countries, and reports from non-government organizations (NGOs) related to warning systems and emergency management.

## 4. Findings

### 4.1 The stressing need for early warning systems in Jordan

The idea of establishing risk-reducing systems that cover Jordan stemmed from fears that hazardous events (e.g., flash floods) may occur at any time and, hence, a life threatening situation for the Jordanian citizen is always a possibility. Indeed, the people working at the United Nation Development Programme (UNDP) in Jordan perceive an urgent need for the existence of different types of EWSs in Jordan to prepare for and mitigate the consequences of emergencies and disasters in Jordan. As stated by one of the UNDP officials: "a number of factors contributed in initiating several projects for warning systems in Jordan as part of the country's effort within its risk-reduction strategies. The main factor is Jordan's high vulnerability to several natural- and man-made emergencies and disasters that include, for example, earthquakes, flash floods, air and water pollution, and terrorist attacks". Nonetheless, the UNDP official pointed out that Flash floods represent the type of risk with the most potential adverse consequences on the people of Jordan. The official stated: "the worst natural disaster that hit Jordan was not the 1927 earthquake with about 200 casualties; it is the floods of Ma'an city [196 kilometers to south of Amman] in 1966 where about 300 people lost their lives, including 30 tourists in Petra [a town, 47 kilometers to the south of Ma'an]….We have thought of a way to protect the people of Jordan, and after conducting several studies, an EWS for flash floods in Petra was found to be highly appealing to start with". He added, "Petra was chosen to establish a flood public early warning system due to the town's nature as the main tourist attraction destination in Jordan. In addition, Petra has a relatively high density population, and its topography, as a town that is surrounded by deep mountains, allows floods to be formed in its valleys in a very short period of time, making the whole area vulnerable to natural disasters. Floods, more than any other type of disasters, are of a particular concern".

### 4.2 Impediments

#### 4.2.1 Lack of awareness about the importance of early warning systems could expose these systems to vandalism

Some of the EWSs will be managed remotely. For example, the flash floods warning system that is proposed in Petra will be controlled by the Department of Meteorology in Amman, about 243 kilometer from Petra. One of the real concerns raised by the UNDP official was that lack of awareness from the Jordanian citizen about the importance of

these systems. He stated, "Applying an early warning system for floods in Petra necessitates that the Department of Meteorology [in Amman] operates some gates that control the flood of water. These gates are very expensive. Nonetheless, there are some fears that people in some isolated areas around Petra may deliberately or unintentionally destroy or tamper with these gates. People should know that these gates are there to help and protect them. Accordingly, there is a need to educate the people of Jordan about these systems in order to increase their level of awareness in regards to the importance of these systems before start deploying them".

**4.2.2 Lack of readiness from the Jordanian citizen in regard to how to deal with emergencies, emergency systems, and emergency notifications**

The government of Jordan needs to start preparing the public on how to deal with the potential threats of all kinds of emergencies and disasters threatening the country, toward creating a society that is adequately capable of coping with the impacts of these extreme events. Part of building this society dictates that the people of Jordan know how to accurately and correctly interpret the notification or message of the EWS. Indeed, the EM Expert stated, "how can we make the citizen of Jordan deal with the notifications of the early warning system and correctly interpret its messages or alerts is of a high importance ". On the same level of importance, the structure of the warning message is highly critical to the success of these systems. The RSD Director contemplated, "The content and style of the message targeting the public must be different in its structure than those targeting government officials and emergency management personnel. The message should be easy to be understood, concise, accurately structured, and well thought out. The public of Jordan need also to be ready and understand that every customized message they receive is really urgent and is not just being sent out as a matter of course. People must not treat the received message as just another piece of advertising e-mail or SMS. It has to be both professional and appropriate".

**4.2.3 Cultural misconceptions can be real impediments for citizen acceptance of early warning systems**

The UNDP official made a point that the culture of Jordan can play a negative role regards people's acceptance of public early warning systems. The official affirmed, "We need to start studying the culture of the Jordanian people and their acceptance for EWSs, especially people in rural areas of Jordan that usually associate accidents or disasters as part of their Islamic providence [i.e., God is conceived as the power sustaining and guiding human destiny, and people cannot have a control over those events]. Thus, these religious beliefs would adversely influence the way people would accept these systems since they perceive an emergency or disaster as an inevitable event that is destined from God and, therefore, no system can help them to avoid its consequences". However, the UNDP official emphasized that their role as specialists in emergency management should not be limited to installing and maintaining these warning systems but to be extended to explain to the public that all religions urge us to value and protect life and property in all possible ways. The official continued, "We say to these people that God in Quran [the Muslims' holy book] urge us to recite in order to understand how to protect ourselves, important others, and our properties using all available means and methods". He continued, "Both Christianity and Islam urge us to be rational and logical when dealing with all types of disasters, and accepting these systems would be part of our rational preparation for such extreme events. In short, accepting early warning systems does not collide with the cultural values and beliefs of Jordanians. Still, the role of these systems needs to be correctly communicated properly to them".

**4.2.4 Financial issues**

Issues that were clearly expressed by several interviewees are associated with the cost of applying an early warning system in an area instead of another. The UNDP official explained that the correlation between the cost of an EWS and the population distribution is of a particular importance when choosing the geographic area in which the system is installed. The official explained, "It is more cost-effective and easier to implement and deploy an early warning system in less densely populated area than in an area with a high population". Another reason for choosing a small area with a small population is that small projects of early warning systems can be tested and implemented in these areas with small budgets that rely mainly on the donation of foreign countries. The RSD Director explained, "We take into consideration the cost that government and donors will bear. Foreign donors hesitate to finance large warning systems in Jordan that require large budgets unless some success is exhibited first from smaller systems".

Another point is that a small EWS that can be deployed within the available budget can serve as the base for a larger warning system that covers larger geographic area. For instance; "an early warning system project in Petra may cost 300,000 dollars, and in Aqaba [another tourist attraction city in Jordan that is located about 128km south of Petra] an extension of Petra's project may cost only 50,000 dollars. It will be very cost-effective if Petra's project supports

Aqaba's with a slight increase in the original financial cost".

### 4.3 Recommendations

#### 4.3.1 Soliciting more international funding for public early warning systems in Jordan

Jordan is a favorite tourist destination in the Middle East region. According to the UNDP official, the quality of the EWS in the way the notifications are presented to its recipients would highly impact its success. The official provided an example by saying, "We need to understand the people who visit Jordan. They come from different cultures. Presenting the warning message on electronic billboards in multiple languages can be used as a credit for Jordan in the eyes of donors. Japanese people, for example, constitute a large portion of the tourists visiting Jordan. If the Japanese tourist perceives a special attention and care through a customized warning notification in his or her own language while staying in Jordan, Jordan becomes a favorite and even repeated destination for this tourist. This would help in increasing the appreciation of the Japanese government for the measures taken by the Jordanian government to protect the Japanese people while visiting Jordan, and therefore facilitate asking the Japanese government to help in funding the early warning systems of Jordan".

#### 4.3.2 Augmenting the awareness of the Jordanian citizen about these systems

People should know that these systems exist to help them and to protect them. The utilization of these systems under emergency management arrangements could be dimmed by underestimating their true value by the people of Jordan. Therefore, a true effort from the Jordanian government is needed to clear up such misconceptions as it can be postulated that concerns about vandalism would always exist if any early warning system were to be utilized in the country. As the ultimate purpose for the utilization of an EWS is to save lives, it should then be in the government's best interest to provide the general public with an adequate level of information about the benefits of these systems, their underlying technologies, and their limitations, to increase the public awareness and appreciation for these systems. Such fundamental knowledge and understanding from the citizenry should offer a mechanism to alleviate concerns about the success of these systems while, at the same time, help in the development of a general appreciation for the government practiced security measures.

The RSD Director illustrated the role of the government in spreading awareness among the people of Jordan about how to manage and cope with emergencies and disasters. The Director referred to a national comprehensive plan that one of its targets is to emphasize the responsibility of all ministries and government departments in the educational effort. "A national comprehensive plan emerged from the High Council for Civil Defence, and one of its main objectives was to clarify the role of each ministry in Jordan in spreading awareness about natural and man-made emergencies", affirmed the RSD Director. The JSAT representative also gave an in-depth illustration about the effort of the Jordanian government in educating the people of Jordan in regard to emergencies when he stated that "Jordan Civil Defence and the Ministry of Education started to work closely together to spread awareness about all type of hazards that have the potential to impact negatively on Jordan. This joint effort targets all schools in Jordan from all age groups". He continued, "Schools are the first awareness stage. The next stage will target housewives through documentary films and relevant manuals. The following stage will be to target different societal sectors such as people with special needs, and people who reside in remotely, isolated villages".

#### 4.3.3 The need for multiple notification mechanisms within the Jordanian early warning systems

The mechanism through which the notification is delivered to people is crucial for the success of any early warning system. For example, in the suggested floods EWS in Petra, one way to notify people is by using electronic billboards that convey the level of potential risk. The UNDP official gave an example: "The Department of Metrology, and through its early warning system, notifies the residence and tourists in Petra region through electronic billboards that there is a 5% chance risk probability that a flood will occur during the coming week. This risk probability might become 50% two days before a possible flood, 90% a day before the flood, and 99% couple of hours before the impending flood when water starts to flow in the valleys".

There was a general consensus among the interviewees on the need to have more than one notification mechanism in every EWS once implemented. In addition to billboards, these mechanisms, as the CivDef Officer suggested "might include such means as sirens with a distinctive tone for each type of emergency".

Hotels, hospitals, schools, and other public venues can also be utilized to disseminate the warning message to people. For example, the EM Expert suggested that: "There is a current agreement with all hotels in Jordan to display government messages on their internal electronic boards and screens, thus enabling the residents of these hotels to read important notifications. This government-hotel agreement can be used as a notification mechanism in

any proposed system so as to advise hotel residents about the impending threat before going out. This form of agreement can be extended to be implemented in schools, universities, hospitals, and any other public venues".

**4.3.4 The need for the right approach to convey the message of the early warning system**

The JSAT representative pointed out the possibility that people might react in a very passionate or scared way to the warning message received, thus creating what can be called public panic, even for warnings regarding medium-scale emergencies. He explained, "Short message service (SMS) on mobile phones as part of a location-based emergency management solution can be possibly utilized to disseminate warning messages to preselected officials and persons (e.g., schools principles, mayors, municipal government officials, community influential members, etc.) in a designated threatened area. This type of mobile phone solutions however cannot be utilized to send warnings to all the people reside in a specific area for reasons related to technology, but more important to the way that people might react on the received warning. We do not want to create a state of public panic once the warning message is received. We have to consider also the psychological factors. Therefore, we cannot truly work directly with people, we rather prefer to work with officials and preselected influential persons who can then wisely convey the warning message of the system to the public". The RSD Director concurred, "We can use mosques minarets and churches to disseminate spoken alerts to people who live around in a way that would not create panic among them regarding the impending emergency".

**5. Discussion and Implications**

Almost all of the interviewees noted the pressing need for establishing a public early warning system in Jordan as the system has the benefits of preventing, or at least mitigating, losses in both lives and assets in the case of a natural disaster such as flash floods. However, Jordan's need for such a system is more urgent now as the country is currently a main destination for huge influxes of refugees from the surrounding countries (i.e. Syria and Iraq), and it has been for the past ten years, and, therefore, faces a host of migration-related challenges (Rausa, Lloyd 2012, The United Nations Development Programme 2010). Due to its political stability, as well as its strategic location at the center of instable countries, Jordan has long enrolled actively with humanitarian duties in receiving refugees since 1948. However, this enrollment has created overgrowing concerns over national security and the country's few valuable resources, most important, drinking water (United Nations Department of Public Information 2013).

One of the key impediments toward applying a public EWS in Jordan is the costs associated with such a system. Calling for synergy with the private sector might be part of the solution to overcome cost barriers as the investment of the private sector in some of the system's resources does not only help in protecting the assets of the sector from the adverse impacts of potential disasters, as part of the private sector's business continuity planning, but is also regarded as a good opportunity to exhibit the private sector's social commitment toward the community to where it belongs.

Decision makers in Jordan also should acutely consider soliciting international financial support as one of Jordan's development strategies for building its future EWSs. It is strongly argued that without the support of the international funding bodies, Jordan will not be able to develop and deploy its public warning systems, at least not in the foreseeable future.

Any new use of technology or solution should be presented to people with a high level of awareness-raising campaigns (Cantwell 2002). Emergency management officers (such as officials in Jordan Civil Defence) have a crucial role in this context. The role may include preparing adequate training programs and workshops for the general public, and contacting social media to augment the awareness of people about the importance of public EWSs. As discussed earlier, introducing an early warning system without providing such sufficient preparation and information for the public might be mixed up inappropriately with people's religious beliefs. Even in some cases, the lack of proper knowledge about the warning system tools and messages may result in vandalizing these tools or cause adverse results from misinterpreting the system's messages if an extreme event occurs (Aloudat 2012).

An effective EWS can be a proactive tool that protects assets, and saves lives, particularly in areas vulnerable to natural disasters such as Petra. One way of achieving an effective system is done through establishing a layout or a theoretical framework that clarifies the different roles of the numerous actors in any proposed future system (Aloudat, Michael 2010a, b), including the roles of Government of Jordan, UNDP, Jordan Civil Defence, Department of Metrology, private sector, community key informants, local officials, and the like. The framework should also include a full explanation, (and in some cases operating manuals) of different notification tools that basically include billboards, in addition to other means that can be plausibly used

such as sirens and the speakers that are found in the minaret of each mosque and church.

## 6. Conclusion

Emergencies and disasters are inevitable events in our lives, and their adverse impacts are regarded true challenges to national security planning for any country. Being a country that is prone to a variety of natural- and man-made emergencies and disasters, this study examines the current and future prospects of public early warning systems in Jordan. The findings clearly illustrate that the existence of effective systems in Jordan is an urgent need that will help the government of Jordan in sustaining its fragile economy and effectively contributing in reducing future potential risks on the Jordanian society.

As identified in the findings of this study, not a single but multiple tools and information dissemination mechanisms should be used in any future EWS in Jordan, including electronic billboards, sirens, and speakers of mosques and churches, all of which should have relatively low costs in terms of operation and maintenance.

The findings of this study also indicate that a well prepared and fully aware society regarding the future deployment of a public warning system in Jordan are crucial factors to the success of such a system. Providing adequate awareness-raising programs and campaigns that cover the different sectors of the Jordanian society can be of great benefit in achieving the desired success.

Some of the impediments that are identified and directly associated with realizing public early warning systems in Jordan include the costs barriers, lack of citizen readiness for such systems, and cultural misconceptions of some Jordanians.

Finally, soliciting international funds and effectively enrolling the private sector in supporting and funding future public early warning systems can truly help overcoming most of the financial obstacles, while providing proper education and awareness programs can resolve many of the cultural issues concerning the utilization of the these systems in Jordan.

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