Cambodia's Early Warning System 1294: An Adaptable Technology Promoting Safety for All

Introduction – The remarkable story of EWS1294, the national early warning system of Cambodia

In the 2021 World Risk Report, Cambodia was ranked as one of the top 15 most disaster-prone countries globally[1]. Severe floods are a major and recurrent hazard in Cambodia, affecting more than 25 % of the Cambodian population[2]. Due to a lack of disaster preparedness and coping capacities, lives and livelihoods are highly impacted, so are economic development and natural resources, according to the 2015 Cambodia's Second National Communication to the UNFCCC[3]. Projected climate change trends also indicate an increase in both the frequency and intensity of extreme weather events and more severe floods in the coming decades. Without action, by 2040, around 180,000 people more will be affected by extreme river flooding. EWS1294 provides an upstream response to flood and disaster risk challenges by disseminating timely and reliable information to communities at risk.

Several floods in the 2000s and 2010s severely affected the lives and livelihoods of Cambodian people in about 20 provinces. According to a study[4] by the Ministry of Environment (2011) following the 2010 floods, 36% of Cambodians did not receive any information about the risk, and 72% of Cambodians who received warnings received them too late. In 2013, flooding affected more than 1.8 million people across 20 provinces in Cambodia. During this time, many families were unprepared for the intensity of the storms, nor were they aware of the severity of the flooding, affecting their lives and livelihoods.

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[1] Bündnis Entwicklung Hilft Ruhr University Bochum – Institute for International Law of Peace and Armed Conflict (IFHV). *World Risk Report 2021*, 2021. Accessible at: https://reliefweb.int/sites/reliefweb.int/files/resources/2021-world-risk-report.pdf

[2] World Bank and Asian Development Bank. *Climate Risk Country Profile Cambodia*, 2021. Accessible at: https://www.adb.org/publications/climate-risk-country-profile-cambodia

[3] Ministry of Environment, Kingdom of Cambodia. *Cambodia's Second National Communication – Submitted under the United Nations Framework Convention on Climate Change*, November 2015. Accessible at: https://unfccc.int/sites/default/files/resource/khmnc2.pdf

[4] Ministry of Environment, Kingdom of Cambodia. *Understanding Public Perceptions of Climate Change in Cambodia*, January 2011, p.13.

River water levels being measured in Kandeang District, Pursat province, Cambodia (Photo by People in Need Cambodia).

Recognizing that the lack of flood information and warnings prevented families from preparing for floods, resulting in significant human and economic losses, People in Need (PIN) further supported the Royal Government of Cambodia (RGC) in disaster risk reduction and flood resilience. Thus, began the story of EWS1294 in 2013, in response to the absence of any structured early warning system in Cambodia. Named after the mobile short code "1294", EWS1294 began first as a voice-based mobile phone early warning information dissemination system piloted in three flood-prone villages in Pursat province in 2013. Over the past 9 years, and thanks to support from international donors and close collaboration with NCDM, EWS1294 has seen progress in its expansion across Cambodia

Enhanced over the past years, the EWS1294 is now a life-saving system that provides accurate and timely flood information to national and provincial authorities, and allows them to easily and quickly disseminate reliable warning messages to at-risk communities regarding climatic or societal hazards. EWS1294 is now officially recognized and owned by the Royal Government of Cambodia as the national early warning system, covering all Cambodian provinces.

I. EWS1294, an effective and adaptable system.

Since its development in 2013, EWS1294 has proven itself by successfully disseminating 774,000 alerts to at-risk EWS1294 subscribers. Over the past 9 years, the expansion of EWS1294 to the whole of Cambodia, the broadening of it, means, and subjects of dissemination, and the ability of national disaster risk management authorities to take over the system demonstrates its good functioning, adaptability, and

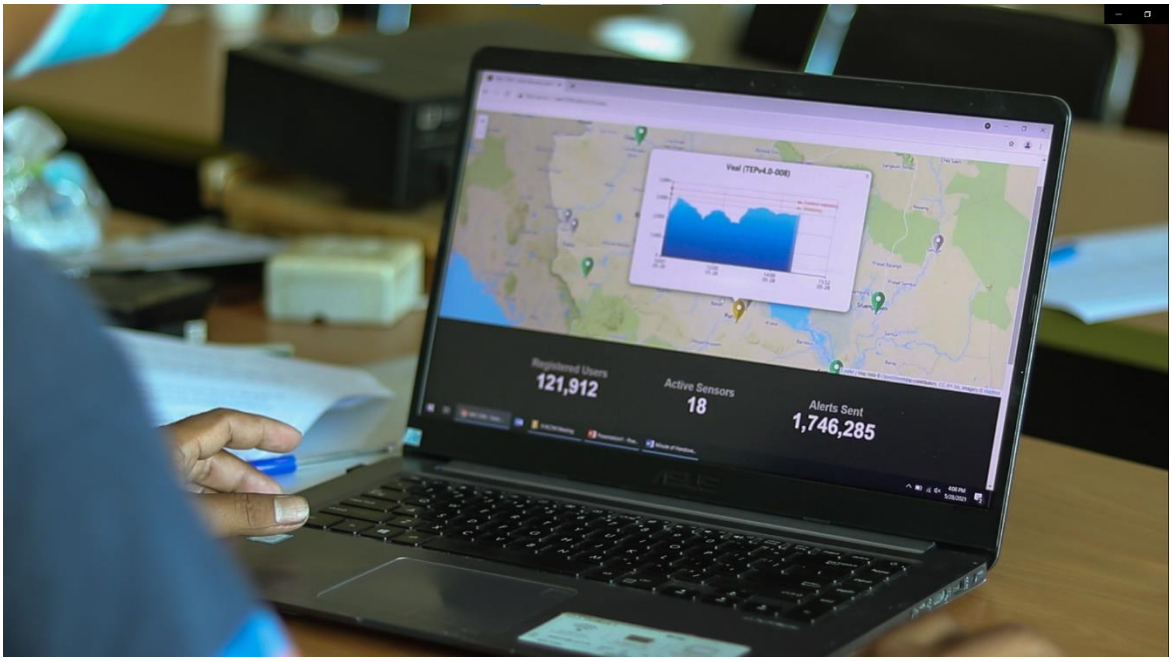
replicability. Thus, various lessons can be drawn from the experience of Cambodia's national early warning system. In this sense, 6 achievements are key to the success of EWS1294 and could inspire other initiatives to replicate such a system.

1. **Simplicity**

EWS1294 is a user-friendly life-saving system that provides accurate and timely flood information to national and provincial authorities and allows them to easily and quickly disseminate reliable warning messages to at-risk communities regarding climatic or societal hazards. EWS1294 is a simple technology that was designed following four necessary components for an effective EWS: (1) disaster knowledge; (2) hazard monitoring; (3) warning dissemination; (4) preparedness and response and undergoes yearly evidence-based cycles of upgrades. The simplicity of the system revolves around two features:

i. Flood knowledge and monitoring

Flood monitoring is ensured by the EWS1294 Tepmachcha sensors. These gsm-enabled, solar-powered and sonar-based water gauges continuously monitor the water level in critical locations where they were installed. During the installation, national, provincial and local disaster management authorities help identifying the dangerous water level threshold to be informed in the dashboard. The water level data collected from the sensor is displayed in a user-friendly manner on the EWS1294 Dashboard. For instance, depending on the water level (normal, warning, severe), the sensor icon appears green, orange or red on the Dashboard, facilitating the monitoring of the disaster risk management authorities.



Early Warning System (EWS) 1294 Dashboard allowing real-time monitoring of water levels (Photo by People in Need Cambodia).

ii. Alert dissemination and emergency preparedness

The alert dissemination has been developed in a user-friendly and secure way to be used efficiently by both national and local authorities. The dissemination system is easily accessible from the EWS1294 Dashboard. The dissemination dashboard has been developed over the years to facilitate disaster risk management authorities' dissemination – from a computer and more recently from a mobile phone; two options are available. By using the pre-recorded alert message, officials can broadcast a flood warning, selecting the information and safety instruction relevant to the situation. By uploading their own recorded voice message, officials can also issue alerts for other types of climate and societal hazards. Alerts are disseminated via the "1294" code via Interactive Voice Response (IVR), an automated telephone system that sends pre-recorded calls to subscribers in at-risk locations. At the same time, as end-users, the general public can easily register to the system by calling "1294" free of charge in order to receive early warnings disseminated by the provincial authorities in case of risks.

2. **Scalability**

EWS1294 was first piloted in 3 flood prone villages in Pursat province in 2013, which was heavily affected by floods this year. The first voice-based mobile phone early warning dissemination system had addressed the urgency in saving lives of local communities prior to, during, and after times of disasters. This experience marked the beginning of the implementation of a national early warning system.

Thanks to its simplicity of operation, ease of use for NCDM and PCDMs, and to the support of international donors, EWS1294 has been replicated and extended to all provinces of Cambodia over the past years. The following below are the system's core elements which supported its national scalability:

i. The EWS1294 Tepmachcha sensors have undergone regular hardware improvements to improve their performance and to resolve any challenges that have arisen. The installation of new Tepmachcha sensors across the country has been facilitated by their simple installation and operation, allowing the system to be extended to all provinces.
ii. The collection and sharing of data to the data management platform could easily be extended to other provinces as it relies on the Cambodian cell phone network. Over the years, the software of the EWS1294 has been improved and has incorporated all new provinces and sensors.
iii. The dissemination of the alert could be scaled up nationwide as the Royal Government of Cambodia assigned the mobile short code "1294" for registration and free outgoing calls throughout Cambodia.
iv. The overall simplicity of the system ensured that the system was user-friendly for NCDMs and PCDMs across Cambodia, facilitating the capacity and willingness of disaster management authorities to use and promote the system.

3. **Accessibility / Inclusivity**

EWS1294 was developed by the Royal Government of Cambodia and People in Need as an accessible, inclusive, and safety-focused system. By expanding the system nationwide, EWS1294 is now reaching communities across Cambodia. EWS1294 is available to all users of the major local telecommunication companies, Smart, Cellcard and Metfone. Subscription is fast and free. To subscribe to EWS1294, one must dial the number "1294" and follow the instructions to indicate the location for which one wishes to be informed.

In addition, the system was developed as a telephone-based alert system after assessing that the majority of Cambodians own a telephone. The alert can be received on low-tech mobile phones. Finally, the Interactive Voice Response (IVR) system promotes the inclusion of vulnerable people, including those with low literacy. The IVR system has therefore played a key role in the success of the system in reaching the Cambodian population, including the most vulnerable.

The "1294" hotline is accessible to all for free; this 4-digit number assigned by the Royal Government of Cambodia allows the dissemination of early warning messages (Photo by People in Need Cambodia).

4. **Multi-stakeholder collaboration**

Building Cambodia's EWS has involved constant coordination and strong working mechanisms between different stakeholders. It has encouraged and fostered collaboration between different stakeholders: Intergovernmental agencies such as the National Committee for Disaster Management (NCDM) and the Ministry of Posts and Telecommunications (MPTC), international development agencies, international governments and donors, civil society, private companies, and local communities.

Throughout its development, the EWS1294 is a system that has fostered multi-level coordination for decision making and implementation. At the national level, the NCDM and MPTC, along with their

international partners, have worked to ensure that the system is accessible and inclusive to all communities in Cambodia, that the necessary regulations are in place to facilitate the operation of the system, and that accurate information is communicated amongst stakeholders. The NCDM now provides overall supervision of the system at the national level. At the local level, provincial and sub-provincial disaster management authorities have been responsible for the dissemination of warnings and maintenance of sensors, as well as addressing the concerns of local communities. Private companies have been heavily involved in software and hardware operation and improvements to the system, resulting in successful public-private partnerships.

This early and close collaboration among all stakeholders is key to successful handover. The early involvement of national and provincial disaster management authorities has fostered a sense of ownership of EWS1294 at the national and local levels, as well as a great deal of understanding and initiative regarding the system. This multi-stakeholder coordination has thus been one of the best practices experienced by the system as it now supports the long-term sustainability of the system.

5. **Multi-hazard EWS**

EWS1294 has evolved from a flood early warning system to a multi-hazard early warning system, disseminating alerts about climate or societal-related risks. When the COVID-19 pandemic broke out in early 2020, provincial officials have utilised the system to inform the public on social distancing practices to ensure the population's safety. Within the first three weeks of the pandemic, the system had successfully disseminated 129,843 individual messages related to COVID-19 safety to the public. The message focused on information about the virus and as well as preventive measures to follow to avoid the spread of the virus to more people.

6. **Multi-channel dissemination**

Initially, Cambodia's early warning system operated solely through an interactive voice response (IVR) system via the "1294" hotline. Provincial authorities are in charge of creating alert messages to registered users of '1294' in at-risk locations of their province. Compliance with the Common Alert Protocol (CAP), an international standard format for emergency alerting and public warning supported by the World Meteorological Organization (WMO), was a first step towards multi-channel dissemination. Since last year, additional means of dissemination have been introduced for EWS1294.

In October 2021, a new means of dissemination was introduced and piloted in the city of Battambang province. Following the success of the “1294” hotline, NCDM has piloted an innovative urban EWS as a last-mile communication channel. This innovation was initiated through participatory methods with community members, which led to the recommendation of using public loudspeakers as another effective way to disseminate early warning messages, even without access to smartphones or the Internet. Once alerts have been communicated to provincial authorities, warning messages sent through "1294" are now disseminated in real time through public loudspeakers.

Since January 2022, radio broadcasting has been introduced for EWS1294 through collaboration with ABC radio station. As a result, EWS1294 alert messages are now broadcast by ABC radio station in areas at risk. In addition, with the support of NCDM and MPTC, there is a potential for developing the SMS broadcasting modality for EWS1294. This technology will allow the EWS1294 alert messages to be sent via a mobile telephone network to all subscribers of the partner telecommunication company, within the at-risk

geographical area. SMS Broadcasting does not require people to subscribe and will therefore increase the reach of the system.

Multi-channel dissemination is key to ensure greater reach of the system to at-risk communities in Cambodia.

Urban EWS Speaker installed in Kdol Daun Teav Commune, Battambang City, Battambang Province, Cambodia (Photo by People in Need Cambodia).

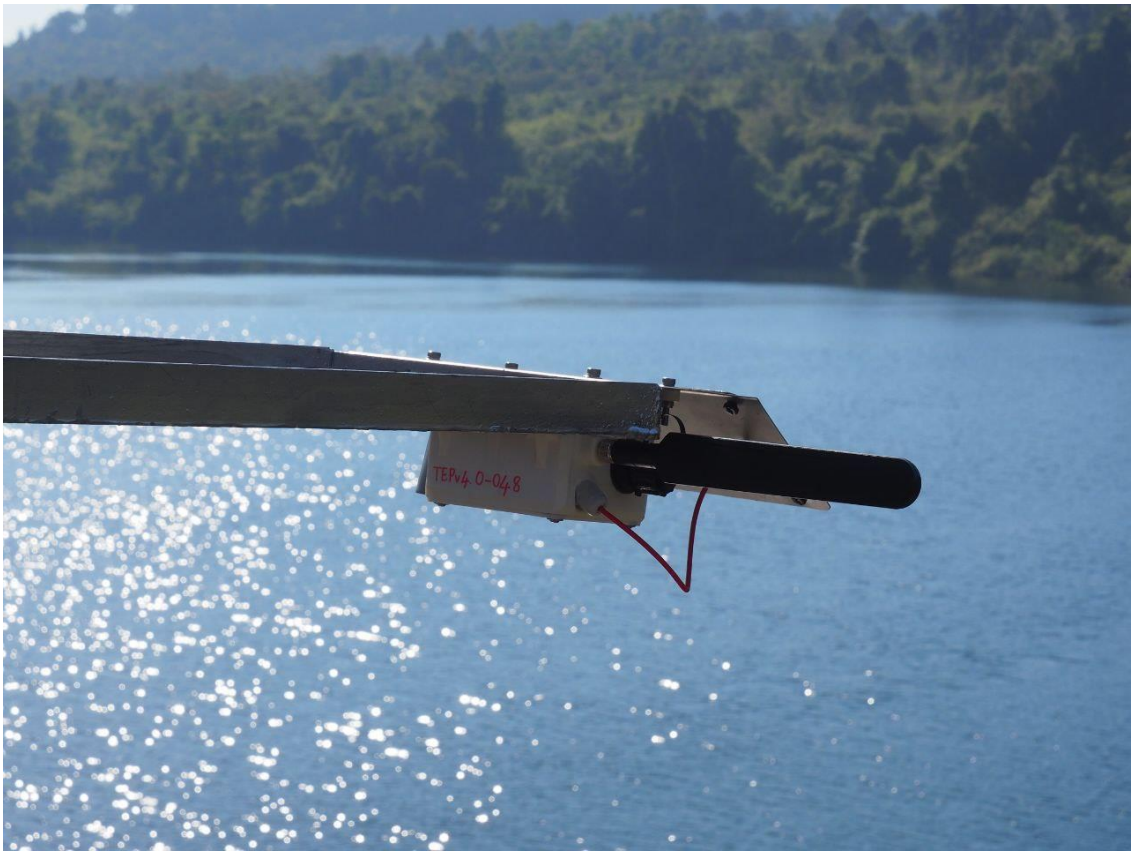
II. Lessons Learned from EWS1294: challenges and best practices in developing a national Early Warning System.

Over the past few years, several challenges have been faced in developing this national early warning system. Lessons can be drawn from this experience, and could be considered for replication. It is important to note that these lessons learned sometimes reflect the local context in which the system was developed.

1. Sensor operation and maintenance

One of the main challenges has been to ensure the operation and maintenance of the sensors. There are many reasons for this. The nationwide expansion of the system has resulted in a large increase in the number of sensors to be managed, which has required additional time and manpower to maintain the

sensors. Despite the simple operation of the sensors and the improvements made to the sensor over the various versions, maintenance must be performed every couple of years to replace the batteries, remove the cobwebs that sometimes clog the sonar, clean the solar panel, amongst others. One of the main lessons learned from this experience is the need to train not only national and provincial disaster management authorities in sensor maintenance, but also local focal points who can easily perform basic sensor maintenance. Periodic improvements to the sensor are required to adapt to challenges encountered during operation (e.g., mobile connectivity issues, damage to the sensor, etc.) Therefore, close collaboration with all stakeholders and delegation of responsibilities are required.



EWS1294 Tepmachacha sensor installed in Boeung Preav commune, Sre Ambel district in Koh Kong Province (Photo by People in Need Cambodia).

2. Reach of the system

In the past few years, an obvious challenge has been to increase the reach of EWS1294. Although the number of subscribers has slowly and steadily increased over the years, the system is still far from reaching the entire population at risk. Yet, reach is the most critical element for an early warning system.

Some limitations have been identified in the subscription modality. In conducting a number of workshops and awareness campaigns throughout the Kingdom, it was identified that the most effective way to increase the number of subscribers is to conduct very local promotional campaigns to explain the operation and benefits of the system to the population. Such campaigns often require a great deal of time and effort. People in Need has begun efforts to train NCDM, PCDMs, and Village Disaster Management Groups (VDMGs) in some provinces to promote the system at the local level. An additional limitation due

to the subscription modality is the regular changing of sim cards by Cambodian people, which result in a loss of subscribers reachable by EWS1294. These subscription barriers indicate the need for alternative strategies to move forward in order to increase the number of people reached by the system.

The lesson learned from this experience was to continue to develop dissemination strategies to ensure greater reach of the system. Local campaigns are undoubtedly unavoidable to raise awareness, but are not sufficient to ensure the broader reach of the system at the national level.

People in Need conducted a EWS1294 training to Village Disaster Management Groups (VDMGs) in Kandal province, Cambodia (Photo by Tim Ha for People in Need Cambodia).

3. People-Centered Design

Overall, the main lessons learned from the development of EWS1294 were the need to place users - in this case national and provincial disaster management authorities - at the heart of system development. By developing a user-friendly and scalable system, the Royal Government of Cambodia, in collaboration with People in Need, was able to build a fully operational national early warning system that saves lives. Keeping the needs of local communities in mind, collecting knowledge and feedback from communities, and evaluating the impact of the system have also proven critical to improving the system. Technological solutions must be integrated with strong multi-stakeholder collaboration and community engagement.

Conclusion

With the support of various international donors and with the close cooperation of the Royal Government of Cambodia through NCDM and PIN, EWS1294 became the national Early Warning System, covering all provinces and saving many Cambodian lives and livelihoods. In this success story, key achievements can be emphasized for the development and improvement of early warning systems in other countries and regions.

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This article was written by People in Need (PIN) Cambodia.

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