



SENSOR MAINTAINING by NCDM in Pursat City, Pursat Province.

Photo: Mech Sreylakh

Early Warning System 1294

In an effort to enhance the disaster resilience of vulnerable populations across Cambodia, PIN has established a nationwide early warning system (EWS), enabled through an effective longstanding collaboration with the country's National Committee for Disaster Management.



Jak Chowdhary

The development of EWS1294 has successfully strengthened the disaster preparedness and emergency response capacities of the Royal Government of Cambodia. Hence, the knowledge accumulated and lessons learnt throughout this 8-year process may be extremely valuable for the design of future projects aiming to achieve similar outcomes in alternative country contexts.

Programme Background

The inception of the project came following a period of intense flooding across the Lower Mekong Basin (LMB) in 2011, driven by a series of

tropical storms combined with heavy monsoon rains, which resulted in the worst flood season in the region since 2000¹. In Cambodia, the flood event caused 250 fatalities and 100 - 160 million USD worth of economic

250

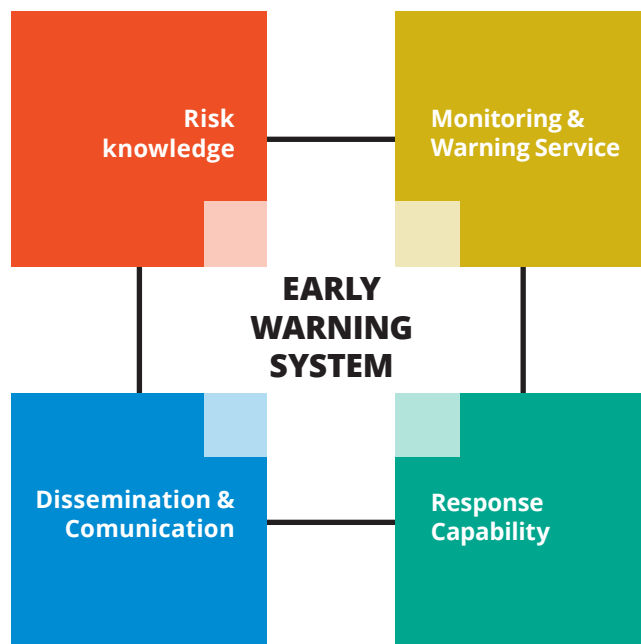
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damage². Furthermore, Cambodia had experienced 34% of total flood fatalities and 35% of total flood damage in the LMB, for floods documented between 2000 and 2011. Hence, the

2011 flood event, in addition to the trends identified in the years prior, indicated a clear need to strengthen the flood management capacities of the Royal Government of Cambodia (RGC), leading to the conceptualisation of the EWS1294 project.

The goal of the project was to increase the disaster resilience of flood vulnerable populations through enhanced flood early warning systems (EWS). The initial approach aimed to develop an innovative dissemination platform that could be utilised by disaster management authorities to share timely life-saving information in advance of natural hazards. In 2013, PIN partnered with the RGC's National Committee for Disaster Management (NCDM), setting the institutional foundations required to ensure

successful future implementation. The platform was named EWS1294, after the phone number “1294” was granted by the Ministry of Post and Telecommunications (MPTC), as a free service for all users of the 3 telecommunication companies (Smart, Metfone & Cellcard). Initially the system was piloted in 3 flood prone villages in Pursat province, as a mobile phone early warning information dissemination platform, sharing voice messages to subscribers via interactive voice response (IVR) technology. Since its initial piloting, EWS1294 has developed into a multi-hazard multi-channel EWS, now recognised by NCDM as the country’s national EWS, and is operated by the Provincial Committees for Disaster Management (PCDMs) across all 25 provinces of Cambodia.



Programme Design

Developments achieved under EWS1294 have been designed based on the Climate Risk & Early Warning Systems (CREWS) checklist, an analytical framework published by the United Nations International Strategy for Disaster Reduction (UNISDR) in 2006³ and later refined by the World Bank (WB), the World Meteorological Organization (WMO) and the United Nations Office for Disaster Risk Reduction (UNDRR). The framework establishes four components for effective end-to-end, people-centred EWS⁴, as illustrated below.

Component 1 - Monitoring & Warning Service

To enhance the hazard monitoring and warning capacities of the RGC, PIN employed a technological approach to flood forecasting, developing

THE FOUR COMPONENTS for effective early warning systems⁵

through a collaboration between PIN Cambodia and the DAI Maker Lab. The aim was to create an affordable time-efficient technology that could be rapidly expanded to create a comprehensive flood monitoring network in Cambodia. The gauges were initially tested in two flood prone sites in the provinces of Kampot and Pursat, and over time have seen considerable software and hardware upgrades that have increased their reliability and resilience to the dynamic conditions that they are exposed to in the field. The existing network currently includes 28 sensors installed across the country.

Each unit shares near real-time water level data recorded at in-situ locations using sonar technology. This information is then

& Severe Warning Level). These thresholds indicate the point where fluvial conditions will lead to flooding and are determined during the sensor installation process. This information is then used to support the Provincial Committees for Disaster Management (PCDM) in determining whether to send a warning message to vulnerable populations via EWS1294. Additionally the EWS1294 sensors have been programmed to automatically trigger a phone call to the focal points assigned to that unit when the water level approaches a danger-threshold.

EWS1294 has therefore strengthened the hazard monitoring capacities of the RGC, by providing a flood monitoring platform to support NCDM’s decision-making during emergency situations. Current projects are now being implemented to enable NCDM to manage this component independently of PIN, through a combination of technical capacity building and by connecting the ministry to a local automations company who will serve as the technological focal point for the future.

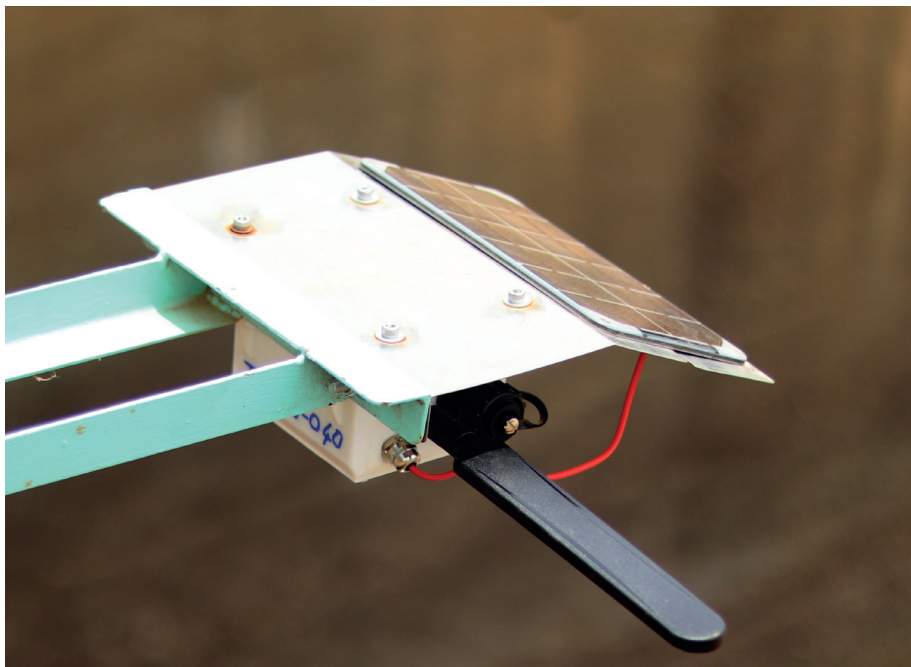
Component 2 - Dissemination & Communication

EWS1294 was initially designed as a dissemination tool to enable

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a network of low-cost gsm-enabled water gauges, that provides scientific evidence of dangerous fluvial flood conditions to the national and provincial ministries. These automated water gauges, named ‘Tepmachcha’, were developed in 2016

automatically shared to a centralised data visualisation platform that is accessible for disaster management authorities. The visualisation displays the water level trend over time and how close the level is to approaching a danger-threshold (Warning Level



TEPMACHA SENSOR in Kandieng District, Pursat province.

Photo: Koy Chanpor

last-mile connectivity from disaster management authorities to populations vulnerable to flooding. This component developed by PIN requires beneficiaries to subscribe to the system by calling the number “1294” and submitting their province, district and commune. These details, along with the phone number, are then stored on the EWS1294 data management platform. The recipient beneficiaries are then determined based on the target location of the warning messages, selected by the PCDM. The subscribers attributed to that location will then receive a phone call containing information on the upcoming hazard, as well as suggested instructions to promote good emergency preparedness actions. This model has been highly successful, leading to an accumulated 118,351 as of November 2nd 2021 unique subscribers, with the system activated for 168 callouts and 226,580 completed calls made in 2020 alone. The dissemination system is now being utilised beyond its initial purpose of flood events, to also warn vulnerable populations of storm events, intense periods of UV exposure and to reduce Covid-19 transmission.

Despite the abovementioned successes, EWS1294 must continue to be developed to increase the system’s reach, ensuring that a greater number of vulnerable people can

be accessed, following the ‘leave no one behind’ principle set out by the UN. To achieve this, PIN Cambodia are currently increasing the number of communication channels available under EWS1294, creating a multi-channel EWS. This has been enabled through a technical modification to the dissemination dashboard, following the WMO’s Common Alerting Protocol (CAP). CAP is an international standard for all-hazard emergency messaging that homogenises the format of alerts across all forms of media. This allows multiple communication channels to be triggered through 1 mechanism and ensures coherent messaging across each medium. Hence, the application

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of CAP across an entire nation’s EWS, would considerably reduce the likelihood of mixed messaging and subsequent confusion amongst the public.

This standardisation was applied to the dissemination platform in August 2020, facilitating the addition of new and diverse communication channels. The first addition was the developed of automated Facebook posts that could be triggered directly from the

dashboard and posted to the EWS1294 Facebook Page, which currently has 130,000⁶ followers, marking a massive increase in system beneficiaries. Further channels currently being developed for EWS1294 include; Facebook Chatbot, Cell Broadcasting, Radio Broadcasting, Urban Public Speakers and Telegram Messenger. As the number of available channels continues to grow, the reach of the system will increase and have access to a wider demographic range.

Component 3 – Response Capability

To build the emergency response capabilities of Cambodian people and institutions, PIN has conducted flood emergency response trainings to District & Commune Committees for Disaster Management (DCDMs & CCDMs) across the country. These capacity building sessions have been undertaken as part of the EWS1294 promotional campaigns, to strengthen the knowledge of local institutions and increase subscription within communities highly vulnerable to flooding. The sessions involve a discussion on existing emergency preparedness and response plans, followed by a presentation by PIN’s Disaster Management team on the importance of EWS1294 within the disaster risk reduction (DRR) landscape of Cambodia. These presentations emphasise the value of early warning information and detail the appropriate actions to take after receiving a message from EWS1294.

In addition to the promotion of EWS1294 with disaster management authorities, PIN Cambodia also aims to strengthen emergency response capacities through the establishment of Village Disaster Management Groups (VDMGs). VDMGs are comprised of proactive members of the community who take the lead in disaster preparation, emergency response and impact recovery at village level. The groups are headed

by the Commune Chiefs and their assistants, with the traditional structure consisting of three sub-teams; (1) Rescue, (2) Sanitation and (3) Emergency Response. These groups are in effect across the Kingdom under the NCDM, DCDM, CCDM structure, although PIN has often supported the setting-up of VDMGs in communes where they are not overly active. VDMG activities conducted by PIN involve DM capacity building, through interactive sessions that impart disaster preparedness skills and emergency response knowledge, as well as encouragement to subscribe to EWS1294.

Through these abovementioned actions, in addition to promotional activities, the EWS1294 project has enhanced the response capabilities of the Cambodian people and its institutions, through the facilitation of early action by providing timely early warning information, as well as enhanced risk education through capacity building.

Component 4 – Risk Knowledge

The EWS1294 project has aimed to instil flood risk knowledge within local populations through promotional campaigns in schools, particularly in communities considered to be 'high-risk'. Similarly to the VDMG capacity building, the purpose of these sessions is to

spread an educational understanding of disaster preparedness, through interactive sessions with the younger members of the community, as well providing information, education and information materials to be shared with their families. This is an effective method for sustainably building risk knowledge

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that should be maintained within future generations, as well as enabling access to a large spatial coverage, due to the hub-nature of schools.

Since the creation of the EWS1294 Facebook Page in March 2020, PIN has been focussing on sharing educational materials online through social media. In April 2019, there were an estimated 7.8 million Facebook users in Cambodia, accounting for 46% of the country's population⁷; this number continues to grow as smart phones have become increasingly

abundant across the Kingdom. Social media platforms therefore present a valuable opportunity to enhance EWS, by disseminating early warning information and transferring risk knowledge to the population. Hence, PIN Cambodia are currently implementing a Natural Disasters Safe Steps Campaign, with the goal of strengthening public risk knowledge through the sharing of good disaster preparedness and emergency response actions. This campaign involves a range of media, such as videos, graphics, articles and interviews with national and international stakeholders.

Demonstrated Impact

In December 2020, PIN Cambodia conducted an assessment to evaluate the impact and sustainability of EWS1294 and identify areas for future developments to the system⁸. The evidence accumulated in the study demonstrated the extremely positive impact of EWS1294, by providing timely, life-saving, hazard warning information and therefore contributing to increased disaster preparedness across the Kingdom of Cambodia.

The assessment showed that the biggest benefit of the EWS for both VDMGs and subscribers is an improvement in emergency preparedness and response time. At



NCDM OFFICER carried metal bracket to install the sensor in Samluot District, Battambang province.

Photo: Tin Socheata

Key Lessons Learnt For Future Application



A primary focus of the EWS1294 project was to enhance the forecasting capacities of NCDM through the use of Tepmachcha river sensors. This was an innovative approach that attracted numerous project donors and led to large amounts of time and funding being dedicated to the development of the sensors. **Although, the developments have been successful and the sensor network is an important component of EWS1294, a greater impact may have been achieved if this effort was instead dedicated to the dissemination component, to enable the cell broadcasting communication channel that is currently being developed. This shift could have exponentially increased the reach of the dissemination system, which was the primary gap identified in the EWS landscape of Cambodia and would have prevented the limitation of the subscriber model.**



Despite the continual growth in subscribers and an increase in successful EWS disseminations from 2019 to 2020, a challenge identified within the impact study was to find a more effective way of increasing the reach, and therefore number of beneficiaries, of the system. EWS1294 was experiencing an increase of 50 subscriptions per day and a natural daily increase of only 10.3-26.2. **As the nationally recognised EWS for Cambodia, the existing subscription model must be reformed to either establish more effective methods of increasing subscribers or take an alternative approach to accessing at-risk beneficiaries.** Furthermore, the assessment showed that the number of failed calls was largely constant, and that it changes little with an increased number of subscribers. The fact that people in Cambodia change phone numbers frequently also limits the efficiency of continuing with a subscriber-based system. **As a result, PIN highly recommends transitioning to a broadcast-based dissemination modality, which would allow operators to adjust for a number of variables (changing phone numbers, coverage issues) and would ensure that the largest possible share of the population receives EWS messages.**



As demonstrated by the EWS1294 Impact Assessment, VDMG trainings are a highly successful method of increasing the emergency response capabilities of vulnerable communities. However, due to their localised nature it is inefficient to attempt to conduct these trainings on a large scale. **Hence, it would be more effective to design a high-quality TOT programme with disaster management authorities at a higher spatial scale, to build the capacities of the district governments and enable the VDMG trainings to be conducted over a wider region, on a more frequent basis.** While data collected in the impact assessment shows that PIN has already made effective use of Facebook as a communications tool for EWS1294, through the transfer of risk knowledge to the population, the study underlined the need to further capitalise **on the platform's reach, through the production of audience specific content coupled with financial boosting capabilities.**



A number of issues connected to the sonar sensors have also been identified which are further described in more detail at this [link](#).

the level of VDMGs surveyed, 76% reported taking actions very shortly after receiving EWS messages. Similarly, 93% of VDMGs highlighted the clarity of messages sent as a strong point of the system. At the level of subscribers, 76% of early warning alert recipients reported having more time to react to the coming floods, and 89% claim to know which actions to undertake thanks to the personalised messages. Therefore, EWS1294

provides an extremely positive impact to the Cambodian population, due to the high level of efficiency of the system and the strong clarity of the messages that are disseminated; enhanced by the inclusion of the CAP standardisation.

One of the most important impacts of EWS1294, to ensure a people-centred approach, is the system's influence on community action after receiving a warning message. This is supported

by the results of the impact assessment, showing that 61% of subscribers take actionable steps after receiving a message from EWS1294, including the protection of family and livestock (41%), emergency preparedness (88%) and evacuation (24%). 90% of registered users forward the information received in warning messages to other people in their surroundings. With the average household size of registered users, which is 4.7 persons (from impact assessment data), the impact of one received early warning message increases exponentially with each additionally informed person. Of the total number of VDMGs involved in the study, 55% said that after receiving the warning message they also inform others in their area. Hence, an additional strength of EWS1294, is that the messages contain valuable information that can guide beneficiaries towards important disaster prevention actions, prior to flood events.

The analysis showed that the confidence of government officials in the system is very high, and that the majority believe that EWS1294 increases the safety of people in vulnerable areas. The assessment showed that PCDMs know how to operate the system and are fully capable of sending early warning alerts. This was reflected by the callout data, reporting that 235 callouts were made by EWS1294 in 2019 and 2020, successfully completing 284,838 calls across 21 different provinces. These calls were responsible for reaching an estimated 1.17 million people and displayed vast amounts of growth in terms of dissemination, exemplified by the 184.7% increase in the number of callouts and a 335.3% increase in completed calls from 2019 to 2020. These statistics therefore support the positive and sustainable impact from the EWS1294 dissemination platform, which is directly linked to the government's confidence in the system's effectiveness.

1 Additional information can be found at: <https://earthobservatory.nasa.gov/images/76212/floods-in-cambodia>

2 Data sourced from: <https://www.mrcmekong.org/assets/Publications/basin-reports/Annual-Mekong-Flood-Report-2011.pdf>

3 Source: <https://www.unisdr.org/2006/ppew/info-resources/ewc3/checklist/English.pdf>

4 Information from PIN Cambodia's internal study: People in Need (2019) Flood Early Warning Systems in the Lower Mekong

5 Graphic taken from: United Nations Development Programme (2018) Five approaches to build functional early warning systems.

6 As of 27/10/2021

7 Data sourced from: [https://napoleoncat.com/stats/facebook-users-in-cambodia/2019/04#:~:text=There%20were%207%20810%20000,group%20\(3%20600%20000\)](https://napoleoncat.com/stats/facebook-users-in-cambodia/2019/04#:~:text=There%20were%207%20810%20000,group%20(3%20600%20000))

8 Contact PIN Cambodia for access to the EWS1294 Impact Assessment document.



MS CHEA CHAMROEUN, Village Chief of Banteay Neang Commune, Banteay Meanchey Province.

Photo: PIN

Case Study: Village chief saves lives in Cambodia with EWS1294

Chea Chamroeun is village chief of the Banteay Neang commune in the Mongkul Borei District, located within Cambodia's Banteay Meanchey Province. In 2015 Chea Chamroeun participated in a workshop organised by PIN on EWS1294. Since then, Chamroeun has been helping her community prepare for the worst. Chamroeun stated: "It's a great tool, and subscribing to the system was simple and straightforward, so it was easy for me to share it with the members of my commune. I think about 30 people registered with the system after I told them about it."

In October 2020, 14 provinces, including Banteay Meanchey, were affected by flash flooding. Houses, agricultural land, and infrastructure, including roads, schools, and health centres were inundated. Leam La, a staff member of Banteay Meanchey's Provincial Committee for Disaster Management, reports that "Banteay Meanchey Province was one of the most affected provinces,

second only to Battambang. Approximately 192,240 people were affected, of which 4,567 were displaced. 28 people lost their lives, including five children."

Several hours before the flash flood, Chamroeun was alerted to the impending disaster by EWS1294. "I received a call from EWS1294 the morning before the water made its way to my village. It was unexpected because the last time we experienced flooding was eight years ago, in 2012", she recalled. Although the alert caught her by surprise, Chamroeun remained calm, acted quickly to inform the other villagers of the unexpected event, and

immediately moved her disabled son to higher ground.

Five hours later, the flash flood wreaked havoc on the commune, destroying approximately 194 hectares of rice fields and crops, and damaging 200 houses. "I was glad to receive the timely warning from 1294. As a village chief, it allowed me to disseminate information to the villagers more quickly than before and to prepare for evacuation. The early warning made a big difference, especially for my disabled son," says Chamroeun. Although the flood greatly impacted their livelihoods, no lives were lost at Banteay Neang Commune.

i EWS 1294 - funding partners

Since 2013, PIN has been working closely with its partners and various levels of government in Cambodia, to strengthen climate information and early warning systems. The continuous development of EWS 1294 is led by PIN, with funding from the Ministry of Foreign Affairs of the Czech Republic and UNDP Cambodia. The programme was also previously funded by the EU's Civil Protection and Humanitarian Aid Operations, the World Food Programme and the Swiss Agency for Development and Cooperation, with support from the National Committee for Disaster Management.