

MOBILE INNOVATIONS FOR EARLY WARNING SYSTEMS

10 Lessons from the
GSMA Innovation
Fund for Anticipatory
Humanitarian Action

GSMA
Mobile for
Development

M4D



GSMA

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GSMA Mobile for Humanitarian Innovation

The GSMA Mobile for Humanitarian Innovation programme works to accelerate the delivery and impact of digital humanitarian assistance. This is achieved by building a learning and research agenda to inform the future of digital humanitarian response, catalysing partnerships and innovation for new digital humanitarian services, advocating for enabling policy environments, monitoring and evaluating performance, disseminating insights and profiling achievements.

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GSMA Innovation Fund

The GSMA Innovation Fund accelerates digital technology solutions that are addressing key global challenges. Through grant funding and tailored venture building support, we enable innovative organisations in low- and middle-income countries (LMICs) to scale and amplify social and environmental impact.

For more information, please visit:

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Contents

Introduction	2
What is anticipatory humanitarian action?	6
What role does mobile innovation play?	8
10 lessons: The GSMA Innovation Fund for Anticipatory Humanitarian Action	12
1: Mobile and digital tools accelerate and strengthen anticipatory action	14
2: Trust determines whether early warning systems succeed	16
3: Digital and financial literacy shape impact	18
4: Designing for those most at risk strengthens the whole system	21
5: Cash assistance accelerates action	24
6: Strategic partnerships turn EWS innovation into adoption	26
7: Government engagement anchors EWS legitimacy and sustainability	28
8: The mobile industry holds unique levers for scale	30
9: Diverse pathways to scale	32
10: Financing remains a hurdle, but demand is rising for EWS innovation	34
Recommendations	36

Introduction

Around the globe, climate-related shocks are becoming more frequent and destructive, disproportionately affecting low- and middle-income countries (LMICs). Disasters not only claim lives but can damage livelihoods, displace communities and weaken vital infrastructure. In recent years, the humanitarian sector has placed growing emphasis on strengthening anticipatory action – measures taken before a crisis hits to reduce its impacts.¹

Mobile and digital technologies are playing an increasingly important role in anticipatory humanitarian action. They can improve forecasting, deliver life-saving alerts and provide rapid access to cash and essential services. Their reach makes them powerful preparedness tools, particularly where humanitarian resources are stretched. However, several challenges remain. Communities in need of assistance are more likely to live in areas without reliable connectivity or data infrastructure.² Digital delivery can also deepen inequalities if marginalised groups are excluded, while issues of privacy, data protection and bias in emerging technologies have introduced ethical dilemmas.

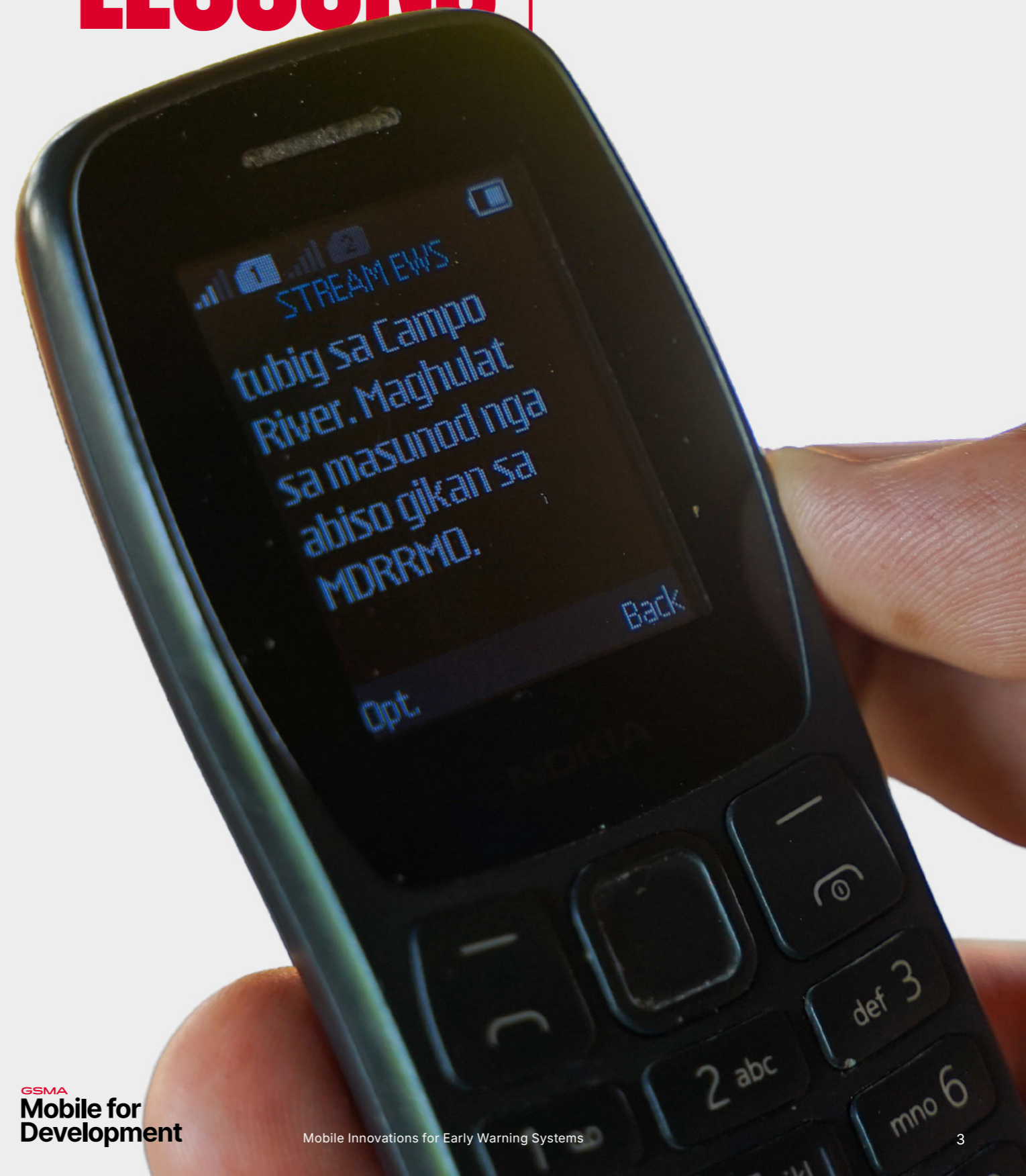
The GSMA Innovation Fund for Anticipatory Humanitarian Action (hereafter referred to as “the Fund”) was launched to test how mobile and digital solutions can make humanitarian preparedness

and response more effective. From 154 applications, eight grantees were selected from seven countries, including both startups and non-profits. While anticipatory humanitarian action covers a spectrum of pre-crisis measures, from risk forecasting to early response, the majority of innovations in this cohort focused on early warning systems (EWS) – the mechanisms that trigger and enable timely action.³

The Fund was designed not only to support innovators and deliver impact, but also to generate evidence. By working closely with the eight grantees, the GSMA explored what works, common challenges and what it takes to sustain and scale promising solutions. This synthesis paper presents 10 key lessons from the Innovation Fund cohort to inform and guide future efforts, offering practical insights for the humanitarian community to strengthen mobile-enabled anticipatory action.

10 KEY LESSONS

This synthesis paper presents 10 lessons from the Innovation Fund cohort to inform future efforts, offering practical insights for the humanitarian community to strengthen mobile-enabled anticipatory action.



1. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) defines anticipatory action as “acting ahead of predicted hazards to prevent or reduce acute humanitarian impacts before they fully unfold”.

2. GSMA. (2024). *Connectivity in Crisis: The Humanitarian Mobile Coverage Gap*.

3. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) defines anticipatory action as “acting ahead of predicted hazards to prevent or reduce acute humanitarian impacts before they fully unfold”.

The GSMA Innovation Fund for Anticipatory Humanitarian Action

The [GSMA Innovation Fund for Anticipatory Humanitarian Action](#) launched in 2022. The initiative was funded by the UK Foreign, Commonwealth & Development Office (FCDO) and was supported by the GSMA and its members. The Fund backed solutions that leverage mobile and digital technology to help anticipate potential humanitarian impacts and enable effective early response. By focusing on the important theme of anticipatory action, the Fund contributes to the minimisation of humanitarian impacts and the improvement of preparedness in the face of sudden-onset crises.

Grant period: October 2023–March 2025



8 grantees

ActionAid, Buraq, NAXA, People In Need, Rumsan, Synnefa, TAHMO, Tearfund



7 countries

Cambodia, Ethiopia, Ghana, Kenya, Nepal, Pakistan, the Philippines



1.3 million people reached

54% women



\$4.3 million in additional investment

unlocked from other sources during the GSMA grant period

Explore the grantee case studies

ActionAid Cambodia

Strengthening Cambodia's national early warning system, EWS 1294



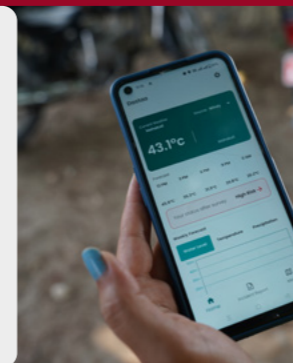
Buraq Pakistan

Mobile-enabled EWS for anticipatory action in Pakistan's northern mountain ranges



NAXA Nepal

Digital and spatial technology for anticipatory action in Nepal



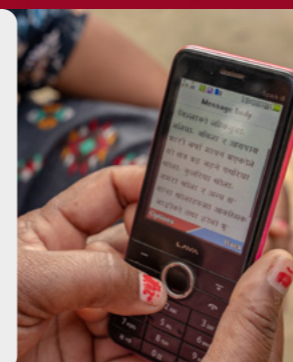
People In Need Philippines

Internet of Things (IoT) and mobile technology for anticipatory action in the Philippines



Rumsan Nepal

Blockchain for anticipatory action and cash assistance in Nepal



Synnefa Kenya

Smart farming solutions for anticipatory action in Kenya



TAHMO Ghana

Commercial microwave links to develop early warning flood systems in Ghana



Tearfund Ethiopia

Equipping agro-pastoralists in Ethiopia with access to climate information and insurance



What is anticipatory humanitarian action?

Anticipatory action refers to measures taken before a predicted hazard occurs.

Over the past two decades, natural hazards have claimed 1.23 million lives, with 90% of these deaths occurring in LMICs. The increasing frequency and severity of such events are closely linked to the accelerating impacts of climate change, which the World Bank warns could push up to 130 million people into extreme poverty by 2030.⁴

As disasters become more frequent and damaging, the humanitarian sector is increasingly focused on anticipating crises and acting before impacts escalate. Early, pre-emptive action offers a critical opportunity to reduce loss of life, preserve livelihoods and protect key infrastructure that underpin community resilience.

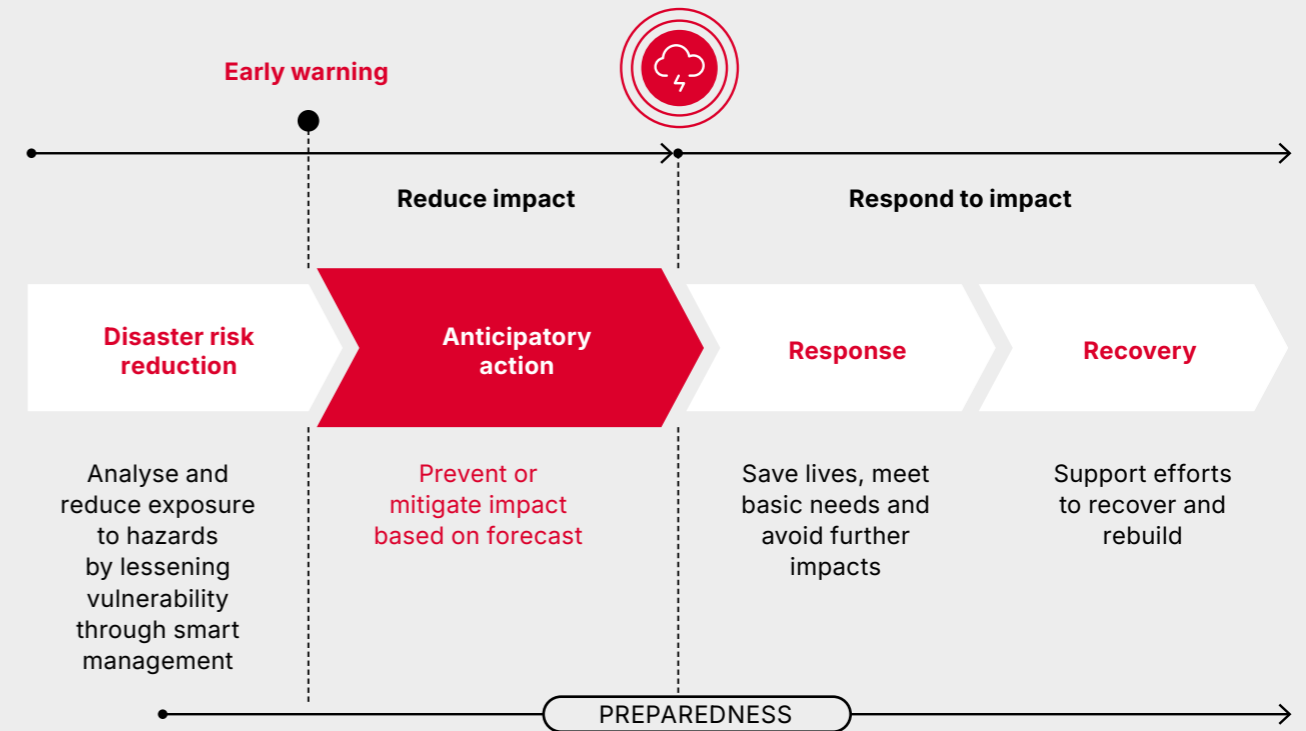


Anticipatory action


Anticipatory action refers to measures taken before a predicted hazard occurs.⁵ Risk information is used to activate support in advance, reducing the scale of humanitarian response required after the event. Anticipatory action relies on strong early warning systems.

4. Jafino, B.A. (2020). Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030. Policy Research Working Paper 9417. World Bank Group.
 5. Risk-informed Early Action Partnership (REAP). (2022). Glossary of Early Action Terms.

Figure 1: Anticipatory action in the disaster risk management cycle



Source: Tozier de la Poterie, A. et al. (2021). "Managing multiple hazards: lessons from anticipatory humanitarian action for climate disasters during COVID-19". Climate and Development, 14(4).

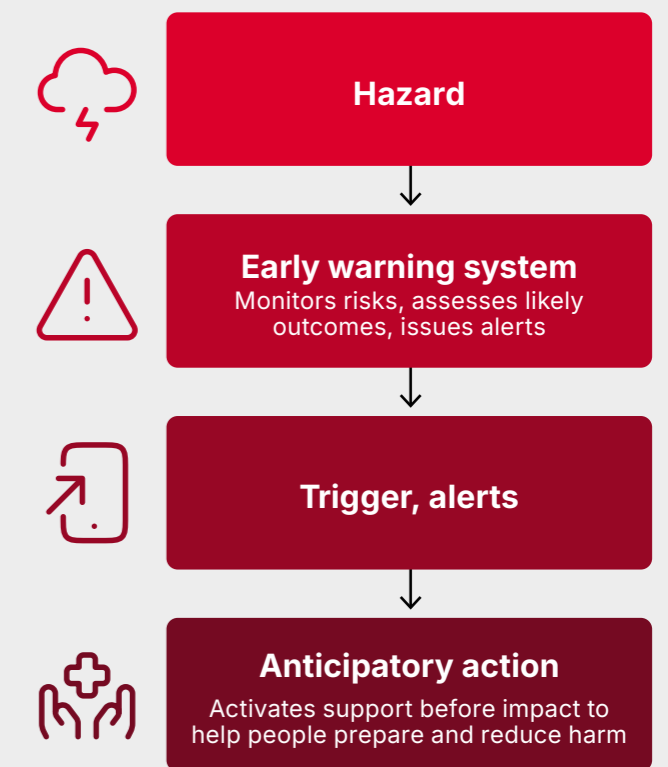


Early warning systems

EWS monitor hazards, assess potential impacts and issue alerts to those who need to make decisions. They provide the forecasts and thresholds that determine when anticipatory action should begin.

EWS signal that a crisis is likely, while anticipatory action turns this information into decisions. When the two work together, organisations can act earlier, direct resources where they are most needed and reduce the scale of humanitarian response required.

Figure 2: Early warning systems' role in anticipatory action



Source: GSMA. (2025).

What role does mobile innovation play?



Mobile and digital tools are playing an increasingly important role in how anticipatory humanitarian action is designed, delivered and scaled.

Their value lies not only in their reach – 5.8 billion people now own or have access to a mobile handset – but also in their infrastructure, data and services.^{6,7} This makes mobile technology and the mobile industry crucial links between early warning signals and effective humanitarian action.

Mobile channels can deliver vital risk information directly to communities and humanitarian actors. SMS, voice messages, apps and cell broadcast (CB) enable alerts and preparedness advice to reach large populations. These channels also support feedback loops, giving authorities a clearer view of who has received and acted on messages.

Mobile services extend beyond communication. Increasingly, analytics derived from mobile network data can help identify how hazards might affect different locations and which groups are most exposed. Digital financial services, including mobile money, also provide a mechanism for early assistance as savings, insurance payouts or cash transfers can be triggered once risk thresholds are met, allowing households to take steps to protect themselves before losses occur.⁸

As digital ecosystems evolve, frontier technologies are strengthening anticipatory humanitarian action. AI models are improving forecasts and hotspot identification, IoT devices can feed real-time data into EWS, while blockchain is creating more transparency.

5.8BN

The value of mobile tools lies not only in their reach – 5.8 billion people now own or have access to a mobile handset – but also in their infrastructure, data and services

6. GSMA. (2025). The State of Mobile Internet Connectivity 2025.

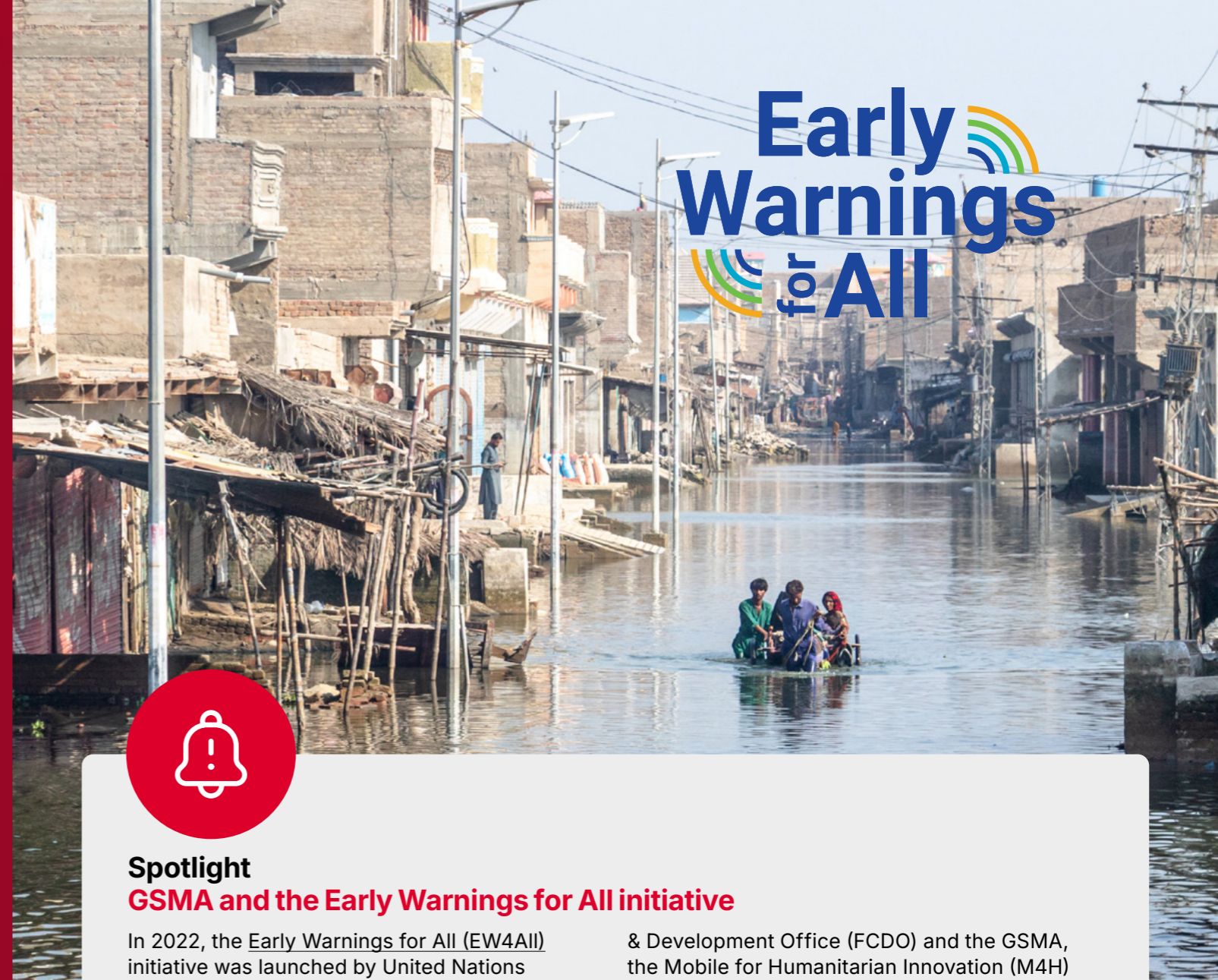
7. GSMA. (2025). The Mobile Economy 2025.

8. GSMA. (2019). Mobile money enabled cash aid delivery: Essential considerations for humanitarian practitioners.

Mobile and digital technologies leveraged by the cohort

The following figure illustrates the mobile and digital capabilities underpinning these functions. Most Innovation Fund grantees integrated several of these elements, demonstrating how mobile solutions convert early warnings into timely, anticipatory action on the ground.

Figure 3: Examples of mobile and digital technologies used in anticipatory action



Spotlight GSMA and the Early Warnings for All initiative

In 2022, the Early Warnings for All (EW4All) initiative was launched by United Nations Secretary-General, António Guterres, with the aim of ensuring that everyone in the world is protected by an early warning system.

With 96% of the world's population covered by a mobile network and 5.8 billion unique mobile subscribers globally,^{9,10} mobile can play a life-saving role in early warning dissemination and communication, with mobile networks ideally placed to deliver risk alerts.

The mobile industry has long-standing experience in the development and implementation of EWS and is committed to the ambition of the EW4All initiative.¹¹ With funding from the UK Foreign, Commonwealth

& Development Office (FCDO) and the GSMA, the Mobile for Humanitarian Innovation (M4H) programme is playing a leading role in the EW4All initiative by:

- Convening the mobile industry and enabling multi-sector partnerships to develop and implement EWS
- Investing in innovative digital solutions for EWS through the GSMA Innovation Fund
- Publishing research on mobile-enabled EWS, including on CB and enhancing inclusion in risk communications
- Providing technical assistance to mobile network operators (MNOs) and partners developing mobile-enabled EWS with a user-centric approach

9. GSMA. (2025). The State of Mobile Internet Connectivity 2025.

10. GSMA. (2025). The Mobile Economy 2025.

11. GSMA. (2024). Mobile-Enabled Early Warning Systems: The GSMA and the Early Warnings for All Initiative.

10 LESSONS

The GSMA Innovation Fund for Anticipatory Humanitarian Action

Key lessons emerged from the GSMA Innovation Fund for Anticipatory Humanitarian Action cohort. Together, they highlight what matters most in creating and scaling mobile and digital solutions for anticipatory action.

1.
Mobile and digital tools accelerate and strengthen anticipatory action



2.
Trust determines whether early warning systems succeed



3.
Digital and financial literacy shapes uptake



4.
Designing for those most at risk strengthens the whole system



5.
Cash assistance accelerates action



6.
Strategic partnerships turn EWS innovation into adoption



7.
Government engagement anchors EWS legitimacy and sustainability



8.
The mobile industry holds unique levers for scale



9.
Diverse pathways to scale



10.
Financing remains a hurdle, but demand is rising for EWS innovation



RECOMMENDATIONS



Lesson 1

Mobile and digital tools accelerate and strengthen anticipatory action



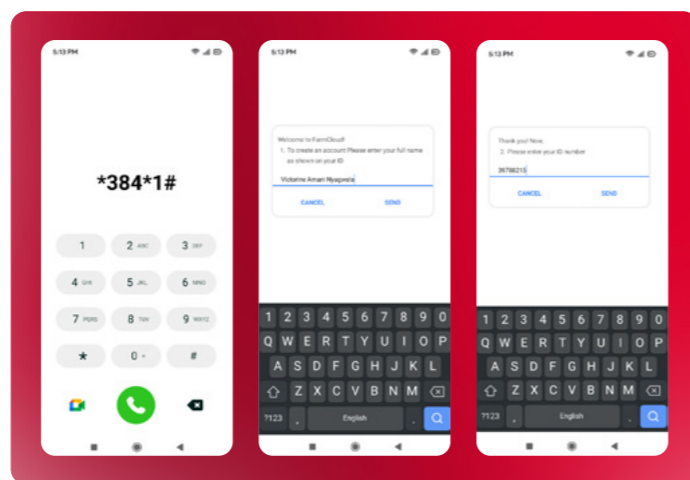
"Before, it was hard to coordinate during disasters. But last monsoon, I got an early warning alert from NAXA's Digital and Spatial Technologies for Anticipatory Action (DASTAA) platform and quickly teamed up with health workers, volunteers and municipal staff. We evacuated vulnerable families, provided medical kits, and ensured safe drinking water. With better coordination and clear communication, I can now serve my community more effectively. DASTAA has truly changed how we respond together, we're stronger and more prepared."

– Coordinator, Dodhara Chandani, Nepal

In many humanitarian settings, access to timely, reliable information is a challenge. Forecasts can arrive too late, reach the wrong audiences or make decision-making difficult. With support from the Fund, grantees generated valuable evidence on how mobile-enabled technology can help close these gaps and better support communities, humanitarian actors and governments.

Embedding tools such as sensors, real-time data streams and mobile alerts generated better data and supported more informed decisions and stronger anticipatory action. For example, in Pakistan, **Buraq's** rainfall sensors and landslide monitoring stations provided an extra 30 minutes of warning before flash floods occurred – critical time that traditional forecasts could not offer. In Nepal, **NAXA's** impact-based forecasting¹² reframed hazard data around likely human consequences, allowing local governments to plan evacuations and resource deployment more effectively. In Ghana, **TAHMO's** data networks strengthened national flood forecasting, while **Rumsan's** blockchain-enabled systems in Nepal tracked cash assistance transparently, ensuring that support reached intended households.

Multi-channel communication through mobile and digital platforms has proved essential. SMS and smartphone apps reach connected users, while voice messages in local languages proved particularly inclusive for those with low literacy levels. In Kenya, **Synnefa's** USSD services enabled farmers to access soil and weather data without smartphones, demonstrating how simple technology can extend reach and usability. Meanwhile, Facebook emerged as the most influential platform in Nepal and Cambodia as most target communities were active users and preferred receiving important updates via groups and pages.



12. Instead of predicting what the weather will be, impact-based forecasting (IBF) assesses the potential impacts it will have on people, assets or infrastructure.



Spotlight

IVR: an effective channel for inclusive communication

Interactive voice response (IVR) proved highly effective in six of the eight projects, helping reach people with lower literacy or digital skills. In Pakistan's mountain regions, **Buraq** delivered warnings in local languages such as Chitrali and Balti, with voice calls giving simple instructions, assurance that alerts were received and, crucially, data on how much of the messages recipients listened to.

In Nepal, **Rumsan** found that combining SMS and IVR maximised reach. Younger and literate users responded better to SMS, while older or less literate individuals preferred IVR. Survey results showed 60% could understand SMS messages fully, while 40% ignored or did not grasp them due to literacy barriers – underlining the need for multi-channel approaches.

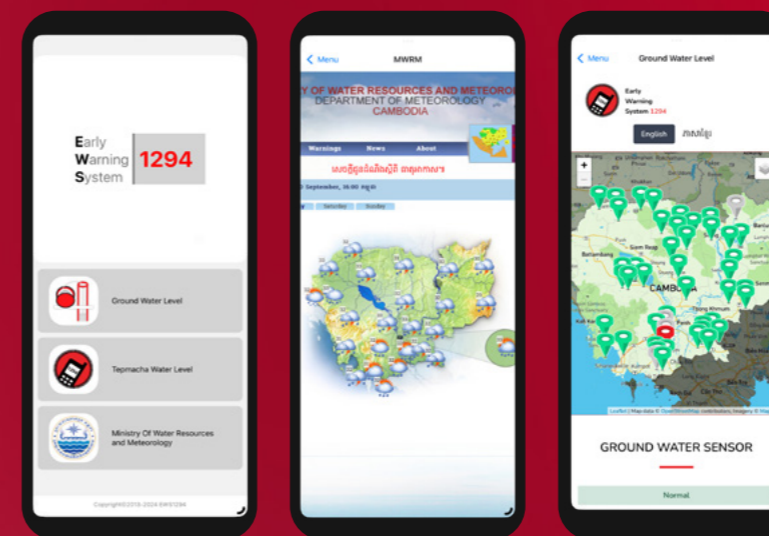
Tearfund also found IVR effective for weather and agricultural advisory support. Localised voice messages improved understanding and were widely shared – often among four to five people per device – extending reach beyond individual phone owners.



"Earlier, there was no information coming from anywhere. We used to place sticks in the Karnali River to guess if the water was rising or falling. Someone would go check and come back saying, 'The water's above the stick', that was our only warning. Now, we get early alerts directly on our phones.

The IVR calls that we received this year were very helpful, clear voice messages in our local language that tell us what's coming and what to do. It's easy to understand, even for people who can't read. These messages have given us time to move to safety, protect our animals, and save our belongings. They've made a huge difference for families like mine."

– Community member, Janaki Rural Municipality, Kailali, Nepal



The projects show that mobile and digital tools can do more than add new features – they also make EWS more accurate and effective. However, the cohort found that creating solutions that work is only half the task. The real challenge is designing solutions that people understand, can use and, most importantly, trust.

Lesson 2

Trust determines whether early warning systems succeed

Across the cohort, **trust was the single most important factor determining whether a solution was adopted.** Building trust took time and consistent effort – often far more than grantees had anticipated.



Even the most technically sound solutions struggle to gain traction if users do not understand their value. Uptake of digital tools depends on trust – both in the technology itself and in those delivering it – particularly among marginalised communities that have experienced exclusion or harm in the past.¹³

Across the cohort, **trust was the single most important factor determining whether a solution was adopted.** Building trust took time and consistent and ongoing effort – often far more than grantees had anticipated.

Projects that involved users early in the design phase were more likely to succeed. Co-creation workshops, field testing and user feedback loops helped ensure that solutions reflected real needs and local contexts. In Nepal, **Rumsan** worked with community members, the Danish Red Cross and municipalities to adapt its blockchain platform to local realities. In Ghana and Kenya, **TAHMO** and **Synnefa** refined their alert formats and user interfaces based on repeated testing with farmers and community members. These approaches not only improved functionality but also instilled users with confidence, knowing that their views and preferences shaped the solutions.



Spotlight Human-centred design for EWS

Evidence shows that innovations are more sustainable and scalable when they are designed *with* the people who use them, not just *for* them.¹⁴ Human-centred design (HCD) principles ensure that lived experiences, preferences and challenges are embedded in a solution from the outset. GSMA research in South Africa and Tanzania explored how risk communication becomes more inclusive when it is co-designed with communities, reflecting the social, cultural and behavioural dynamics that influence how people act on early warnings.¹⁵

Across the cohort, projects that applied HCD principles saw stronger engagement and impact. In Nepal, **NAXA** and its partner Viamo ran extensive user workshops in local languages to design risk messages that reflected how communities actually interpret forecasts. For **Synnefa**, repeated field testing helped refine alert formats and interfaces for clarity and usability. By grounding design in users' realities, grantees developed tools that people were more likely to understand, trust and act on.



Local ownership proved vital to building trust.

In Pakistan, **Buraq** appointed local caretakers to maintain weather stations, signalling that the technology belonged to the community rather than an external organisation. **TAHMO's** network of citizen scientists in Ghana performed a similar role, collecting river data and maintaining stations to improve accuracy and legitimacy.

Partnerships with trusted intermediaries deepened community trust. **Synnefa** worked through cooperatives and NGOs to reach female farmers in Kenya, while **Tearfund** embedded its services in self-help groups that women already relied on for savings and support. By aligning with familiar institutions, projects reduced scepticism and helped users see the EWS as part of their own networks.



Together these approaches highlight an intuitive but often overlooked point: without explicit investment in trust and local ownership from the start, EWS will not be used. The strategies employed by the cohort ensured solutions were not just technically sound but also socially meaningful. Future funding models should budget as seriously for community engagement and trust-building as they do for technical design.

13. GSMA. (2023). Digital Innovation in Humanitarian Settings: Lessons from the GSMA Mobile for Humanitarian Innovation programme.

14. Podesta, A. (22 August 2023). "Community-led innovation for a locally led humanitarian system". Start Network.

15. GSMA. (2025). Making Early Warnings Work for All: People Centred Design.

Lesson 3

Digital and financial literacy shape impact



"People in our villages are being scammed in different ways – lottery scams, fake prize calls, and unknowingly sharing personal data. During the digital finance awareness sessions conducted by Rumsan, many were shocked to realise the risks they faced daily. Seeing the impact, we've now decided to integrate digital fraud awareness into our community programs and allocate municipal resources for it. This truly opened our eyes to the urgent need for financial literacy in the communities."

– Disaster focal person, Janaki Rural Municipality, Nepal

Early warning systems depend on user skills as much as they do on technical design. Even well-conceived digital tools can fall short if users lack the knowledge or confidence to apply them effectively. Limited digital literacy can also heighten exposure to online and information risks, particularly when users do not know how to manage them safely.¹⁶

The cohort showed that digital and financial literacy training was not an optional add-on – it was a core condition for uptake. Training helped people understand and act on the information they received, reduced digital risks and gave response teams the confidence to manage new systems. For example, in Nepal, workshops on digital wallets and fraud prevention enabled households to use mobile cash transfers securely and avoid fraud. These investments had broad ripple effects, strengthening the digital capabilities of communities.



16. GSMA. (2023). Digital Inclusion in Humanitarian Settings: Lessons from the GSMA Mobile for Humanitarian Innovation programme.



Spotlight

Alert frequency is a delicate balance

Determining the right frequency of alerts is an important decision for any EWS. Sending too many can lead to alert fatigue or cause people to tune out. Too few, and users may not have the trust or familiarity needed to act quickly. Some grantees found that communities distrusted early warning messages, suspecting they were scams intended to lure them away from home and leave them exposed to theft.

Buraq addressed this by sending general climate-related alerts every month to maintain engagement and familiarity with the system. These were complemented by real-time alerts in response to specific hazards, such as heatwaves or the start of the monsoon season. This approach helped ensure users stayed connected to the system while high-risk alerts were still perceived as urgent and credible.

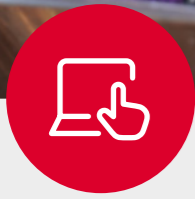
Given the high number of spam messages received by mobile phone users in Cambodia, **ActionAid** found that credible information sources were particularly important for trust in the 1294 system. Having government names associated with the messages helped to increase confidence and uptake of the advice.



The need for training extended across the entire EWS ecosystem. At-risk households, the community response teams managing equipment, humanitarian staff and government partners all needed support to use new EWS tools effectively. In the Philippines, **People in Need** invested in capacity building for disaster managers, helping governments take more ownership of the solutions and operate them independently and with confidence.



Building key digital and financial skills must be recognised as essential to effective EWS, rather than a supporting activity. Programmes should be designed around existing literacy levels and, where these are lower, invest in sustained skill building to ensure technology delivers real and lasting impact. Training also needs to be ongoing – reinforced through peer learning, refresher sessions and local champions who keep the skills of communities, response teams and institutions active and up to date.



Spotlight
Financial and digital literacy as a catalyst for anticipatory action

Tearfund's project in Ethiopia showed how building financial and digital skills can transform disaster preparedness and resilience. Through 870 self-help groups, more than 43,000 members – half of them women – learned to save, manage credit and use digital tools with confidence.

Training on bookkeeping, savings and digital financial services helped build trust and transparency, connecting the groups with banks and access to credit for the first time. Women used these skills to start businesses and increase their household incomes, while 2,500 members purchased parametric insurance¹⁷ to protect against climate shocks.

Digital literacy also accelerated uptake of mobile tools, including the project's Jamii.one platform, giving communities timely weather updates and the ability to anticipate and recover from crises. Combining digital and financial skills improved the ability of savings groups to plan ahead and respond effectively to climate-related shocks.

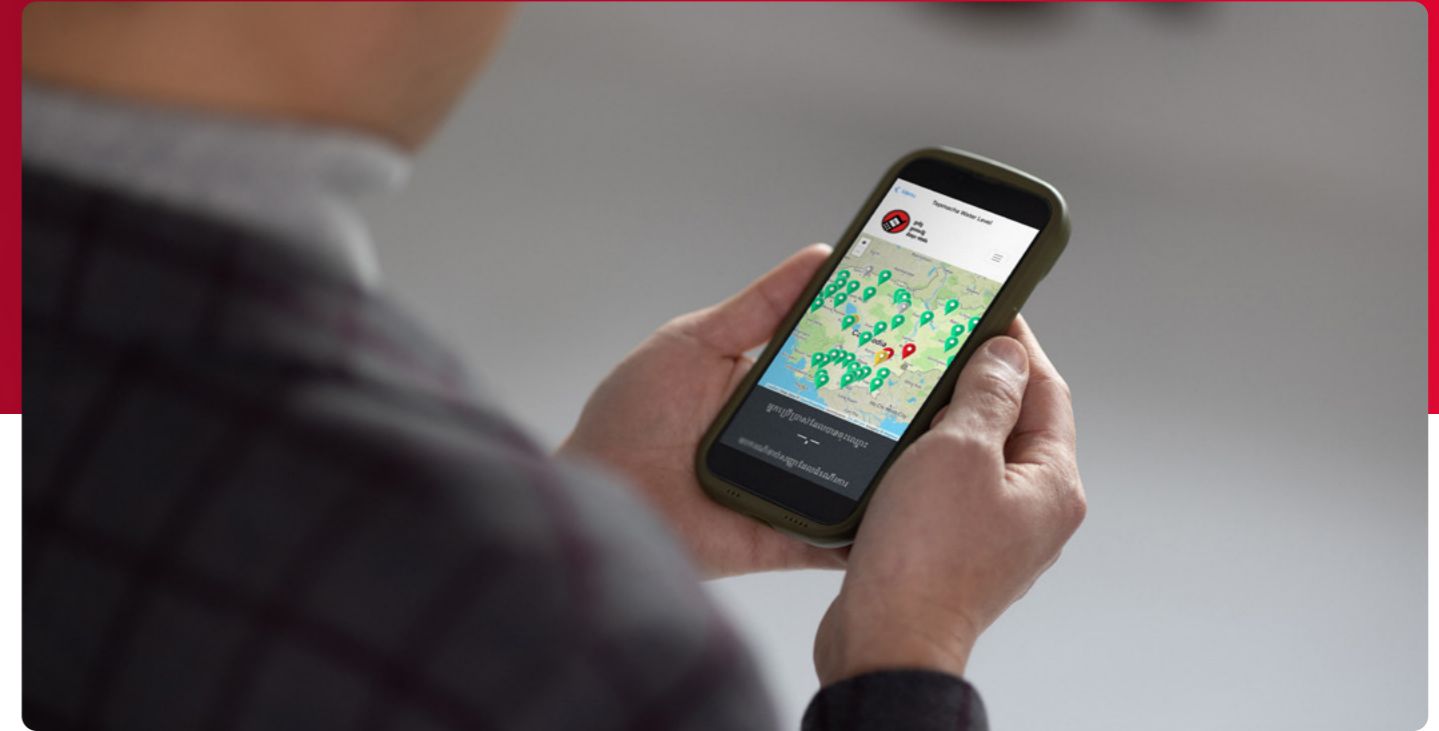
"I received 10,000 ETB (about 72 GBP) from our saving group to start a small off-farm business...I began buying grains at the Woyto market and selling them in Karat. Within a week, I had repaid the loan – including 500 ETB interest – and had enough profit to support my family. Now, we're not depending only on our farm."

– Female farmer, Eregna, Ethiopia



17. Parametric insurance is a financial tool that is gaining traction in Ethiopia to mitigate the risks associated with natural disasters, particularly droughts and floods. This approach differs from traditional indemnity insurance by providing payouts based on predefined indices, such as rainfall levels or temperature thresholds, rather than assessing the actual amount of loss incurred.

Lesson 4
Designing for those most at risk strengthens the whole system



Early warning systems are only as effective as their ability to reach everyone at risk. Mobile and digital tools can expand access to life-saving information, but they can also deepen divides if not designed carefully. Those most exposed to climate and disaster risks are often the least connected, including persons with disabilities, older people, minority language speakers and those with low literacy levels.¹⁸ Inclusive design considers who might be excluded and why, building systems that reflect local realities.¹⁹

Innovation Fund grantees discovered the value of combining digital and offline approaches. This ensured information reached the greatest number under a variety of conditions. In Cambodia, **ActionAid** combined radio, social media and community outreach to reach people with varying access to technology. In Nepal, **NAXA** layered SMS, app alerts, IVR calls and sirens so that everyone could receive and understand warnings. In Pakistan, **Buraq** paired

mobile messages with mosque loudspeakers and sirens to reach remote mountain communities through familiar channels. Using multiple channels was not just about coverage – it also made communication more relevant to different users.



18. GSMA. (2024). *Connectivity in Crisis: The Humanitarian Mobile Coverage Gap.*

19. GSMA. (2025). *Making Early Warnings Work for All: People Centred Design.*



In-person engagement remains essential. Projects that paired digital alerts with community outreach, training or local demonstrations found that information was more likely to be understood and acted on. This was particularly evident for **People in Need** in Cambodia, where local networks and barangays (village administrative divisions) were essential in distributing alerts to communities. Various communication channels were used to reach as many people as possible, including social media and SMS, and working with local leaders and established community networks helped embed digital solutions in familiar structures, building local trust in new technology.

Grantees recognised that their solutions can be most compromised during crises. Connectivity can falter during heavy rains or power cuts, so grantees designed systems that could continue functioning. In Pakistan, **Buraq's** solar-powered sensors and manual sirens ensured warnings could still be issued if networks went down. In Nepal, **NAXA** and **Rumsan** built dashboards that functioned both online and offline, allowing disaster managers to monitor conditions even during internet outages. Blending digital and physical systems made early warning networks more dependable for all users.



Designing for inclusion strengthened systems across the board. It improved reach, clarity and reliability, and reduced dependence on any single channel or user group. Most importantly, it reinforced a core insight from across the cohort: when EWS are designed for those least likely to be reached, they work better for everyone.



Spotlight
Women are often overlooked in the design of EWS

In several contexts where Innovation Fund grantees operated, women were the first to receive and act on early warnings – managing household assets while mobilising children, elderly relatives and neighbours. Despite this, EWS rarely treat women as primary users. The cohort showed that when women were targeted directly, overall uptake and responsiveness improved.

In Pakistan, **Buraq** found that the high proportion of men migrating to cities for work meant women were the primary responders in families. In Nepal, **NAXA** adapted its outreach to ensure women were direct recipients of flood warnings. Similarly, in Ethiopia, **Tearfund** adapted its outreach approach to meet the needs of women's self-help groups – leading to more resilient communities overall.

"As a woman, I used to rely solely on the recorda (public announcement system) for warnings, but the information was often delayed or, at times, did not reach us at all. There were instances when we only became aware of rising water levels when it was already too late to secure our belongings or evacuate safely.

I now receive SMS alerts that allow my family and me to act early. These alerts give us enough time to prepare – securing important things and documents, getting our go-bags ready, and ensuring everyone knows what to do before the situation worsens. Having direct and timely information has given us peace of mind, knowing that we are more prepared and **capable of making decisions to protect ourselves."**

– Resident, Brgy Campo, LGU Bacuag, Philippines



Lesson 5

Cash assistance accelerates action



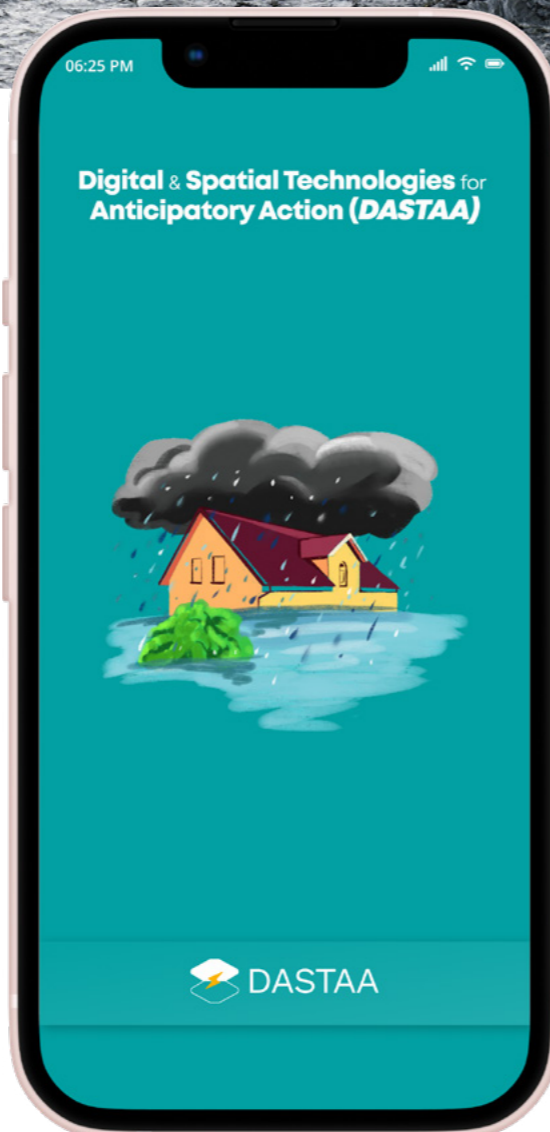
“When the heavy rainfall in July damaged my home, I felt helpless, unsure of how to move forward. Living with a disability already made things challenging, but the support I received gave me a new beginning. With the cash assistance, I equipped myself with synthetic hands and started driving an electric rickshaw. Now, I no longer depend on others; I earn my own living.”

– Male community member, Dodhara Chandani, Nepal

Early warning systems can raise awareness but without resources, households struggle to act. Families often hesitate to evacuate even when they trust a warning, fearing the loss of property, livestock or income. Information alone is not enough – people must also have the means to act on it. Cash and other financial tools proved to be the most effective way to translate awareness into preparedness.

Several grantees integrated financial instruments in their anticipatory action solutions, including cash transfers, insurance and savings groups. This led to clear behaviour change – when people received funds before a hazard occurred, they acted earlier and could protect their assets and recover more quickly.

1. Anticipatory cash transfers. In Nepal, **NAXA's** DASTAA platform linked geospatial risk profiling with mobile-enabled cash transfers. When flash floods hit in July 2024, 870 households received \$32,000 in advance. Household surveys completed before the floods identified which families were at greater risk of damage, making them eligible for larger payouts. Families used the funds to move to safety, buy food and safeguard assets. No casualties were reported, suggesting households both trusted the alerts and used the funds effectively.



- 2. Cash assistance during crises.** **Rumsan's** Rahat platform combined forecasts with blockchain-enabled smart contracts.²⁰ When heavy rainfall hit the Babai River Basin in September 2024, 774 households collectively received \$82,000 within 5.5 hours of activation. Transparency was strengthened through real-time dashboards and multi-signature authorisations, which gave humanitarian partners confidence in how the funds would flow. A post-event survey found that 95% of recipients were satisfied with the timeliness of the support.
- 3. Insurance and credit.** **Tearfund** digitalised ledgers across 870 self-help groups, giving more than 43,000 members quicker access to credit and parametric insurance. This helped households manage climate risks proactively. It also improved members' understanding of financial tools and digital systems, which proved critical in empowering communities and sustaining impact.

Grantees uncovered practical lessons for digital cash delivery. In Nepal, **Rumsan** partnered with Namaste Pay to pilot mobile wallet transfers. Simulations showed strong user preference – 80% said the wallet reduced delays and travel time. However, technical and compliance barriers, including limited API access and low digital literacy, prevented full roll-out and cash was ultimately delivered via bank transfer. Despite this, the pilot laid an important foundation for future digital cash responses.

These interventions also created longer-term benefits. Financial literacy and onboarding to banking services increased confidence in using digital tools, which meant that many households continued to use wallets and credit services after the projects ended. Linking financial services to preparedness therefore not only improved short-term action, but also built more resilient local economies.

Evidence from the projects shows that cash assistance can be a clear route from early warning to action. Cash bridges the gap between receiving information and having the means to respond, giving households the ability to respond to risk rather than absorb its impact.



20. A smart contract is a self-executing digital agreement. It automatically triggers action when predefined conditions (for example, a flood forecast) are met. In this instance, it included sending cash assistance.

Lesson 6 Strategic partnerships turn innovation into adoption



Effective anticipatory humanitarian action relies on collaboration between many actors – governments, humanitarian agencies, community-based organisations, MNOs and technology partners. The Innovation Fund cohort included a mix of organisations – non-profits and startups, local and international – all with different entry points and strengths for effective EWS. All grantees depended on a range of public- and private-sector partnerships to advance their solutions.

While grantees drove innovation, their tools could not gain traction without trusted intermediaries (as shown in Lesson 2). NGOs and community-based organisations provided access to at-risk populations, supported training and ensured systems were used as intended. In Pakistan, for example, **Buraq** led on technology design while the Aga Khan Agency for Habitat focused on ensuring communities understood and trusted the system. In Nepal, **NAXA** worked with DanChurchAid on humanitarian outreach, the Institute of Himalayan Risk Reduction on technical modelling and Viamo on mobile communication, combining their strengths to co-develop early action protocols with local governments.

Governments and public institutions were equally vital, providing legal authority and pathways to long-term sustainability. In Ghana, **TAHMO's** partnerships with the National Disaster Management Organisation (NADMO) and the Ghana Meteorological Agency (GMet) gave it the mandate to disseminate alerts nationally, while collaborations with MTN and AT Ghana enabled the commercial microwave links (CML) data pipeline that powered its forecasts. These partnerships grounded innovation in national systems and paved the way to longer-term adoption.



Spotlight GSMA's role as a funder, convener and partnership catalyst

The GSMA Innovation Fund support extends beyond grants, offering grantees introductions to mobile operators, private donors and government agencies, investor-focused bootcamps, speaking slots at global events and visibility through GSMA marketing. Feedback from the cohort indicated that the credibility and convening power of the GSMA were as valuable as the financial support itself.



By bringing together key stakeholders – MNOs, international NGOs, startups and governments – the GSMA has helped grantees build the partnerships needed for sustainability and scale. Actively brokering partnerships and putting weight behind innovators has proven as important as the grant, as it instills confidence in partners and investors to unlock further funding.



Creating strategic relationships often took time and effort for the cohort, but it has proved critical for pilots to become institutionalised. Partnerships are the backbone of anticipatory action, as EWS only work when all elements – the mandate, infrastructure, innovation and community trust – are aligned.

Lesson 7

Government engagement gives EWS legitimacy and a path to sustainability



“The sensors provided by the project have significantly improved our ability to detect and monitor potential flood hazards in real time. What made the project truly impactful was the way it engaged us throughout the entire process. **As Municipal Disaster Risk Reduction and Management Office, we were not just recipients of the system but active participants in its development.** We were involved in designing and refining our own alerting messages, working closely with our communities to ensure that the alerts were localised, relevant and easy to understand. This process of co-creation fostered a strong sense of ownership and responsibility among us and the people we serve.”

– Romeo Soria, MDRMO Head, Mahayag, Zamboanga Del Sur, Philippines

Early warning systems cannot succeed without government support. Governments set the policy and regulatory environment, define mandates for issuing alerts and ultimately determine whether systems remain pilots or become institutionalised. Securing engagement and buy-in from both national and local governments was critical for all projects in the cohort, and valuable insights were gained from navigating government partnerships and best practices.

Most grantees found that local governments were often their strongest champions. They are closer to communities, integrate EWS tools in day-to-day disaster management and can act quickly when hazards hit. National governments, on the other hand, have the authority to scale and formalise systems. Although they can be more challenging to engage with, without their endorsement, projects that operate effectively at the local level can struggle to achieve legitimacy or national reach.

For example, in Ghana, **TAHMO's** partnerships with GMet and NADMO were essential, as only national bodies are authorised to issue official alerts. In the Philippines, **People in Need** worked closely with 12 local government units (LGUs) across five provinces, strengthening coordination and ensuring local ownership.

Policy and regulatory hurdles emerged as common challenges. In Pakistan, Buraq had to secure new certification following a policy change before it could install more weather stations. **TAHMO** encountered delays due to shifting permit requirements for sensor relocation. Their experiences highlight the importance of adapting to regulatory shifts.

Several approaches helped grantees navigate these complexities. Co-creation with government authorities proved particularly effective. **People in Need** involved local disaster risk reduction (DRR) offices early, ensuring its solution aligned with municipal priorities. Building on existing systems also made adoption easier, as shown by **ActionAid** in Cambodia, which developed communication

materials that could be integrated into routine government meetings. **NAXA** kept municipalities engaged through political transitions, aligning its work with evolving national strategies.

The most successful EWS solutions bridged different levels of government. Local champions drove adoption and practical use while national authorities provided the mandate for scale and long-term sustainability. In Cambodia, **ActionAid** formalised its solution through a Memorandum of Understanding (MoU) with the Ministry of Rural Development and the National Committee for Disaster Management, ensuring that activities aligned with government priorities and could be embedded in official plans.



The cohort showed that sustained engagement, rather than one-off advocacy, builds confidence and legitimacy among government actors. Positioning mobile-enabled EWS as tools that can help governments meet their own efficiency and preparedness goals – for example, reducing costs, improving response times and protecting citizens – is the strongest basis for long-term adoption. It is also important to remember that sufficient resources need to be allocated to upskill government technical personnel and ensure these key advocates can continue to operate and sustain the systems without the innovators.

Lesson 8

The mobile industry is uniquely positioned to scale anticipatory action



The reach of mobile networks makes the industry a critical enabler of anticipatory humanitarian action. MNOs can support the monitoring and prediction of hazards, facilitate the dissemination of early warning messages and provide platforms for disbursing cash directly and securely.²¹ In the cohort, engagement with MNOs took different forms. While some grantees secured formal MoUs, others worked through intermediaries or existing services. Both approaches proved viable.

Direct partnerships gave projects credibility and unlocked access to unique datasets. In the Philippines, **People in Need's** MoU with **Smart** meant flood alerts were sent under the MNO's name, strengthening trust and integration with government response. In Ghana, **TAHMO** worked with AT Ghana and MTN to establish the first operational CML data pipeline for rainfall retrieval, anchoring forecasts in national systems. Meanwhile, in Cambodia, **ActionAid's** 1294 platform was mandated to be free on major mobile networks, underscoring the vital role of mobile in delivering early warning messages.

21. GSMA. (2024). *Mobile-Enabled Early Warning Systems: The GSMA and the Early Warnings for All Initiative.*

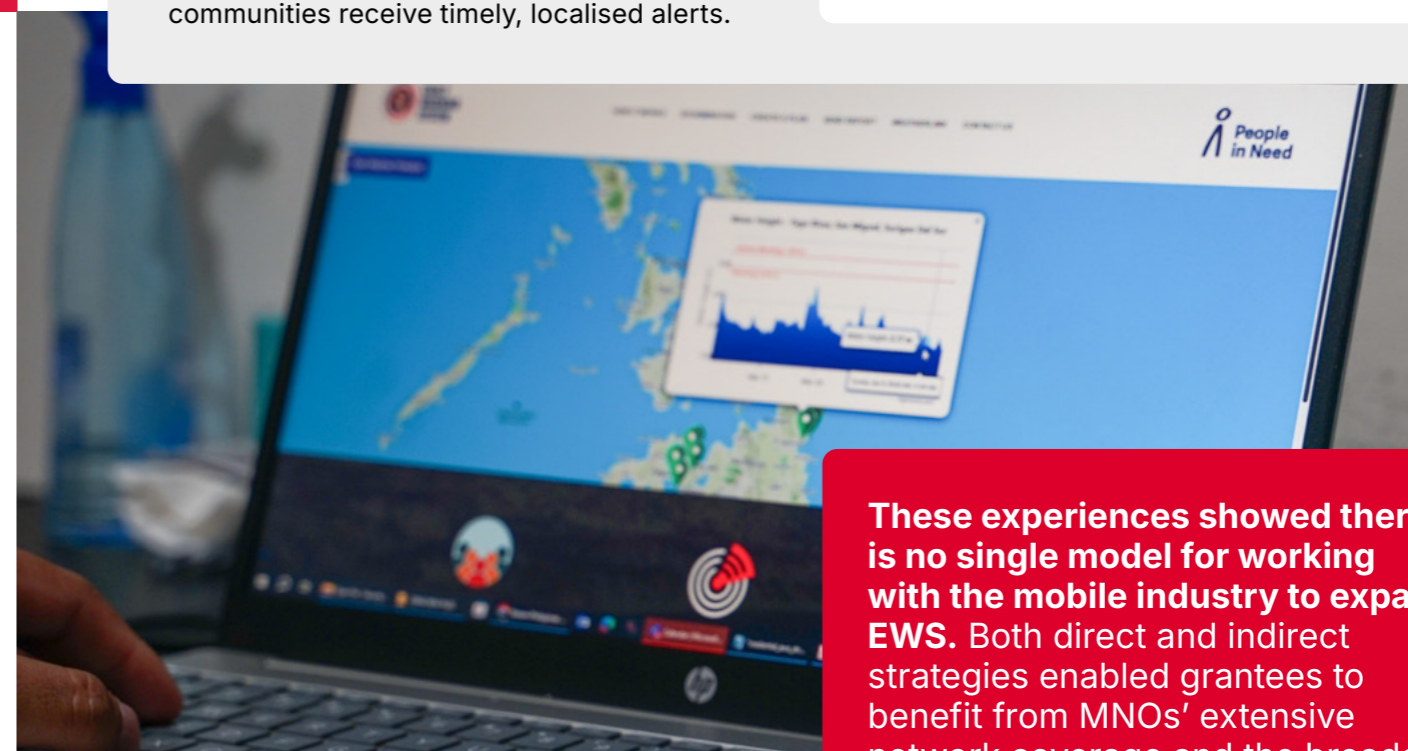


Spotlight How People in Need and Smart are delivering life-saving alerts

People in Need partnered with **Smart**, an MNO in the Philippines, to ensure early warning messages reached at-risk communities. Introduced through the GSMA, the two organisations formalised their collaboration at a GSMA Humanitarian Connectivity Charter workshop in January 2024, signing an MoU to support the project. With Smart's technical support, the project developed and implemented an SMS dissemination model, ensuring communities receive timely, localised alerts.

"Our partnership with People in Need is more than just a technological endeavour; it's a commitment to safeguarding communities and empowering them with the tools they need to mitigate the impact of natural calamities. By leveraging PLDT's reliable fiber connectivity and Smart's cutting-edge solutions, we are setting a new standard in disaster preparedness and resilience."

— Roberto W. Suzon, PLDT Enterprise (owner of Smart) Corporate Relationship Business Head for Northern Mindanao



Indirect MNO engagement was also valuable, as it was often faster and more flexible. Working through intermediaries was sometimes a more effective way to leverage MNO infrastructure without the time required for formal agreements. In Ethiopia and Nepal, grantees partnered through organisations like Viamo to reach users via IVR and SMS messages in local languages. Mobile money platforms also provided rapid, secure channels for humanitarian cash assistance, as demonstrated by **NAXA** and tested by **Rumsan** in Nepal.

These experiences showed there is no single model for working with the mobile industry to expand EWS. Both direct and indirect strategies enabled grantees to benefit from MNOs' extensive network coverage and the broader capabilities of mobile channels. Where direct engagement was possible, projects gained credibility and scale. Where it was not, intermediaries and existing services offered practical routes to reach users. Future efforts should build on both approaches while encouraging more systematic engagement with MNOs.

Lesson 9

Diverse pathways to scale



An ongoing question in the humanitarian sector is what “scale” should mean for successful innovations. Should the focus be on expanding solutions across geographies or increasing their impact in one or a few locations? Geographic expansion can increase visibility and attract new partners, but it also risks stretching capacity and becoming less locally relevant. Increasing impact in a single context can create strong ownership and integration, but can also tie long-term success to one government’s priorities or budget cycles. For anticipatory humanitarian action, where systems need to be anchored in national institutions and infrastructure, the answer to scaling is rarely straightforward.

For many grantees, the primary path to scale is government uptake and ownership. In Cambodia, **ActionAid** is working to transfer its EWS to the Ministry of Rural Development, embedding the platform in national disaster management (NDM)

plans. In Pakistan, **Buraq** saw growing interest from local authorities to finance and manage their weather station assets – a signal that a solution will be most sustainable when governments recognise its operational and financial value.

Others have focused on geographic expansion. For example, **People in Need** is exploring replicating its solution in other provinces with flood-monitoring needs, while **NAXA** is applying its model in Bangladesh and Malawi through new partnerships. **Synnefa** is also exploring regional expansion beyond Kenya, building on a successful roll-out in Rwanda in 2024.

Some grantees have moved beyond a single climate hazard, repositioning their solutions as broader climate risk management systems. **ActionAid**, **Rumsan** and **Buraq** have all extended their platforms to cover new risks, sectors and user groups – increasing relevance and opening doors to new sources of funding.



Spotlight

The GSMA Innovation Fund for Humanitarian Replication and Scale

Despite its importance, scaling humanitarian innovation remains an underexplored and underfunded area. Most investment is directed at developing and piloting new ideas, rather than supporting their large-scale adoption.²²

To address this gap, the GSMA launched a new humanitarian innovation funding cycle in 2025 with a focus on scale. This round will provide grants and venture-building support for

12 months to six Innovation Fund alumni working to expand or replicate their proven humanitarian innovations.

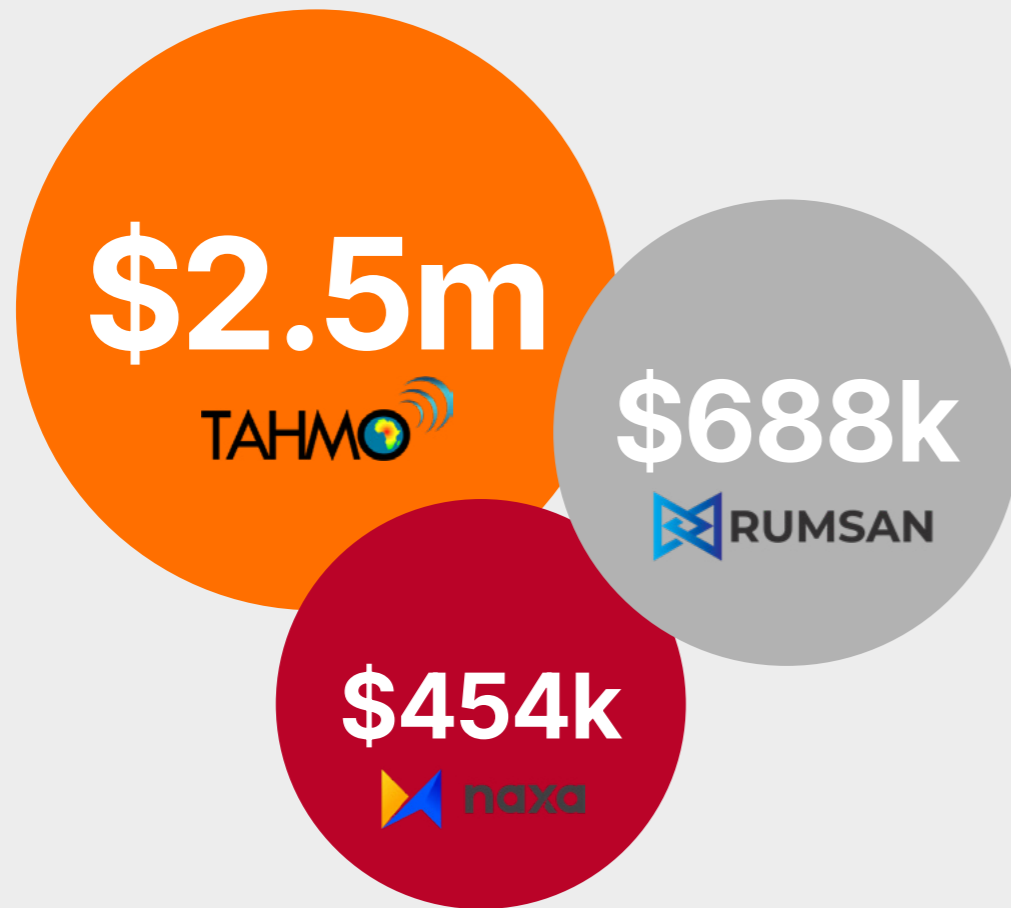
The Fund not only offers an opportunity for innovators to scale, but also to strengthen the evidence base for humanitarian innovations by identifying the catalysts and conditions for sustainable growth. To learn more about the cohort, see the Fund’s [announcement blog](#).

The cohort has shown there is no blueprint for scaling a humanitarian innovation – the key is aligning community needs, national systems and the interests of partners. Investments should support this mix, recognising that the most impactful solutions arise from context and opportunity rather than uniform replication.

22. Elhra. (2024). [Failure to Scale](#).

Lesson 10

Financing remains a hurdle, but demand is growing for innovative EWS



While investment is critical for humanitarian innovations to grow, securing suitable funding is a challenge. Funding and resources for EWS can be particularly difficult, given that these systems are typically treated as public goods and therefore rely more heavily on donor and government support. Disaster risk reduction is also commonly seen as a government responsibility, even though preparedness has proven economic benefits and effective EWS can prevent significant losses.²³ Estimates put the return on investment in EWS at 10 times their initial cost.²⁴

Despite these challenges, the cohort secured more than \$4 million in follow-on funding during the grant period, signalling growing confidence in anticipatory approaches. NAXA raised \$454,000 to expand its platform beyond Nepal; Rumsan attracted \$688,000 to scale its blockchain-enabled cash system; and TAHMO secured \$2.58 million from the Gates Foundation to extend its weather station network across Ghana, Kenya and Rwanda.

Several grantees also explored new business models to reduce their dependence on grants.

Tearfund has piloted microfinance and insurance-linked models through self-help groups. Synnefa has introduced tiered subscription plans, balancing affordability for smallholder farmers with premium services for commercial clients. TAHMO is testing cross-subsidies, providing free data to governments

and communities while charging private users, while NAXA has begun trialling software-as-a-service (SaaS) models for humanitarian, government and private clients. Each approach reflects a pragmatic response to the challenge of finding financially sustainable ways to maintain and grow essential services once donor funding ends.



The cohort's experiences show that achieving financial sustainability for EWS is difficult but progress is being made, even if full commercial viability remains a long-term goal. Donor and investor confidence may strengthen as more evidence emerges on the cost savings, avoided losses and social benefits associated with anticipatory action systems. Innovators can play a vital role in this shift, bringing new technologies, business models and partnerships that can make early warning and anticipatory action more inclusive and effective. While sustained financing remains a challenge, the momentum from this cohort is a sign of growing demand for innovative AA solutions.

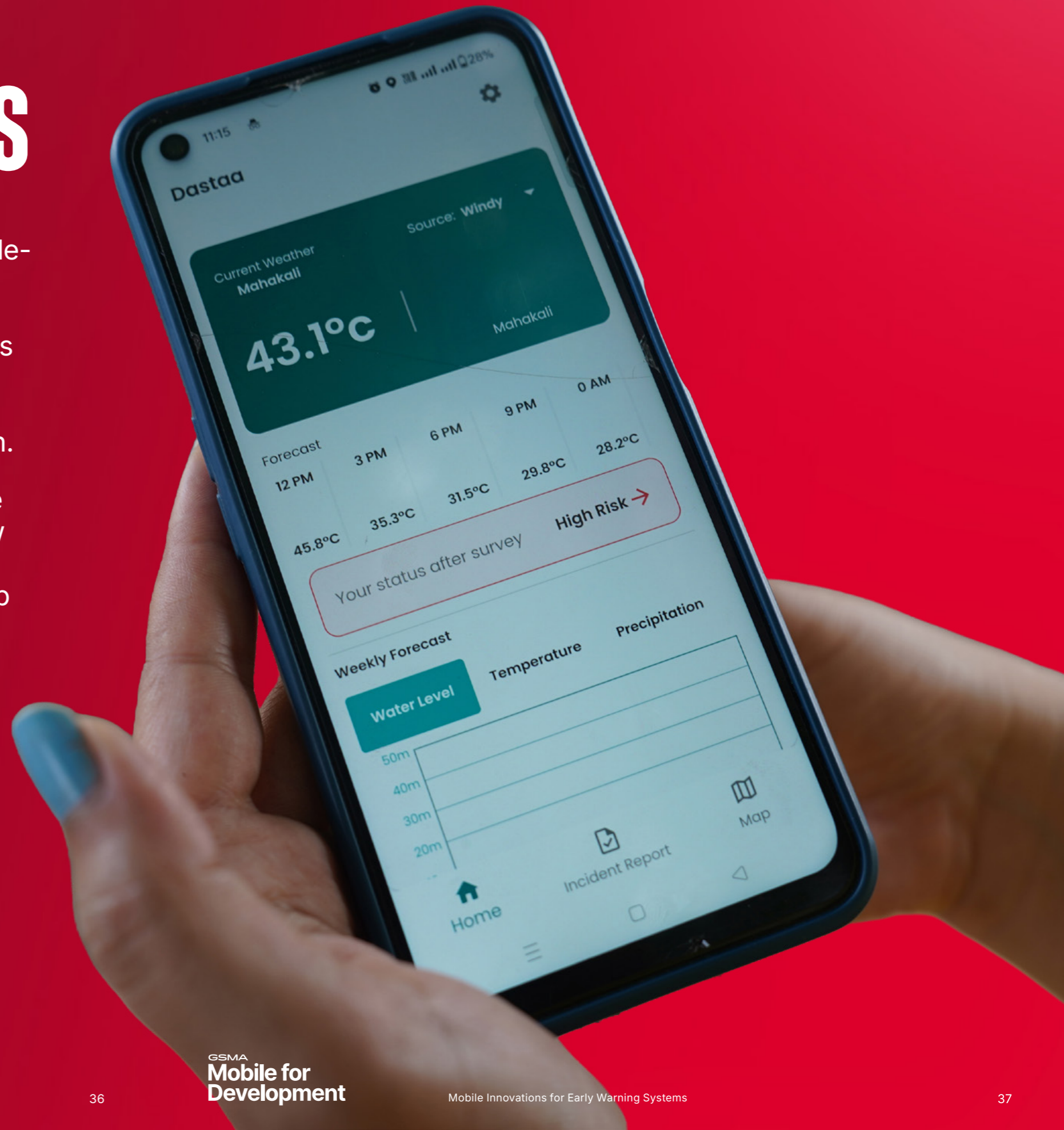
23. Baker, T., Srivastava, S. and Schmeising Barnes, M. (15 August 2025). "Beyond lives saved: Why early warning systems are a smart investment". ESCAP.

24. Global Commission on Adaptation. (2019). *Adapt Now: A Global Call for Leadership on Climate Resilience*.

RECOMMENDATIONS

The GSMA Innovation Fund for Anticipatory Humanitarian Action cohort has shown that mobile-enabled anticipatory action works – delivering measurable impact across diverse and complex contexts. The next step is to build on this progress by scaling proven approaches, embedding successful models in government systems and addressing the funding gaps that can limit growth.

As more organisations adopt innovative EWS, the question is less whether they work and more how they can be sustained. Grantees have shown the potential of new revenue streams and partnership models, but translating them into longer-term, system-wide adoption will require continued coordination and investment.



The following recommendations translate the 10 lessons from the cohort into concrete steps for the humanitarian ecosystem.



For innovators and implementing partners

Prioritise usability and trust

Recognise that the uptake of EWS depends as much on relationships and skills as functionality. Invest equally in trust and capacity building as in the technical solution itself.

Develop viable business models early on

From the outset, explore ways to balance public good with financial sustainability, such as tiered pricing, cross subsidies or SaaS. Embedding a clear value proposition early helps attract the partners and funders needed to scale.

Design for adoption, rather than dependency, from the start.

Build systems that communities and governments can manage with limited external support. Ensuring local ownership at all levels from the start is the best route to uptake and meaningful impact.



For donors and investors

Combine funding with convening power

The cohort showed that formal backing from a credible organisation can be as valuable as grants. Actively connecting innovators to governments, MNOs and private-sector partners helps attract the type of support innovations need to grow.

Invest in scaling innovation, not just pilots

While shorter-term grants are valuable for testing ideas, they rarely support institutional adoption. Multi-phase or blended financing models are important to institutionalise successful pilots at the national level.

Support evidence of economic value

Targeted research could help quantify avoided losses and efficiency gains, strengthening the investment case and building more confidence among governments and investors.



For governments

Support and champion innovation

Partner with local innovators to co-design solutions that are inclusive, user-led and contextually appropriate.

Strengthen coordination across different levels of government

Closer collaboration between national and local bodies can create faster and more effective early warning and response.

Embed anticipatory action systems in national frameworks

Align early warning tools with disaster risk management policies, budgets and coordination structures to ensure they can continue operating outside donor-backed projects.

Invest in technical capacities

Allocate funding, staff time and infrastructure to strengthen EWS and staff confidence to manage them. This can improve both preparedness and broader institutional capabilities for technology-enabled services.

The GSMA and the mobile industry will continue to build on these 10 lessons by convening partners and supporting stronger anticipatory humanitarian action through initiatives such as the **GSMA Innovation Fund for Humanitarian Challenges**, the **GSMA Innovation Fund for Humanitarian Replication and Scale** and ongoing global efforts to strengthen **mobile-enabled early warning systems**.

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