Project Management Update from Nepal[1]

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By Yamanta Raj Niroula, PMP
International Correspondent for PM World Journal
Kathmandu, Nepal

When the Time Runs Out: Project Management Lessons from Nepal's Flood Disaster (August 2026)

1. Introduction

The catastrophic flood and debris-flow event of 26 August 2026 along the Bhotekoshi[2] and Trishuli corridors has placed Nepal's early-warning capability under intense scrutiny. The event developed in a high-mountain environment where a rapidly evolving source-area process generated a destructive downstream flood and debris-flow sequence. The United States Geological Survey has described the event as a debris flow and flood likely triggered by rapid slope failure involving a glacier, while cautioning that the precise geological interpretation remains subject to further investigation. That qualification matters because the assessment should remain grounded in what was knowable at the time, rather than treating an evolving scientific interpretation as if it had been established before the event.

The immediate temptation after a disaster is to ask whether the warning system worked or failed. That question is understandable, but it is too broad to be useful without first

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[2] The Bhotekoshi River affected in this event is the uppermost reach of the Trishuli River system; it is a distinct river from the larger Bhotekoshi (a Sun Koshi tributary) roughly 65 kilometers to the east, which was not affected by the 26 August event. As of this writing, Nepal Police had confirmed more than 780 deaths and over 2,500 people missing across the affected districts, with additional deaths and several hundred missing reported across the border in Tibet. These figures are continuing to change as search-and-rescue operations proceed, and are cited here only to establish the human scale behind the systems-level questions this report addresses.

defining what the system was required to detect, how quickly it was expected to detect it, who was authorized to act, how warnings were to reach exposed populations and how much time people actually needed to reach safety. Nepal possesses substantial elements of an early-warning capability, including hydrometeorological monitoring, forecasting arrangements, communications infrastructure and community-based warning experience. The existence of these components, however, does not establish that the integrated system can provide adequate protection for every credible hazard scenario.

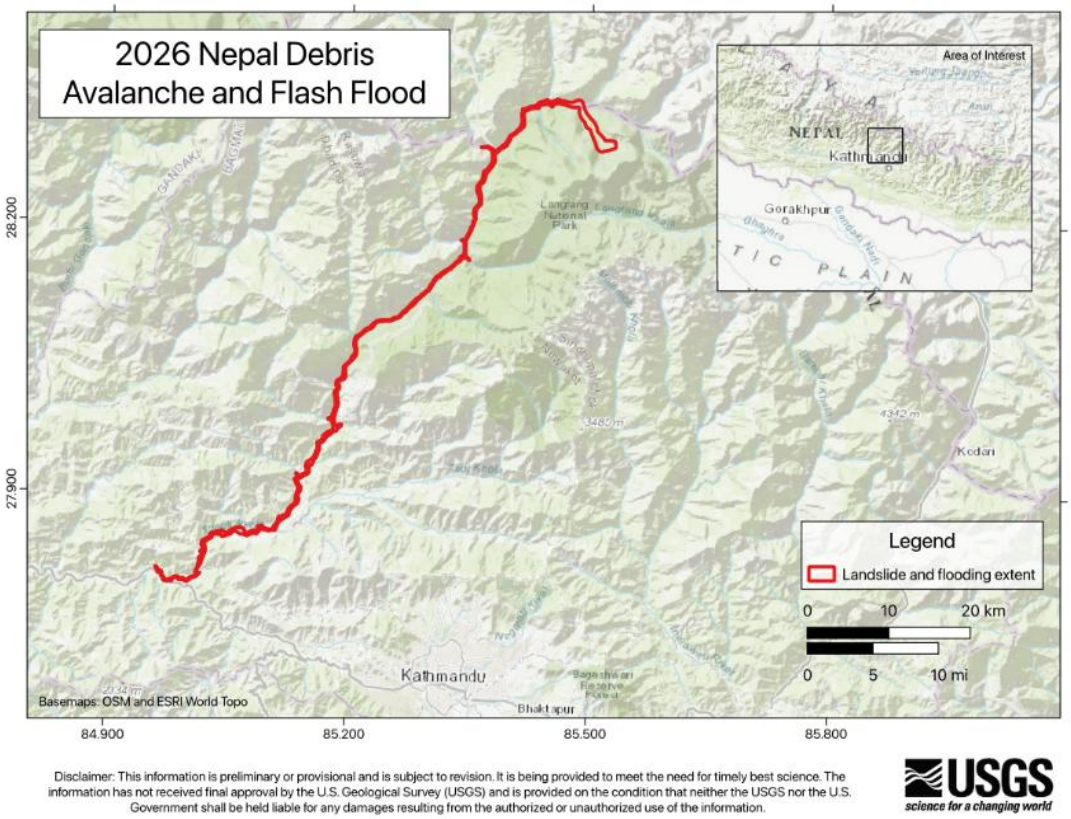

Figure 1: Spatial extent of the 26 August 2026 Nepal debris avalanche and flash flood (Source: U.S. Geological Survey, 2026). The event propagated from the high-mountain source area through the Lhende Khola, Bhotekoshi and Trishuli river systems, illustrating the geographic scale over which warning capability must operate.

This distinction is the starting point for an analysis. Early-warning capability is often delivered through several investments and institutional workstreams: monitoring networks, forecasting systems, telecommunications, alert platforms, emergency procedures, community preparedness and infrastructure for evacuation. Each can have its own scope, budget, schedule, contractor, owner and acceptance process. Yet the public benefit is created only when these separate components operate together under the conditions for which protection is required. A monitoring station may function correctly while providing information too late. A forecast may be scientifically sound while reaching a decision-maker after the useful warning window has narrowed. An alert may be

transmitted successfully while recipients lack sufficient time, information or access to safety.

The central thesis of this report is therefore that an early-warning programme should be managed as an integrated, lifecycle operational capability rather than as a collection of technology projects. Its principal deliverable should not be defined by the number of stations installed, messages transmitted or people trained, although those remain important project outputs. The more meaningful deliverable is the amount of reliable, actionable protective time that the system can demonstrate under defined hazard scenarios, including credible failures of critical components. This shifts the project management focus toward requirements definition, systems integration, risk management, interface management, testing, benefits realisation, lifecycle financing and controlled re-baselining after major events.

The article does not attempt to determine, from preliminary information, whether the August disaster could have been prevented or whether a particular agency or technology was responsible for the loss of life and damage. Those are questions for a formal, evidence-based investigation. Instead, the event is used as a case through which to examine how disaster-warning programmes should be defined, designed, controlled, tested and sustained when the hazard itself can move rapidly and damage the infrastructure on which the warning system depends.

2. A Warning Repeated

The August 2026 disaster also needs to be considered alongside Nepal's recent experience with rainfall-driven flooding. In early October 2025, heavy and unseasonal rainfall affected the Kathmandu Valley and other parts of the country, while forecasts and warnings had been issued in advance. The consequences included flooding, transport disruption and emergency responses in exposed areas. At the time, the discussion centered not simply on whether information had existed, but on the more difficult question of how effectively technical information had been translated into timely decisions and protective action.

The two events should not be treated as identical failures. Their physical mechanisms were substantially different, their geographic contexts were different, and the available warning opportunities were not necessarily comparable. The 2025 event was associated primarily with intense rainfall and conventional flood processes, whereas the 2026 event involved a rapidly developing mountain process whose downstream consequences appear to have evolved on a much shorter timescale. A rainfall forecast available days in advance cannot be evaluated using the same operational assumptions as a source-area failure that may provide only minutes of useful lead time.

Nevertheless, placing the events side by side raises a legitimate systems question. How effectively does Nepal's disaster-management architecture convert scientific information into decisions and protective action across different hazard pathways? The question is more useful than assuming that every disaster reflects the same institutional deficiency. It directs attention toward the common interfaces that must function regardless of the

hazard: requirements, information flow, decision authority, warning dissemination, community response and post-event learning.

This distinction also prevents hindsight from becoming the basis for project judgement. The fact that a later investigation identifies information that was not available during the event does not mean that the project could reasonably have been expected to act on that information beforehand. A mature after-action process must reconstruct the information state at each moment, identify what the approved system was designed to recognize and determine whether the observed performance was consistent with the approved requirements. Only then can corrective action be assigned to the appropriate project or program control.

3. When the Time Runs Out

The most revealing question raised by the 2026 event is not how much warning a system can theoretically provide, but how much actionable time remains when the warning reaches the people who need it. A warning has operational value only if sufficient time remains between reliable recognition of danger and the moment when people must already be somewhere safe. That interval varies sharply by hazard. A slowly rising river may provide hours for interpretation and response, while a debris flow, outburst flood or rapidly propagating flood wave may compress the same sequence into minutes. A communication system that performs adequately in the first situation may offer little practical protection in the second.

Figure 2: Flood and debris impact along the Trishuli corridor following the 26 August 2026 event. The concentration of settlements and infrastructure along the river corridor illustrates the narrow spatial and temporal margin available for protective action.

Actionable time is consumed throughout the warning chain. It begins with detection and continues through transmission, data processing, interpretation, decision-making, authorization, dissemination and receipt. It also includes something that technical specifications often leave outside the system boundary: the time people need to understand the warning, decide what to do and reach safety. Each delay may appear tolerable when considered separately. Their accumulation becomes consequential when the hazard-to-impact interval is short.

This suggests a different way of defining project requirements. Rather than beginning with available sensors, communications equipment or software and asking what warning performance they can provide, the project should begin with the required protective outcome and work backward. If an exposed settlement requires fifteen minutes to reach a designated safe location, that response requirement establishes a constraint on everything upstream. The detection and decision architecture must create enough lead time to accommodate evacuation, while retaining a reasonable allowance for uncertainty, equipment failure and communication disruption. Technology should then be selected and configured against that requirement. Otherwise, the project risks becoming an exercise in installing equipment rather than creating protection.

The distinction between project output, operational outcome and benefit is particularly useful here. A monitoring station is an output. Detecting a dangerous condition early enough to support a defined protective response is an operational outcome. Reduced exposure because people receive and act on that information is the benefit. These are related, but they are not interchangeable. A project can complete its physical installations, pass equipment tests and still fail to produce the intended benefit.

Reports concerning the event indicate that the Syapru Besi monitoring station recorded a water level of approximately 1.62 meters at around 8:40 a.m., before transmission was lost at approximately 8:50 a.m. The reported warning threshold was substantially higher than the level recorded when transmission ceased. Warnings were subsequently disseminated downstream through established communication mechanisms. The precise sequence, including the timing, reliability and operational interpretation of each observation and warning, requires a time-synchronized investigation before firm conclusions can be drawn.

The reported downstream conditions nevertheless expose a difficult design problem. Nepali officials reported that the Trishuli River rose by as much as nine meters in approximately thirty minutes. If that account is confirmed, the rate of change illustrates the limitations of relying primarily on thresholds designed around gradually evolving river conditions. A system may be functioning exactly as specified and still provide insufficient protection if the phenomenon it is monitoring changes faster than the architecture can detect, interpret and communicate it.

That possibility should shape the project investigation. The relevant question is not merely whether a sensor worked. It is whether the system was designed to recognise the hazard that actually developed, at a location and with sufficient lead time to support protective action. This requires examination of sensor-placement assumptions, hazard

models, warning thresholds, communications redundancy, failure modes, decision authority and community response times.

These are project management questions because they originate in requirements, risk allocation, systems integration, interfaces, procurement, operations, maintenance and acceptance criteria. They also expose a less comfortable issue in complex projects: the weakest point may not be the component with the lowest technical specification. It may be the interface between components, institutions or decisions.

For that reason, the central control variable for an early-warning project should not be the number of stations installed or messages transmitted. It should be whether, under the conditions for which protection is required, the integrated system preserves enough time for a person to act. Once that time disappears, technical performance elsewhere in the chain may have little remaining value.

4. The Hazard Envelope

Every early-warning project begins with assumptions about the hazards it is intended to address. Those assumptions form part of the project's technical and operational baseline, even when they are not described explicitly as a requirements document. In Nepal's mountainous catchments, the hazard envelope may include rainfall-driven floods, glacial lake outburst floods, landslide-dam failures, debris flows, ice and rock avalanches, rainfall-triggered landslides and compound events in which one process initiates another. The 2026 disaster demonstrates why a warning architecture designed mainly around conventional rainfall and river-level relationships may not cover every credible source-area process.

This does not mean that conventional flood forecasting is inadequate. River gauges, rainfall observations and hydrological models remain fundamental to flood management. The project management issue is whether the approved requirements clearly state the circumstances under which those tools are expected to provide sufficient lead time, and whether the system contains other observation pathways where the hazard assessment indicates that conventional signals may arrive too late.

Requirements management should therefore begin with a controlled hazard envelope. For each material scenario, the program should establish where the hazard may originate, how quickly it can propagate, which signals may precede it, what population and infrastructure may be exposed, what warning time is required and what components could fail because of the same physical event. The result should be requirements baseline that is sufficiently specific to support design and acceptance while remaining capable of controlled revision when scientific evidence or major events materially change the risk picture.

Figure 3: A combination of satellite images shows Syapru Besi on August 23, 2026, before a flash flood (top) and on August 26, 2026, following a flash flood (bottom) that affected the area (Source: PLANET LABS PBC, 2026)

This is where project change control becomes important. Reconsidering a requirement after a major event should not mean abandoning the approved baseline whenever an unexpected consequence occurs. It should mean applying a defined process to determine whether the event reveals an incomplete assumption, an implementation problem, a design weakness or a genuinely new hazard condition. That distinction protects both project discipline and public safety. It prevents uncontrolled scope growth while avoiding the opposite problem of preserving an obsolete design simply because the original contract has already been completed.

5. The Actionable-Time Gap

A useful way to manage warning performance is to establish an end-to-end time budget. Conceptually, the protective margin can be expressed as the time available between recognition of a dangerous hazard and impact, less the time consumed by detection, transmission, processing, decision, dissemination and community response. The resulting margin should include a reserve for uncertainty and credible disruption. The formula is not intended as a universal engineering equation, but as a project-control

device that makes hidden time consumption visible across organizational and technical boundaries.

The first component is detection. The program must define what constitutes a meaningful signal and the maximum time permitted between that signal becoming observable and the system recognizing it. The requirement should reflect the hazard mechanism. A downstream water-level threshold may be appropriate for a gradually rising river, while a rapid mountain process may require additional source-area or multi-hazard signals. Detection requirements should therefore be derived from the hazard envelope rather than from the capabilities of an existing instrument network.

The second component is transmission and data latency. Critical information has a useful age limit. A measurement that arrives after the hazard has already propagated beyond the point at which it could support a decision may remain scientifically interesting while becoming operationally ineffective. Project specifications should therefore define the maximum permissible age of critical observations at the decision point, including the effects of communications outages and degraded network performance.

The third component is processing and decision. Automated systems can reduce time when abnormal signals can be recognized using predefined rules, but automation does not remove the need for governance. The project must establish when a system can trigger escalation automatically, when expert confirmation is required and who has authority to issue a public warning. Excessive verification can consume the very warning window that verification is intended to protect, while insufficient verification can create unacceptable false-alarm costs. The appropriate balance is a risk-governance decision that should be established before the emergency.

The fourth component is dissemination and response. A warning is not complete when it leaves the issuing agency. It must reach the intended population through channels that remain available under the hazard conditions, and recipients must understand the nature of the threat and the action required. The project should therefore measure not only message delivery but the time from warning authorization to receipt, comprehension and protective movement. The remaining interval is the system's true protective margin.

For project controls, the implication is straightforward. Detection time, data latency, decision time, dissemination time and response time should be treated as measurable performance variables. Their combined behavior should be monitored as a system rather than reported as unrelated indicators. A program may achieve excellent performance in four stages and still fail to deliver sufficient actionable time because the fifth stage is the limiting constraint.

6. System Resilience

Resilience in an early-warning system should mean more than high availability during normal operations. It should mean the ability to retain sufficient protective capability after a credible failure has occurred. This is particularly important in Himalayan valleys because the infrastructure supporting the warning system can occupy the same corridors as the infrastructure exposed to the hazard. Roads, bridges, power supplies,

telecommunications routes and monitoring stations may all be damaged by the same event, creating common-mode failure across components that appear independent when viewed separately.

The number of installed assets is therefore a poor measure of resilience by itself. Five monitoring stations may still represent a single effective observation pathway if all depend on the same physical structures, power network or communications corridor. Genuine redundancy requires independence against the failure mode being considered. Depending on the basin and hazard, that may involve different locations, elevations, structures, power sources, communications routes or sensing technologies.

Multi-hazard observation can improve this resilience when it is justified by risk analysis. River levels and rainfall may be supplemented by seismic observations, terrain deformation, remote sensing, cryospheric information and credible local reports where those signals can materially improve detection time. The objective should not be to accumulate data without a decision purpose. Each additional observation pathway should have a defined role in the warning logic, an owner, a maintenance arrangement and a performance requirement.

The program should also define degraded operation. If the primary gauge disappears, if a telecommunications network fails, if power is lost or if a key decision-maker cannot be reached, the system should have a predefined operating mode that identifies what functions remain available and what escalation rules apply. Resilience is demonstrated not by assuming that all components will continue to work, but by showing how much useful warning capability remains when some components do not.

7. Institutional Interfaces

Much of an early-warning chain exists between institutions rather than inside a single technical platform. Hydrological specialists observe and interpret conditions, disaster-management authorities coordinate preparedness, local governments communicate with communities, telecommunications providers deliver alerts, emergency services support response and communities make decisions about whether and how to act. Each boundary can create latency if responsibilities, authority or information requirements are unclear.

The project should therefore treat institutional interfaces as formal system interfaces. For each significant hazard scenario, the operating model should identify who monitors, who validates, who escalates, who authorizes the public warning, who informs local authorities, who initiates protective measures and who confirms that the warning has reached the intended population. A responsibility matrix is useful because it exposes assumptions that may otherwise remain invisible until an emergency occurs.

Decision authority is particularly important when the evidence is incomplete. A rapidly developing hazard may not be classified precisely before action is required. The warning architecture should not require certainty that cannot realistically be achieved within the available time. Instead, the program should define how precautionary action is authorized

when the consequence of delay is severe, how uncertainty is communicated and how false-alarm performance is reviewed after the event.

Cross-border hazards add another layer of interface management. The Bhotekoshi system illustrates that a physical process can originate beyond Nepal while producing severe downstream consequences inside the country. Regional initiatives such as HKH-HYCOS demonstrate the value of hydrological information exchange across the Hindu Kush Himalaya, but information exchange becomes operationally useful only when the receiving institution knows what information will arrive, how quickly it will arrive, how it will be authenticated and what action the information is expected to trigger. Data without an operational receiving function may have scientific value without providing timely protective benefit.

8. Community Response

The last stage of early warning is frequently reduced to dissemination, but the actual operational chain extends further. A person must receive the message, understand its significance, trust its credibility, know what action is required, know where to go and have a route that remains usable. The time required for these actions is therefore part of the project's performance requirement rather than an external factor that can be ignored after the alert is sent.

Nepal's experience with community-based warning provides an important foundation because multiple channels can reinforce one another. Sirens, radio, public-address systems, volunteers and mobile communications each offer different advantages and vulnerabilities. Common Alerting Protocol implementation can support consistent warning messages across channels, but standardization of the message format does not demonstrate that people will respond correctly. The project must therefore connect communication performance with behavioral and evacuation outcomes.

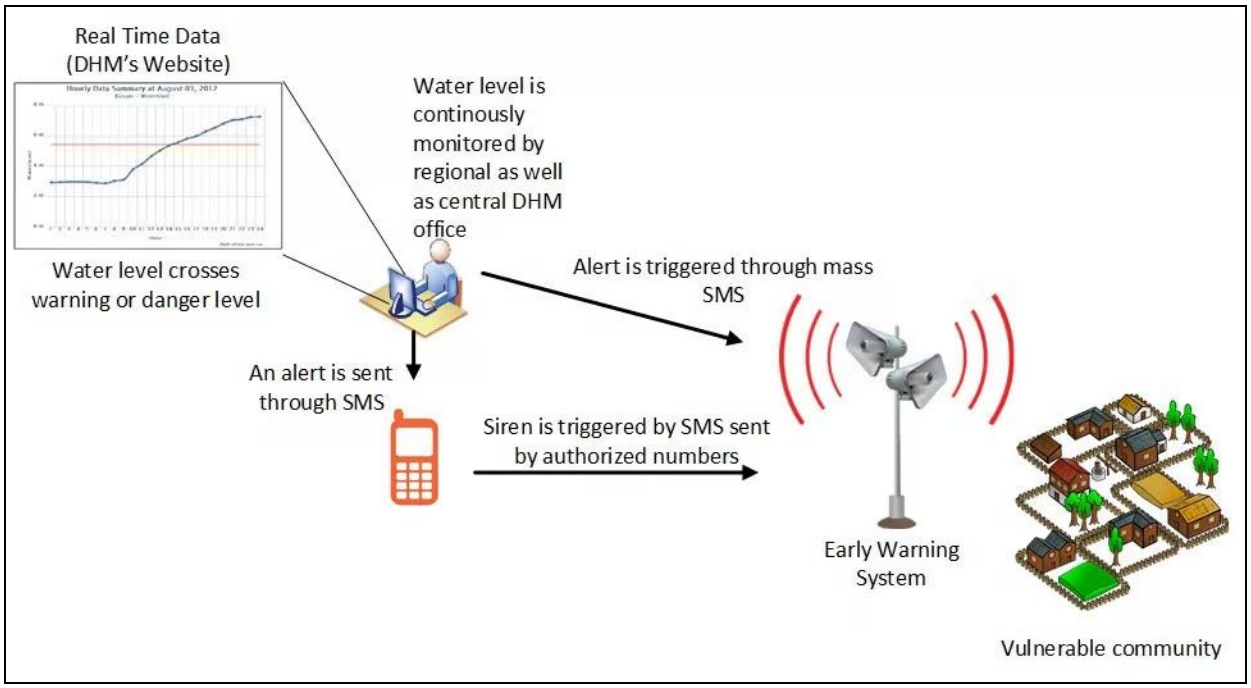

Figure 4: A component of Nepal's community-based flood early-warning infrastructure (Source: Renewable World). Such installations demonstrate the value of local warning capability, while also illustrating the need to integrate physical assets, communications, procedures and community response into a single operational system

Community preparedness should be measured through demonstrated capability rather than training counts alone. Exercises should test whether representative groups can receive a warning, interpret the instruction and reach designated safe locations within the time assumed by the project. Preparedness planning should also account for people who may need assistance, including patients, older people, persons with disabilities and children, as well as transient populations using major transport corridors who may not possess local knowledge.

This is fundamentally a benefits-realization issue. If the project claims that an early-warning investment reduces risk, the benefit should be connected to the ability of exposed people to act before impact. A large number of delivered alerts is therefore an output, while a demonstrated reduction in response time or an increased proportion of the exposed population able to reach safety within the required window is evidence of operational benefit.

9. Lifecycle Management

The protective value of an early-warning system extends far beyond the period in which capital equipment is procured and installed. Sensors require calibration, batteries and components require replacement, telemetry equipment fails, software requires maintenance, communication services require recurrent funding and trained personnel may move to other positions. Community procedures also deteriorate when exercises

and public engagement are not sustained. These are normal lifecycle conditions, not exceptional events.

For that reason, ownership and operation should be established before the system is accepted. The program should identify who owns the assets after handover, who maintains them, who funds recurring communications and replacement components, who performs calibration, who monitors performance and who has authority to suspend an unreliable component from operational service. A system that cannot be maintained to its required performance level should not be described as a sustainable warning capability simply because it was successfully commissioned.

Lifecycle financing should be treated as part of the investment case. The budget should recognize recurring expenditure for maintenance, data services, technical staffing, spare parts, exercises, training, testing, system upgrades and periodic reassessment of the hazard baseline. Where upstream and downstream communities share the benefit, financing arrangements may also need to reflect shared risk rather than purely administrative ownership.

Lifecycle management also requires controlled change. Scientific knowledge, exposure patterns, technology, land use and hazard behavior can change after the original project baseline has been approved. A mature program should therefore have a formal mechanism for reviewing material new evidence, assessing its implications for requirements and approving changes where justified. This is not a departure from project discipline; it is an essential part of maintaining the validity of a long-lived operational system.

10. End-to-End Acceptance Testing

A monitoring station can pass a commissioning test without proving that the warning system works. The same is true of a forecasting model, communications platform, server, siren or mobile alert service. Component acceptance establishes that individual elements perform their specified functions. It does not demonstrate that those elements operate together quickly enough to deliver the intended protective outcome.

Acceptance testing should therefore be scenario-based and end-to-end. A conventional flood scenario can begin with rainfall and river-level changes and continue through detection, interpretation, warning, dissemination and evacuation. The test should measure elapsed time at each critical interface and determine whether the required protective margin remains available. The purpose is not simply to demonstrate that every component operates, but to establish whether the integrated system achieves the required outcome.

Failure scenarios are equally important. The program should test loss of the primary monitoring station, communications disruption, power failure, delayed access to a decision-maker and rapid-onset hazards for which downstream river thresholds may provide insufficient lead time. The test should demonstrate the surviving function, not merely the existence of a backup asset. If an alternative channel exists but requires an

additional hour to activate, it may provide redundancy on paper while failing to provide useful operational resilience.

Operational readiness should be a condition of acceptance. Procedures, authority, maintenance arrangements, communication channels and community response should be exercised together before the system is considered fully operational. This standard is more demanding than installation completion, but it is consistent with benefits-based project governance because the investment exists to produce a functioning capability rather than an inventory of commissioned assets.

11. Project Risk and Control

A mature risk register for an early-warning program should describe how the system can lose protective capability rather than merely listing equipment failures. Risk should be expressed in terms of scenario, consequence, existing control, residual exposure and treatment. This makes it possible to identify risks that cross organizational boundaries and would otherwise remain distributed among separate projects.

Risk scenario	Consequence	Response	PM discipline
Source-area hazard is not directly observed	Detection begins too late for effective action	Multi-hazard and upstream observation where justified	Requirements and systems integration
Primary monitoring asset is destroyed	Critical information becomes unavailable	Independent observation and degraded-mode procedures	Risk and resilience management
Shared communications infrastructure fails	Multiple warning channels fail together	Independent dissemination pathways	Risk and communications management
Decision authority is unclear	Warning issuance is delayed	Explicit escalation and authority matrix	Stakeholder and interface management
Evacuation route is blocked	Warning does not translate into safety	Alternative routes and route-status arrangements	Benefits and operational readiness
Maintenance is deferred	Reliability declines over the lifecycle	Funded maintenance and asset management	Lifecycle and cost management
False alarms become frequent	Public confidence and compliance decline	Threshold review and performance monitoring	Quality and risk management
Hazard exceeds the approved design basis	System operates outside intended requirements	Periodic hazard-envelope review and change control	Requirements and change management
Cross-border information arrives too late	Downstream warning window is reduced	Formal data-sharing and escalation arrangements	Interface and stakeholder management

Table 1: Project Management Risk and Control Framework for Early-Warning Systems

This approach also changes how project controls should be interpreted. Requirements management determines what hazards and protective outcomes the program is expected to address. Risk management identifies conditions that could prevent the capability from being achieved. Integration management connects observation, forecasting, communications, decision authority and community response. Quality management verifies that requirements have been met. Schedule management controls the time consumed across the warning chain. Cost management must include lifecycle expenditure rather than only capital procurement. Stakeholder and communications management govern the institutional and public interfaces, while benefits management establishes whether the delivered system produces the intended protective outcome.

These disciplines should not operate as separate reporting streams. Their value comes from showing where the warning chain is constrained. A system with excellent monitoring availability may still have inadequate actionable time if decision latency is high. A system with rapid decision-making may still fail if communication channels are vulnerable to the same event. A community may be fully trained while evacuation routes remain unusable. Project controls should therefore focus attention on the limiting factor in the integrated system rather than encouraging each workstream to optimize its own indicators.

12. Lessons

The value of an after-event review depends on whether it changes the system. A narrative description of what happened can be useful for historical record, but it becomes a project-control instrument only when findings are translated into verified corrective action. The review should reconstruct the physical event and the warning chain on a common timeline, establish what information was available at each point, determine what decisions were possible and identify where actual performance diverged from the approved requirements.

The investigation should distinguish at least five categories of failure. A requirements failure occurs when the approved requirements did not adequately represent a credible hazard or protective outcome. A design failure occurs when the requirements were appropriate but the architecture could not satisfy them under foreseeable conditions. An implementation failure occurs when an appropriate design was not delivered or maintained as specified. An operational failure occurs when a correctly designed and implemented system does not operate according to its procedures during an event. A governance or interface failure occurs when institutional authority, coordination or decision arrangements prevent the technical capability from producing the intended outcome.

The distinction is consequential because each category leads to a different corrective action. If a sensor failed because maintenance requirements were not followed, the response may concern operations and asset management. If the sensor was maintained correctly but its location exposed it to a foreseeable common-mode hazard, the response may concern system architecture. If the sensor operated exactly as specified but could not observe the initiating hazard, the principal issue may be requirements definition. If

information reached the responsible institution but no one had clear authority to issue the warning, the problem belongs to governance and interface management.

Each material corrective action should have an accountable owner, required resources, target date, verification method and evidence of closure. The program should then determine whether the corrective action changes the requirements baseline, risk register, design basis, operating procedures, testing regime or lifecycle funding. This creates a closed control cycle in which the disaster produces measurable changes rather than another collection of general recommendations.

13. Implications for Nepal

Nepal's next generation of early-warning investment should begin with an independent, technically rigorous reconstruction of the 26 August 2026 event. The reconstruction should place the physical hazard, monitoring observations, communications records, decisions, warnings and community response on a synchronized timeline. It should distinguish what was known in real time from what became known later and should identify the warning margin available at each decision point. The purpose should be learning and system improvement rather than premature attribution of blame.

The national hazard envelope should then be reviewed against the evidence from the event and other recent disasters. Conventional flood forecasting should remain central, but the requirements assessment should explicitly consider rapid mountain processes, including debris flows, landslide-dam failures, glacial and cryospheric hazards and compound events. The review should identify which hazards can be detected through existing networks, which require additional observation and which may require precautionary escalation before conventional river-level thresholds become informative.

Critical basins should receive explicit actionable-time requirements derived from impact and evacuation analysis. These requirements should define acceptable detection, data, decision and dissemination latencies and should include a reserve for uncertainty and degraded operation. The purpose is to prevent the program from setting performance standards based merely on what existing technologies can conveniently deliver.

The existing monitoring architecture should also be assessed for common-mode failure. Critical stations should be examined for shared exposure to bridges, roads, power supplies, telecommunications routes and other infrastructure that can fail during the same hazard. Where the risk warrants it, independent observation and communications pathways should be established, with clear degraded-mode procedures and responsibilities.

The country should continue strengthening multi-hazard observation where it provides demonstrable improvement in detection time. Additional data should not be pursued as an objective in itself. Each observation pathway should be connected to a defined decision purpose, performance requirement, owner and maintenance arrangement. The same principle should govern investments in warning platforms, communications, sirens and community systems.

Cross-border operational arrangements should also be strengthened for hazards whose source and consequences can occur in different jurisdictions. Information-sharing agreements should specify the data required, frequency, authentication, escalation conditions, receiving institutions and fallback arrangements. Regional cooperation is most valuable when it reduces decision latency and creates a predictable operational interface rather than simply increasing the volume of information exchanged.

Lifecycle arrangements should be established before new systems are accepted. Each critical asset and service should have a named owner, maintenance regime, replacement strategy, recurrent funding source and performance-monitoring arrangement. Community preparedness should be treated in the same way, with exercises, route verification and warning tests included as continuing operational obligations rather than one-time project activities.

Nepal's early-warning program should adopt end-to-end acceptance and periodic revalidation as core governance requirements. Major system tests should include sensor loss, communications failure, power interruption, ambiguous information, rapid-onset hazards and realistic community response. Major disasters and new scientific evidence should trigger a controlled review of the design basis. This would establish an institutional mechanism through which the warning program can learn without losing the discipline of formal requirements and change control.

14. Conclusion

The 26 August 2026 disaster should not be reduced to a simple judgement that Nepal had a warning system and therefore should have prevented the disaster, nor should the complexity of the event be used to conclude that additional warning capability could not have made any difference. The evidence available immediately after a disaster is incomplete, and the scientific interpretation of a rapidly developing mountain event can evolve as observations are assembled. A credible assessment must therefore reconstruct both the hazard and the warning chain before drawing conclusions about performance.

The project management lesson is nevertheless clear. An early-warning program should not be defined primarily by the assets it installs or the messages it transmits. Its value lies in the operational capability created by the interaction of observation, analysis, decision, communication and response. That capability must be specified against a defined hazard envelope, measured through an end-to-end time budget, protected against common-mode failure, supported by explicit institutional interfaces, tested under degraded conditions and sustained through its full lifecycle.

This perspective also changes the meaning of project success. Completion of scope, schedule, cost and quality requirements remains necessary, but it cannot by itself establish that the intended disaster-management benefit has been achieved. The program must demonstrate that its outputs combine to produce the required operational outcome and that the outcome can be sustained after the implementation phase ends. Where evidence shows that the original requirements or design assumptions are

inadequate, the appropriate response is controlled change and re-baselining rather than either complacency or uncontrolled expansion.

The real deliverable is actionable protective time. It is the portion of the hazard-to-impact interval that remains after detection, transmission, processing, decision, dissemination, comprehension and response have consumed their necessary share. Its adequacy depends on the hazard, the location, the exposed population and the resilience of the warning architecture itself. A warning system can therefore be technically sophisticated and still provide insufficient protection if its integrated latency consumes the available margin.

The unfinished question for Nepal and the wider Hindu Kush Himalaya is consequently not whether another sensor, platform or communication channel should be added in isolation. It is whether the entire warning program can demonstrate, under realistic hazard and failure scenarios, how much useful protective capability remains when the hazard disrupts the very infrastructure on which warning depends. That is a project management question because it concerns requirements, risk, integration, performance, lifecycle responsibility, benefits and change. It is also the question that should determine what the next generation of disaster-warning projects is designed to deliver.

AI Use Declaration

AI tools were used in preparing this report only to improve the clarity and readability of the language. All content was written, reviewed, and edited under human oversight. The author takes full responsibility for the accuracy, integrity, and originality of the work.

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About the Author

Yamanta Raj Niroula, PMP

Kathmandu, Nepal

Yamanta Raj Niroula is an accomplished Project Management Professional with more than 18 years of rich experience in engineering, infrastructure development, and project management across a variety of global settings. His skill set includes project planning, procurement, contract management, stakeholder engagement, and risk management, all with a particular emphasis on delivering projects in remote and developing areas under challenging conditions.

Yamanta holds a Bachelor of Engineering in Civil Engineering and a Master of Arts in Rural Development, along with a Diploma in Civil Engineering. He has been a certified Project Management Professional (PMP®) and an active member of the Project Management Institute (PMI) since 2010.

Yamanta has extensive experience in overseeing construction projects from the initial planning stages to final evaluations, Yamanta specializes in the management of complex processes such as procurement, contracting, and project execution while ensuring efficiency and compliance with regulations. By keeping abreast of industry trends and innovations, he ensures that the projects he manages are sustainable, forward-looking, and adaptable to the ever-changing environment.

Yamanta has successfully managed large-scale infrastructure projects, including roads, electrical infrastructure, wastewater treatment plants, logistics facilities, and disaster recovery programs. He has served in various capacities as Project Controls Specialist, Design Manager, Planning Manager, Engineer and Project Manager across international organizations and UN agencies in Nepal, the Maldives, Singapore, Afghanistan, the Philippines, Nigeria, Yemen, Sudan, and Ethiopia.

He has been responsible for project design, planning, execution, and control, ensuring timely delivery, budget adherence, and quality assurance while enhancing overall program outputs.

Yamanta lives in Kathmandu, Nepal and can be contacted at niroulayr@gmail.com.

View his full correspondent profile at https://pmworldlibrary.net/yamanta-raj-niroula/.

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