

MHEWS as High-Reliability Crisis Team— Reframing Performance

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Abstract: Multi-hazard early warning systems (MHEWS) are central to the Sendai Framework and the Early Warnings for All (EW4All) initiative. Despite advances in forecasting, failures persist even when warnings are timely and accurate, pointing to challenges beyond technical capacity. This paper argues that system performance is primarily constrained by coordination, communication, and governance across the warning chain. Building on Bostrom et al.'s systemic perspective [1], High Reliability Organization (HRO) theory [5][6][7], and the High-Performance Crisis Communication Team model (Rincón-González) [2][3], the study reframes MHEWS as temporary, multi-actor high-reliability teams. Using Mexico's SIAT-CT as an empirical case, a qualitative multimethod approach—combining document analysis, and real-time communication reconstruction—examines system performance under conditions of uncertainty. Findings show that effectiveness depends not only on adaptive coordination and shared purpose, but on the ability to translate warnings into protective action, which remains limited by weak preparedness culture and uneven public response. This reframing contributes to advancing inclusive, people-centered early warning systems capable of supporting climate risk response in complex and rapidly evolving contexts.

Keywords — Crisis Communication Teams, High-Reliability Organizations (HRO), Interorganizational Coordination, Multi-Hazard Early Warning Systems (MHEWS), Warning Chain Coordination

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INTRODUCTION

Multi-hazard early warning systems (MHEWS) are central to global disaster risk reduction strategies, including the Sendai Framework and EW4All [4]. However, persistent failures in high-risk contexts reveal a paradox: systems underperform even when forecasts are accurate and warnings are issued on time. This indicates that the primary challenge is not technological but organizational. Specifically, system performance depends on how actors coordinate, communicate, and act across the warning chain. Bostrom et al. demonstrate that warning systems operate as networks of professionals whose effectiveness derives from interaction rather than isolated outputs [1]. Yet, these actors rarely function as cohesive systems, often remaining fragmented across institutional and sectoral boundaries.

This paper addresses this gap by proposing a reframing: MHEWS as temporary high-reliability crisis communication teams. Drawing on HRO theory [6][7] and the High-Performance Crisis Communication Team model [2][3], the argument is that performance emerges from shared purpose, adaptive coordination, and communication under uncertainty—conditions that are particularly critical for inclusive climate risk response. Empirically, this perspective is applied to the *Mexican Early Warning System for Tropical Cyclones* (SIAT-CT). Using a qualitative multimethod approach—including interviews, document analysis, and real-time reconstruction through YouTube and X—the study analyzes how actors interact across the warning chain.

In Mexico, a country with 17 coastal states, tropical cyclones constitute a persistent threat due to geographic exposure to both the Pacific Ocean, the Gulf of Mexico, and the Caribbean Sea. The hurricane season extends for more than half of the year, while large populations remain increasingly vulnerable to associated hazards. The case of Hurricane Otis illustrates these dynamics, it made landfall in Acapulco, Guerrero, on October 25, 2023, as the first Category 5 hurricane to strike Mexico's Pacific coast. Its rapid intensification—from tropical storm to Category 5 in approximately 12 hours, reaching

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wind speeds of 177 km/h within 24 hours—constituted a critical stress test for the system, revealing its effectiveness in risk communication and in prompting protective action among affected populations.

This extreme event provides an empirical context to analyze how early warning systems operate under conditions of high uncertainty and compressed decision timelines.

The next sections review the literature, outline the methods, present results, discuss implications, and conclude. By the end, readers will gain a team-based understanding of early warning performance and a practical framework to improve coordination, communication, and trust in MHEWS.

LITERATURE REVIEW

Early warning systems are commonly conceptualized as interdependent phases linking hazard detection, risk interpretation, warning dissemination, and protective action. Figure 1 illustrates this structure, adapting Bostrom et al.'s model to the SIAT-CT context and highlighting how multiple actors interact across phases, from forecasting to community-level protective action.

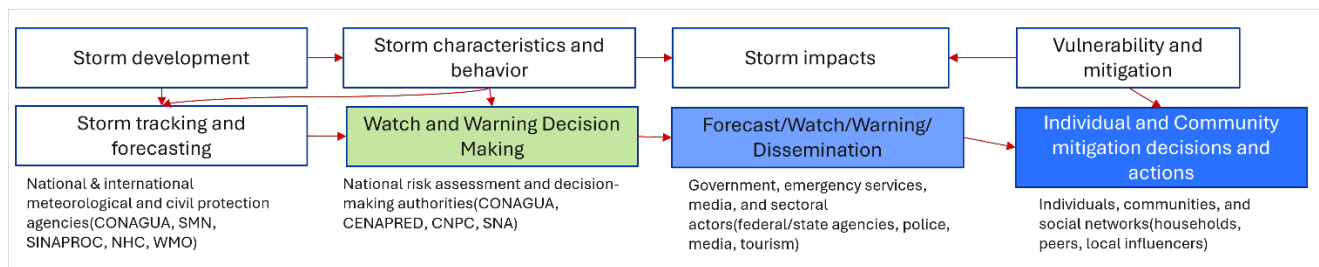


Figure 1. SIAT-CT Model as a Multi-Actor Warning Chain and High-Reliability System (adapted from Bostrom et al., 2016).

Within this framework, multiple actors interact across institutional and social boundaries, shaping system outcomes. Bostrom et al. show that warning systems are not linear pipelines but networks of professionals whose effectiveness depends on interaction, interpretation, and coordination [1]. This perspective emphasizes that crisis response systems performance is a systemic property rather than a technical output.

Crisis response systems operate as temporary, interorganizational structures characterized by fluid roles and distributed authority. These conditions create coordination challenges, including role ambiguity and fragmented decision-making, which directly affect system reliability (Alvinus et al.) [8]. Such dynamics are particularly relevant in complex, multi-hazard contexts.

High Reliability Organization (HRO) theory provides a framework for understanding how systems maintain performance under uncertainty through principles such as preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise [6][7].

These principles shift attention toward collective awareness and coordination. Building on this perspective, Rincón-González conceptualizes crisis communication teams as a temporary, high-performance, multi-actor formation integrating complementary competencies and shared accountability [2][3]. These units are designed to operate under uncertainty and maintain coordination across diverse actors.

Despite these insights, actors in MHEWS rarely function as cohesive teams. Instead, they operate across institutional silos, limiting coordination and effectiveness.

This study addresses this gap by reframing MHEWS as temporary high-reliability crisis communication teams, integrating systemic interaction [1], temporary organization dynamics [8], governance priorities [4], and team-based performance design [2][3]. This reframing contributes to literature by shifting the unit of analysis from warning systems as infrastructures to warning systems as temporary, high-reliability, multi-actor communication teams, thereby bridging system-based and communication-based perspectives.

METHODS OR PROCEDURES

This study employs a qualitative multimethod design to capture institutional structures and operational dynamics.

Document analysis covered national programs, SIAT-CT protocols, and contingency plans to map formal roles and governance structures.

Critical incident reconstruction examined recent tropical cyclone events through timelines of decisions and warnings, actor interactions across phases, communication flows, and public response indicators.

A key contribution is real-time communication analysis, incorporating YouTube videos and messages published on X.

These sources enabled reconstruction of live communication dynamics, including sequencing, framing, amplification, and audience interaction, offering insight into how the warning chain operates in practice. Data were analyzed using HRO

principles [6][7], high-performance team criteria [2][3], and a failure taxonomy (information, task, communication, perspective, coordination, execution).

The combination of document analysis and real-time communication data enabled methodological triangulation, strengthening the robustness of the findings.

RESULTS

This approach enables an analysis of system performance not only as designed, but as enacted in real-world conditions. Findings show that MHEWS performance is shaped primarily by coordination dynamics.

In the case analyzed, the Early Warning System for Tropical Cyclones (SIAT-CT) was activated and operated according to its formal design. Multiple layers of communication were observed, consistent with established protocols. This indicates that, from a procedural perspective, key system components were in place. However, significant performance gaps emerged at the interactional and societal levels.

Evidence shows noncompliance with official instructions among different sectors of the population, including both residents and tourists. In particular, the tourism sector exhibited weaknesses in protocol implementation, contributing to ineffective response behaviors.

While the SIAT-CT system activates multiple layers of communication in a timely manner, as expected, the results indicate that a limited culture of civil protection among the population and tourism sector personnel reduces its effectiveness, as warnings are not consistently internalized and recommended protective actions are not systematically and timely implemented across the different phases of the SIAT-CT.

These findings reinforce that system effectiveness is not determined solely by activation or information dissemination. Rather, it depends on how actors interpret, coordinate, and act upon warnings across the full warning chain. Recurring failure patterns include inconsistent messaging, divergent interpretations of risk, weak coordination across phases, and institutional silos, consistent with known crisis communication failures [2][3].

Conversely, more effective cases exhibit high-reliability characteristics such as shared purpose, adaptive coordination, deference to expertise, and coherent communication. These elements enhance the clarity, credibility, and actionability of warnings, particularly under conditions of extreme uncertainty.

DISCUSSION AND CONCLUSION

The findings support reframing MHEWS as temporary high-reliability teams rather than purely technical infrastructures.

While SIAT-CT operated as expected at the procedural level—activating multiple layers of communication in a timely manner—the results show that system reliability breaks down at the level of coordination, interpretation, and public response.

A weak culture of civil protection among both the general population and tourism sector personnel limits system effectiveness, as warnings are not consistently taken seriously and recommended protective actions are not timely implemented across phases.

This reinforces Bostrom's systemic insight that performance depends on interactions among actors rather than isolated outputs [1]. It also highlights that reliability is not solely an organizational property but a socially embedded process, where preparedness culture, trust, and behavioral response play a decisive role.

Weak preparedness cultures and limited adherence to warnings undermine system effectiveness even when technical components function properly. Increasing climate variability and rapid intensification events further amplify these coordination demands, making reliability under uncertainty a central requirement for MHEWS.

A critical implication is that risk communication and community engagement must be strengthened in practice, not only in design. Even when communication systems are activated as planned, their effectiveness depends on how warnings are interpreted, trusted, and acted upon by different populations. This requires moving beyond the transmission of information toward sustained engagement processes that build preparedness, foster trust, and enable meaningful participation in risk interpretation and response.

Integrating system interaction [1], temporary organization dynamics [8], governance priorities [4], and team-based performance design [2][3], these findings indicate that reliability emerges from coordinated collective action across institutional and societal actors. In this sense, warning system performance should be understood as a form of collective action capability under uncertainty, rather than as a function of information accuracy alone.

Three implications follow. First, governance must strengthen cross-institutional coordination and clarify roles across the warning chain. Second, communication must evolve toward transparent management of uncertainty and sustained engagement with audiences. Third, social integration must prioritize the development of preparedness culture and active community involvement to ensure warnings translate into protective action, particularly among vulnerable and transient populations such as tourists.

These elements are critical for advancing inclusive climate risk response, where effective early warning depends not only on system design but on the integration of diverse actors and end-users into coordinated response processes. Real-time communication analysis further shows that system performance is dynamically constructed through distributed interactions, reinforcing the need for adaptive, participatory, and context-sensitive approaches.

While grounded in the SIAT-CT case, these findings are indicative of broader coordination challenges in MHEWS operating in complex, multi-actor environments. By reframing MHEWS as temporary high-reliability crisis communication teams, this study provides a conceptual and practical pathway for improving coordination, strengthening trust, and enhancing the capacity of early warning systems to support inclusive and effective climate risk response in increasingly uncertain contexts.

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REFERENCES

- [1] Bostrom, A., Morss, R. E., Lazo, J. K., Demuth, J., Lazrus, H., & Hudson, R. (2016). A mental models study of hurricane forecast and warning production, communication, and decision-making. *Weather, Climate, and Society*, 8, 111–129. <https://doi.org/10.1175/WCAS-D-15-0033.1>
- [2] Rincón-González, J. A. (2016). Crisis communication committee as a high-performance team [Conference presentation]. International Association of Business Communicators (IABC) Conference, New Orleans, United States.
- [3] Rincón-González, J. A. (2025). Crisis communication committee as a high-performance team [Conference presentation]. Universidad Panamericana, Mexico.
- [4] Roknideh, F., Fearnley, C. J., & Budimir, M. (2025). Multi-hazard early warning systems in the Sendai Framework. *International Journal of Disaster Risk Science*, 16, 103–116. <https://doi.org/10.1007/s13753-025-00622-9>
- [5] Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations. *Administrative Science Quarterly*, 38(3), 357–381. <https://doi.org/10.2307/2393372>
- [6] Weick, K. E., & Sutcliffe, K. M. (2001). *Managing the unexpected*. Jossey-Bass.
- [7] Weick, K. E., & Sutcliffe, K. M. (2007). *Managing the unexpected: Resilient performance*. Jossey-Bass.
- [8] Alvinus, A., Deverell, E., & Hede, S. (2020). A gender perspective on temporary organisations in crisis management. *NORA*, 28(4), 273–286. <https://doi.org/10.1080/08038740.2020.1785008>