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Disaster risk management and capacity building in prevention: systematic review of public policies in Andean countries

Gestión del riesgo de desastres y formación de competencias en prevención: revisión sistemática de políticas públicas en países andinos

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Abstract

Disaster risk management (DRM) has become a global and regional priority, especially in Andean countries exposed to geological and climatic hazards. This article analyzes public policies aimed at prevention and identifies approaches, gaps, and opportunities to strengthen technical, institutional, and community capacities in the face of disasters. The study adopts a qualitative approach, based on a systematic review under the PRISMA protocol, focusing on public policies on risk management and skills training in Andean countries. A total of 842 records from Scopus, Web of Science, and SciELO were reviewed; after applying the inclusion and exclusion criteria, 25 studies were selected for analysis. The findings show that risk management policies in the region prioritize vulnerability reduction and institutional capacity building through regulatory frameworks, inter-institutional coordination, community participation, and international cooperation. Prevention training combines education and community action, achieving technical and operational advances whose sustainability depends on investment and institutional stability. It is concluded that risk management policies in Andean countries face regulatory gaps, budgetary constraints, a shortage of technical personnel, and inconsistent inter-institutional coordination. In addition, community participation is insufficient and evaluation lacks clear indicators. Overcoming these limitations requires integrated frameworks, stable financing, ongoing monitoring, and greater technical and institutional strengthening.

Keywords: management, prevention, policies.

Resumen

La gestión del riesgo de desastres (GRD) se ha consolidado como una prioridad global y regional, especialmente en los países andinos expuestos a amenazas geológicas y climáticas. Este artículo analiza las políticas públicas orientadas a la prevención e identifica enfoques, brechas y oportunidades para fortalecer las competencias técnicas, institucionales y comunitarias frente a los desastres. El estudio adopta un enfoque cualitativo, basado en una revisión sistemática bajo el protocolo PRISMA, centrada en políticas públicas sobre gestión del riesgo y formación de competencias en países andinos. Se revisaron 842 registros procedentes de Scopus, Web of Science y SciELO; tras aplicar los criterios de inclusión y exclusión, se seleccionaron 25 estudios para el análisis. Los hallazgos muestran que las políticas de gestión del riesgo en la región priorizan la reducción de la vulnerabilidad y el fortalecimiento de las capacidades institucionales mediante marcos normativos, coordinación interinstitucional, participación comunitaria y cooperación internacional. La formación en prevención articula educación y acción comunitaria, logrando avances técnicos y operativos cuya sostenibilidad depende de la inversión y de la estabilidad institucional. Se concluye que las políticas de gestión del riesgo en los países andinos enfrentan brechas normativas, limitaciones presupuestarias, déficit de personal técnico y una coordinación

interinstitucional discontinua. Además, la participación comunitaria resulta insuficiente y la evaluación carece de indicadores claros. Superar estas limitaciones requiere marcos integrados, financiamiento estable, monitoreo permanente y un mayor fortalecimiento técnico e institucional.

Palabras clave: gestión, prevención, políticas.

Introduction

In recent decades, disaster risk management (DRM) has emerged as a strategic pillar in global sustainable development policies (Sawaneh & Fan, 2021). In this context, international organizations such as the United Nations (UN) and the United Nations Office for Disaster Risk Reduction (UNDRR) have promoted regulatory frameworks, including the Sendai Framework for Disaster Risk Reduction 2015-2030 (Imperiale & Vanclay, 2022), through which states have incorporated objectives aimed at strengthening prevention, preparedness, and response. This approach encompasses not only the development of infrastructure and technology but also the formation of technical, institutional, and community competencies, as well as the implementation of actions designed to anticipate and mitigate the impacts of adverse events.

Regionally, Latin America faces structural challenges associated with its geographical and climatic diversity (Cavazos et al., 2024). The Economic Commission for Latin America and the Caribbean (ECLAC) has identified that unplanned urbanization, social inequalities, and the increasing exposure of populations to extreme events have heightened human and economic losses (Moulds et al., 2021). In response, various countries have designed public policies and legal frameworks for DRM, incorporating approaches that link territorial management, education, health, and the environment.

In the Andean countries—Bolivia, Colombia, Ecuador, and Peru—DRM is developed in a context of geological and climatic threats combined with socioeconomic inequalities and heterogeneous institutional capacities. This scenario has influenced the effectiveness of national policies (Núñez-Naranjo et al., 2025). Additionally, the region exhibits high seismicity and the presence of active volcanic zones, frequently recording landslides and floods. Although these countries have formulated national plans and regulatory frameworks, gaps remain in the formation of competencies in prevention, both within the educational system and the community sphere (Carrillo-Maldonado & Díaz-Cassou, 2023).

Academic literature indicates that the formation of competencies in prevention is an essential component of DRM. Furthermore, comparative studies show that communities that develop technical and institutional capacities succeed in reducing human and material damages during adverse events (Chen et al., 2023; Saputra et al., 2025). Research conducted in Asia and Latin America highlights that training in evacuation protocols, access to early warning information, and community organization enhance response and recovery efforts (Perera et al., 2020; Yore & Walker, 2021). Similarly, integrating DRM content into school and higher education programs facilitates knowledge acquisition and promotes participation in preventive actions.

Other studies emphasize that public policies aimed at training in prevention yield better results when they articulate educational institutions, civil protection agencies, and local governments, and when they include monitoring and evaluation mechanisms (Russo & Rindone, 2024). However, evidence also warns that, in the absence of inter-institutional coordination and sustained funding, training actions tend to disperse and lose continuity. In the case of Latin America, previous systematic reviews have shown that the most successful interventions combine investments in infrastructure, educational programs, and community strengthening. This suggests that the effectiveness of DRM depends on a comprehensive approach that articulates technical, regulatory, and social resources (Guerrero et al., 2024).

In light of this context, the present systematic review aims to identify, analyze, and synthesize public policies directed at DRM and the formation of competencies in prevention in the Andean countries. It also seeks to provide evidence that contributes to optimizing the design and execution of these policies, recognizing effective strategies, identifying gaps, and formulating recommendations aimed at reducing human and material losses.

The relevance of this study lies in the fact that the Andean countries share geographical and social characteristics that require solutions tailored to their realities. This analysis also opens opportunities for regional cooperation and the exchange of practices. In this line, the systematization of information will provide useful inputs for policymakers, researchers, and community actors working on disaster risk reduction. Within this framework, the general objective of the research is to analyze, through a systematic review, public policies on DRM and the formation of competencies in prevention in the Andean countries, in order to determine approaches, achievements, limitations, and opportunities for strengthening these policies.

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Methodology

The research adopted a qualitative approach aimed at analyzing public policies regarding disaster risk management (DRM) and the formation of competencies in prevention in the Andean countries. This approach allowed for a comprehensive examination of the content of academic documents and official sources; it also facilitated the identification of patterns, gaps, and opportunities. Moreover, it enabled the interpretation of the strategies and actions described in the selected studies and favored the understanding of their application in different national contexts.

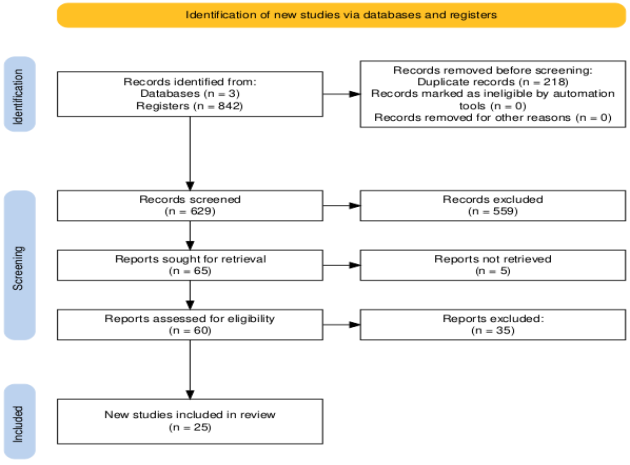
The technique employed was a systematic review, following sequential procedures that included the search, selection, analysis, and synthesis of information. The process was conducted in accordance with the PRISMA protocol guidelines, which ensured methodological rigor at each stage. Consequently, the review included the identification of sources, record cleaning, quality assessment, and extraction of relevant data; it also ensured that the analysis was based on verifiable evidence.

The search equations were constructed with key terms combined using Boolean operators and adjusted to the structure of each database. In Scopus, the formula used was: ("disaster risk management" OR "risk reduction") AND ("competence" OR "skills" OR "capacity building") AND ("Andean countries" OR "Bolivia" OR "Colombia" OR "Ecuador" OR "Peru"). In Web of Science, the equation applied was: ("gestión del riesgo de desastres" OR "reducción del riesgo") AND ("competencias" OR "capacidades") AND ("países andinos" OR "Bolivia" OR "Colombia" OR "Ecuador" OR "Perú"). Finally, in SciELO, a search was conducted using the same terms in Spanish, verifying that the results were directly related to the study's objective.

Inclusion criteria encompassed articles published between 2020 and 2025, with full text availability, direct relevance to DRM and the formation of competencies, and a focus on Andean countries. Exclusion criteria included documents without open access, publications lacking peer review, studies from other regions, and works with methodologies not linked to public policies. Duplicates and records with incomplete information were also discarded to reduce the volume of documents irrelevant to the analysis.

The PRISMA diagram showed that, in the identification phase, 842 records were retrieved from Scopus (n = 412), Web of Science (n = 287), and SciELO (n = 143). During the initial cleaning, 218 duplicate records were removed, with no exclusions registered due to automation or other reasons, leaving 624 for screening. In this stage, 559 were excluded for not meeting the established criteria, resulting in 65 for recovery. Of these, five were not recovered, leaving 60 reports for eligibility assessment. In this final phase, 20 were excluded for reason 1, 10 for reason 2, and five for reason 3. Ultimately, 25 studies were incorporated into the review, forming the basis for qualitative analysis and allowing for a comprehensive exploration of the thematic and geographical diversity of academic production on the topic.

Figure 1. PRISMA flow diagram



Results and discussion

Predominant approaches in disaster risk management public policies in Andean countries

The systematic review of public policies related to disaster risk management (DRM) in the Andean countries shows a sustained focus on reducing vulnerability and strengthening institutional capacities at all levels of government (Greiving et al., 2021). This dual purpose is reflected in the incorporation of DRM as a cross-cutting axis in development planning, integrating actions for prevention, preparedness, response, rehabilitation, and reconstruction into national and subnational plans (Camacho, 2025). Moreover, regulatory frameworks have been adapted to ensure the operational continuity of institutions in the face of emergencies, establishing technical criteria that guide the formulation of sectoral plans and specific programs.

A distinctive feature of these approaches is the existence of planning instruments that articulate national, regional, and local levels, accompanied by permanent inter-institutional coordination mechanisms among ministries, subnational governments, specialized agencies, and response entities (Córdova et al., 2023). This institutional framework also includes the participation of the private sector, civil society organizations, and community networks, which contribute to risk identification, information management, and the implementation of preventive measures (Marcillo-Delgado et al., 2021). Additionally, several countries have developed digital platforms and early warning systems that allow for the anticipation of threats, reducing uncertainty and improving decision-making in risk contexts (Escobar-Rey et al., 2025).

The influence of international organizations has been decisive in shaping these policies, encouraging the adoption of technical standards and evaluation methodologies that align national frameworks with global references such as the Sendai Framework for Disaster Risk Reduction (Cabral-Ramírez et al., 2025). This alignment not only establishes indicators for monitoring and evaluating progress but also guides periodic adjustments in implemented strategies. Furthermore, agreements on technical and financial cooperation have enabled the modernization of strategic infrastructures, the training of specialized personnel, and the execution of institutional strengthening projects (Dupuits et al., 2022).

In this context, community participation has solidified as an essential component for the sustainability of policies. The integration of local actors in decision-making processes increases response capacity and fosters social ownership of the measures adopted (Gómez, 2024). Concurrently, strategies for formal and informal education, as well as outreach campaigns that disseminate practical knowledge for emergency action, have been promoted (Salvioni, 2023). Some experiences even link DRM with ecosystem conservation and land management, contributing to reducing exposure to recurring threats (Agudelo et al., 2020).

In summary, Andean countries have established a framework of action that integrates normative dimensions, operational planning, and social articulation, supported by international cooperation and the development of internal capacities. However, differences in governance models, national priorities, and resource availability influence the speed and depth of implementation, resulting in heterogeneous outcomes across the region.

Strategies for competency development in prevention within educational and community contexts

Strategies for developing competencies in prevention, both in educational and community settings, have evolved in Andean countries as a structural component of DRM, directly articulating with national and subnational policies (Bronfman et al., 2024). This approach recognizes that reducing vulnerabilities and improving response capacity depend not only on infrastructure or technology but also on the level of preparedness and knowledge possessed by individuals, families, and communities.

At the normative level, several countries have mandated the inclusion of DRM content at all educational levels, from early education to university, as well as in technical and community training programs (Espinoza-Molina et al., 2022). These contents progressively address, tailored to each context, the identification of threats, vulnerability analysis, the use of monitoring tools, and the formulation of action plans in emergencies. Knowledge extends beyond theoretical aspects, linking to concrete practices such as evacuation drills, first aid exercises, family emergency plans, and the use of safe routes.

Inter-institutional coordination is key to ensuring that educational contents have practical applications. School authorities collaborate with specialized agencies—such as meteorological services, geological institutes, and national civil defense offices—in the development of updated pedagogical materials, action guidelines, and protocols adapted to each locality. This joint effort has also allowed for training teachers as knowledge multipliers within the school community, generating an extension effect towards families and neighborhoods where students reside.

In the community realm, strategies adopt a participatory approach. Training workshops, awareness days, and preparedness exercises directly involve community leaders, communal associations, and citizen collectives (Smith et al., 2022). These activities convey technical knowledge and strengthen social fabric through neighborhood organization and the construction of mutual support networks. In several cases, community brigades have been formed, trained in damage assessment, basic fire control, evacuation, and management of temporary shelters, serving as vital resources in contexts where institutional response is limited or delayed.

Public communication also constitutes a strategic axis. Mass campaigns disseminated through traditional media and social networks have aimed to reinforce preventive behaviors and promote a culture of self-protection. These campaigns have been designed with an inclusive approach, incorporating indigenous languages and accessible formats for people with disabilities, aimed at ensuring that the message reaches the entire population.

Formation processes include mechanisms for ongoing evaluation that measure not only conceptual mastery but also the acquisition of practical skills and readiness to act in emergency situations (Fazeli et al., 2024). These diagnostics have facilitated the adjustment of methodologies and the reinforcement of specific content, ensuring the relevance and effectiveness of actions (Ramadoan et al., 2023). Evidence shows that when these strategies are sustained over time and accompanied by coherent public policies, they produce tangible results in risk reduction and post-disaster recovery capacity (Paci-Green et al., 2020; Rodríguez-Rivero et al., 2020).

In conclusion, competency formation in prevention constitutes a long-term social investment that strengthens community resilience and contributes to the effectiveness of DRM policies. Its success depends on the continuous coordination among educational systems, civil protection institutions, communities, and the media, as well as the political will to sustain investment and the ongoing updating of programs.

Achievements in vulnerability reduction and capacity building

The achievements in reducing vulnerability and strengthening capacities in DRM across Andean countries rest on three interrelated pillars: regulatory and institutional strengthening, enhancement of technical and operational capacity, and consolidation of national and international cooperation (Waked & Jaime, 2025; Zeballos-Velarde et al., 2023).

Firstly, the creation and updating of regulatory frameworks have allowed for clearer regulation of institutional responsibilities, establishment of standardized protocols, and definition of mandatory action lines across all phases of the risk management cycle. This has resulted in national and subnational systems that coordinate actions for prevention, preparedness, response, and recovery, thereby avoiding fragmentation of efforts and ensuring a more coherent and rapid response (Lima et al., 2020).

Secondly, the mass training of public officials, professionals from key sectors, community organizations, and private enterprises has significantly elevated technical capacity to identify threats, assess vulnerabilities, and design action plans (Kuhlmann et al., 2024; Lucatello & Alcántara-Ayala, 2024). This strengthening of human capital has been complemented by the installation of early warning systems in high-risk areas, reducing response times and increasing the effectiveness of preventive measures (Thuro et al., 2020).

Thirdly, international cooperation has been crucial in financing projects to modernize critical infrastructures, expand and improve communication networks, and optimize logistics for disaster response (Calvo, 2023). At the regional level, collaboration among Andean countries has enabled the development of joint protocols for managing cross-border emergencies, creation of rapid response teams, and sharing of technology and specialized knowledge (Mesquita et al., 2025).

Finally, citizen participation has transitioned from a complementary element to a strategic factor. Experiences in various countries demonstrate that the active involvement of organized communities enhances the effectiveness of policies and ensures implementation that is better suited to local realities.

In summary, the achievements realized are not the result of isolated actions but rather of constant interaction among public policies, technical resources, trained human capital, and active social participation. However, their sustainability requires continued public investment, reinforcement of coordination structures, and assurance of institutional stability. Only in this way can Andean countries consolidate the capacities developed and ensure that the improvements achieved become a permanent foundation for regional resilience.

Conclusions

Disaster risk management policies in Andean countries exhibit limitations that affect their effectiveness. Regulatory gaps and a lack of harmonization between national and local legal frameworks hinder the adaptation of policies to territorial realities, while also creating disparities in institutional capacities among regions. Additionally, budget constraints and reliance on extraordinary allocations condition the continuity of interventions, while a shortage of specialized technical personnel delays preventive actions and reduces response effectiveness.

Inter-institutional coordination is not consistently maintained, and cooperation among entities tends to be activated sporadically. Although community participation is recognized in regulatory frameworks, it does not always translate into inclusive processes nor guarantee sufficient access to information that would enable intervention in planning and execution of measures. Similarly, the evaluation of policies lacks clear indicators and updated data, complicating the ability to measure results accurately, identify shortcomings, and propose improvements.

Moreover, the absence of systematized information on impacts and costs limits regional comparisons and restricts the formulation of evidence-based plans. These limitations are associated with a lack of political continuity, institutional fragmentation, and dependency on external resources. Overcoming these challenges requires strengthening governance, ensuring stable investment, and consolidating permanent monitoring and evaluation systems.

In this regard, decision-makers must promote integrated regulatory frameworks that connect national and local levels, ensuring strategic planning supported by stable financing. Furthermore, it is essential to increase the availability of technical personnel, maintain continuous inter-institutional coordination, and establish community participation mechanisms with timely and adequate access to relevant information. Finally, the definition of precise indicators and the constant updating of data will enable the evaluation of results, adjustment of interventions, and adaptation of policies to the changing conditions of the territories.

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