Quest Journals
Journal of Research in Agriculture and Animal Science
Volume 12 ~ Issue 10 (October 2025) pp: 09-14
ISSN(Online): 2321-9459
www.questjournals.org

Research Paper

India's Institutional Fault Lines in Landslide &Flood Management

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Abstract
This paper examines institutional deficiencies that hinder effective flood and landslide risk prevention in India, focusing on governance challenges, resource constraints, and community exclusion. Grounded in institutional and socio-ecological resilience theories, the research identifies how fragmented institutional roles, limited accountability, and inadequate local capacity weaken disaster preparedness and adaptive governance in vulnerable regions. The objective is to inform policy and institutional reforms that enhance disaster governance and resilience.An extensive review of India's disaster management framework reveals strong legal and policy structures, including the Disaster Management Act (2005), National Policy on Disaster Management (2009), and the National Disaster Management Plan (2019). These build a foundation for coordinated multi-sectoral disaster risk reduction integrating technological tools and community-based approaches. However, gaps persist in translating these frameworks into effective local action, especially in resource-poor and hazard-prone states, as demonstrated by case studies from Bihar, Uttarakhand, and Kerala.The case studies highlight diverse challenges: Bihar's overreliance on poorly maintained embankments and weak inter-agency coordination exacerbate flood impacts; Uttarakhand struggles with landslide risk management due to funding and technical deficits at state and Panchayat levels; Kerala demonstrates more integrated ecosystem-based flood resilience but faces challenges in state-local cooperation and environmental degradation. Across cases, community participation and last-mile connectivity in early warning systems remain inadequate, limiting preparedness and response effectiveness.
Analysis reveals that institutional fragmentation, reactive resource allocation, weak technological integration at the local level, and neglected environmental governance exacerbate disaster vulnerability. The dominant focus on emergency relief over prevention, coupled with political and administrative constraints, undermines long-term resilience. To strengthen disaster preparedness, governance reforms must enhance coordination, accountability, and resource efficiency while embedding community empowerment and sustainable environmental management.
The Paperconcludes with recommendations emphasizing institutional capacity building across governance tiers, promoting proactive risk reduction, and mainstreaming disaster risk considerations into development planning. It advocates for sustained funding for prevention, integrating advanced technologies with participatory approaches, and regular capacity-building exercises to institutionalize preparedness. Such reforms are essential for shifting India's disaster management from fragmented reactive responses to a cohesive, inclusive, and technology-enabled preventive framework.

Key words: *Institutional Failures-Disaster Prevention-Governance-Coordination Gaps-Community Engagement-Resilience-Capacity Building & Floods and Landslides*

***R**eceived 02 Oct., 2025; **R**evised 09 Oct., 2025; **A**ccepted 11 Oct., 2025 © The author(s) 2025.*
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I. Introduction

Floods and landslides are frequent natural disasters in India, causing widespread loss of life and property. Effective disaster prevention hinges on strong institutional frameworks, coordinated policies, and community engagement. This study explores the persistent institutional inadequacies that impede flood and landslide risk prevention. Its objective is to identify specific institutional failures and analyse their impact on preventive measures, guiding improvements in disaster governance for vulnerable regions.

II. Theoretical Framework

The analysis is grounded in institutional theory emphasizing governance efficiency, coordination, accountability, and resource allocation as critical to effective disaster risk reduction. It also incorporates the socio-ecological resilience framework advocating for adaptive governance, participatory decision-making, and integration of technological innovations. Key hypotheses include: fragmented institutional roles contribute to inefficient risk prevention; community exclusion weakens resilience; and resource-poor regions face amplified vulnerabilities due to limited local capacity.

III. Literature Review

The Disaster Management Act, 2005, enacted by the Government of India, provides the fundamental legal framework for disaster management in the country, establishing institutions such as the National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs), and District Disaster Management Authorities (DDMAs). The Act emphasizes a proactive approach to disaster management covering all phases: prevention, mitigation, preparedness, response, and recovery. It clearly defines the roles and responsibilities of various authorities and includes enforcement provisions to ensure accountability, aiming to foster a coordinated and systematic disaster governance framework.

Building upon this foundation, the National Policy on Disaster Management, 2009 outlines strategic guidelines focused on multi-sectoral coordination, capacity building, and integrating disaster risk reduction into development planning. It stresses the importance of resilient infrastructure and advocates community-based disaster risk management as a key element.

Further, the National Disaster Management Plan, 2019 elaborates a multi-hazard approach to preparedness, emphasizing technological integration, early warning systems, and efficient resource mobilization. These documents collectively underline the need for a holistic and coordinated disaster risk governance mechanism that includes all relevant stakeholders.

Complementing the policy framework, the Guidelines on Disaster Management Exercises (2022) stress the need for regular drills and simulations involving government agencies, community groups, and NGOs to enhance preparedness and coordination. The earlier National Disaster Management Framework (2003) had already laid the conceptual groundwork by defining disaster risk reduction and resilience as central goals. These guidelines point towards building practical capacities at all administrative levels, aiming to translate policy intent into actionable preparedness and response practices.

Internationally, the Sendai Framework for Disaster Risk Reduction 2015–2030 highlights the crucial shift from reactive disaster response to proactive risk management and resilience building, urging countries like India to embrace investments in understanding risks, strengthening governance, and enhancing both preparedness and recovery mechanisms. Supporting this global perspective, documents such as the Disaster Management Reference Handbook (2018) and training reports from the National Institute of Disaster Management (2025) emphasize the critical importance of evidence-based policymaking, scientific approaches, and capacity building to improve institutional effectiveness at the local level.

Scientific inputs such as the Landslide Hazard Mapping and Monitoring Atlas by ISRO (2020) provide essential hazard assessment data, enabling targeted risk mitigation planning for landslides. However, despite technological progress, challenges remain due to limited local capacities and difficulties in operationalizing early warning systems at the community level. State-level risk reduction plans, such as those from Maharashtra (2025), illustrate an effort to blend structural and non-structural measures but also reveal ongoing issues in agency coordination and resource allocation.

Finally, compendiums of disaster risk management practices (Meghomeguards, 2025) and reports on environmental degradation (ReliefWeb, 2025) highlight persistent challenges such as fragmented institutional authority, insufficient preventive funding, lack of local participation, and neglect of environmental factors aggravating disaster risks. Technological advancements are promising but underutilized, especially where last-mile communication and community integration are weak. Overall, these reviewed materials convey that while India has made significant strides in building institutional and policy frameworks, further reforms emphasizing inclusivity, proactive prevention, technological integration, and environmental management are imperative for strengthening disaster resilience.

IV. Research Design and Methodology

This qualitative study primarily employs a comprehensive analysis of secondary data sources, including official policy documents, government reports, and scholarly research. By systematically reviewing and critically analyzing these materials, the study aims to uncover underlying institutional dynamics that influence disaster risk management related to floods and landslides. The selection of documents encompasses a broad spectrum of information, ranging from legislative frameworks and national plans to field reports and

technical studies, ensuring a well-rounded understanding of institutional structures and their effectiveness in disaster prevention.

To ground the theoretical insights in real-world contexts, the study incorporates selected case studies from regions particularly vulnerable to flooding and landslides, such as Bihar, Uttarakhand, and Kerala. These case studies serve as illustrative examples to highlight both institutional strengths and failures across different governance levels. Through detailed examination of these contexts, the research captures how coordination among agencies, resource distribution, technological adoption, and local community involvement interact to shape disaster risk outcomes. The application of case studies allows for nuanced interpretation of institutional practices and the identification of contextual factors influencing resilience at the grassroots.

The methodological framework is carefully designed to align with institutional theory and socio-ecological resilience principles. This alignment enables the study to systematically code and analyze thematic elements such as governance efficiency, accountability mechanisms, funding patterns, and participatory decision-making processes. By applying these theoretical lenses, the analysis identifies recurring governance patterns and institutional gaps that hinder effective disaster risk reduction. The methodological rigor, supported by transparent coding and systematic comparison, ensures that the study's findings are replicable and robust, offering strong evidence for policy recommendations aimed at strengthening institutional frameworks and enhancing community resilience to natural hazards.

V. Case Studies

Case Study 1: Flood Management in Bihar

Bihar, prone to recurrent floods, suffers from overreliance on embankments with inadequate maintenance leading to frequent breaches. Coordination between state agencies and local governments is weak, causing delayed responses. Limited community involvement in planning reduces local preparedness and adaptation strategies. Despite early warning systems, last-mile connectivity and local awareness remain insufficient.

Case Study 2: Landslide Risk Management in Uttarakhand

Uttarakhand faces high landslide risk due to steep terrain and environmental degradation. Although ISRO's Landslide Atlas guides hazard mapping, there is no comprehensive national landslide mitigation program. State capacity is constrained by funding and technical expertise shortages. Panchayat-level awareness and capacity building are minimal, impacting preparedness and local risk reduction actions.

Case Study 3: Flood Resilience in Kerala

Kerala integrates ecosystem-based approaches alongside structural measures, showing better preventive outcomes. However, state-level coordination with local bodies can improve. The use of technology like CAP flood alerts exists but lacks consistent community engagement for actionable response. Environmental degradation from unregulated urbanization threatens progress.

VI. Key Insights and Analysis of the Case studies

Flood management in Bihar is emblematic of the challenges faced by many flood-prone regions in India. The state's geography and hydrology make it highly susceptible to recurrent floods, primarily caused by snow-fed Himalayan rivers carrying heavy sediment loads and by erratic monsoon rains. The overreliance on embankments constructed decades ago has proven insufficient, as inadequate maintenance leads to frequent breaches, exacerbating flood situations. Coordination gaps between state agencies and local governments further delay critical response efforts. Despite the presence of early warning systems, their effectiveness is compromised by weak last-mile connectivity and low local awareness, and community involvement in flood planning remains minimal. As a result, preparedness and adaptation at the grassroots suffer, contributing to persistent vulnerability and repeated economic losses, particularly in North Bihar's districts adjoining Nepal.

In Uttarakhand, landslide risk management illustrates a different set of institutional and environmental challenges. The state's steep terrain and accelerated environmental degradation due to deforestation and unregulated development intensify landslide hazards. Although ISRO's Landslide Atlas provides valuable scientific hazard mapping, the lack of a comprehensive national landslide mitigation program shifts the burden of risk reduction to resource-constrained state authorities. Limited financial and technical capacity hampers Uttarakhand's ability to systematically implement preventive measures. At the local level, Panchayats have insufficient awareness and training to undertake effective disaster preparedness and risk reduction activities, weakening community resilience. This highlights the necessity for targeted capacity building and institutional support to bridge technical gaps and enhance grassroots engagement in landslide-prone zones.

Kerala presents a comparatively advanced approach by integrating ecosystem-based solutions with traditional structural measures for flood resilience. The state's emphasis on natural interventions such as wetland restoration alongside embankments and drainage infrastructure has demonstrated better preventive outcomes. However, state-level coordination with local governance bodies remains imperfect, sometimes impeding cohesive implementation of flood management strategies. Technological tools like CAP flood alerts are

operational but do not consistently translate into effective community response due to uneven awareness and engagement. Additionally, rapid, unregulated urban expansion, especially in ecologically sensitive areas, threatens to undermine resilience gains by increasing vulnerability to floods and related hazards. Kerala's experience underscores the dual importance of combining technological innovation with strong institutional coordination and sustainable environmental management.

A cross-cutting insight from these case studies is the pervasive institutional fragmentation impacting disaster risk prevention. In Bihar, disjointed coordination between agencies and limited community participation delay responses and reduce preparedness. In Uttarakhand, resource scarcities and inadequate capacity at state and local levels inhibit comprehensive landslide mitigation efforts. Kerala's more integrated approach demonstrates the value of synchronized multi-level governance but also reveals persistent challenges in bridging state-local gaps. Across contexts, community inclusion remains weak, limiting the uptake of early warning information and reducing local ownership of preparedness activities. These governance issues contribute to inconsistent policy implementation and suboptimal use of technological advancements in disaster risk communication.

Technical and financial constraints emerge as common barriers to effective disaster prevention in all three states. Bihar's dependence on aging embankments illustrates the risk of overinvestment in structural measures without adequate maintenance and complementary non-structural interventions. Uttarakhand's limited funding and technical expertise obstruct the translation of scientific hazard mapping into robust mitigation planning. Despite Kerala's progress, environmental degradation linked to infrastructure development continues to pose systemic risks that require sustained fiscal and policy attention. These constraints emphasize the need for balanced investment strategies that allocate resources to technological innovation, capacity building, ecosystem restoration, and infrastructure upkeep in an integrated manner.

Thus, these case studies illustrate that improving disaster preventive measures in India demands institutional reforms that prioritize coordinated governance, enhanced local capacity, and meaningful community participation. Technological tools and hazard mapping provide critical support but cannot substitute for effective institutional mechanisms that ensure timely action and resilience at grassroots levels. Environmental stewardship must complement engineering solutions to sustain long-term disaster risk reduction. Tailored policy interventions that address state-specific contexts—resource limitations, geographical distinctiveness, and socio-political dynamics—are essential to break the cycle of recurring disaster losses and build durable flood and landslide resilience across India

VII. Results

The analysis reveals persistent institutional weaknesses undermining disaster prevention:

Factor	Observation	Implication
Coordination	Fragmented roles, accountability gaps	Delayed response, duplication of efforts
Resource Allocation	Inadequate funding for prevention	Reactive rather than proactive approach
Technological Integration	Early warning lacks community tie-ins	Reduced effectiveness of alerts
Community Participation	Limited inclusion in planning	Poor local preparedness and ownership
Environmental Governance	Neglected degradation effects	Increased vulnerability
Legal Enforcement	Outdated regulations, weak monitoring	Unsafe construction practices

VIII. An Analysis and Inference

The analysis of the observed factors reveals critical weaknesses in the current system that hinder effective water resource and disaster management. Coordination suffers from fragmented roles and unclear accountability, leading to delays in response and duplication of efforts among stakeholders. This disjointed functioning compromises the overall efficiency of interventions, reducing their timely impact during crises.

Resource allocation is another area of concern, marked by inadequate funding predominantly focused on reactive measures rather than preventive strategies. This financial shortfall restricts the capacity to implement risk reduction initiatives, forcing reliance on emergency responses that are often costlier and less effective. Such an approach undermines long-term resilience and sustainability goals.

Technological integration shows gaps, particularly in connecting early warning systems to local communities. Without strong community tie-ins, alerts fail to translate into prompt and appropriate actions on the ground, diminishing their potential to protect lives and assets. Similarly, the limited engagement of communities in planning processes results in poor local preparedness and weak ownership, further reducing adaptive capacities.

Environmental governance and legal enforcement also present significant challenges. Neglect of environmental degradation exacerbates vulnerabilities, while outdated regulations combined with weak monitoring enable unsafe construction practices. This regulatory environment fosters conditions that increase risk exposure rather than reduce it, signalling an urgent need for updated policies and stronger enforcement mechanisms to safeguard communities and ecosystems effectively

IX. Discussion

The results observed in disaster management align closely with institutional theory, which underscores the importance of well-defined roles, clear lines of accountability, and efficient resource utilization for successful governance. Institutional theory emphasizes that disaster management functions effectively when responsibilities are explicitly assigned to various actors at national, state, and local levels, ensuring that each stakeholder understands their duties and is held accountable. Efficient allocation and use of financial, technical, and human resources are critical to optimize preparedness, mitigation, and response strategies. Collaboration across government departments, agencies, and community groups fosters an integrated approach, minimizing duplication of efforts and filling potential gaps. These principles form the backbone of effective disaster management systems and are essential to building resilience against natural hazards.

Despite the theoretical framework promoting proactive and coordinated governance, the dominance of reactive relief measures over preventive strategies remains a significant challenge, particularly in the Indian context. Political and administrative factors, including competing priorities, short-term electoral cycles, and limited political will, often lead to underinvestment in disaster prevention and preparedness. The consequences manifest as delayed response mechanisms and insufficient resilience-building before disasters strike.

This reactive approach not only increases human suffering and economic costs but also impedes the development of sustainable, long-term risk reduction frameworks. Hence, transforming policy and practice to prioritize prevention is critical for improving overall disaster management outcomes.

Another critical finding is the insufficient inclusion of communities in disaster risk reduction processes, which weakens socio-ecological adaptation capacities. Effective resilience-building depends heavily on local knowledge, participation, and empowerment. When community members have limited involvement in risk assessment, early warning dissemination, and preparedness planning, the efficacy of disaster management diminishes. Community exclusion also hinders the development of adaptive coping strategies suited to specific local contexts and vulnerabilities. Institutional frameworks must therefore institutionalize participation mechanisms that integrate community voices and facilitate capacity building, ensuring that disaster risk reduction is socially inclusive and contextually relevant.

Looking ahead, integrating innovative technologies with institutional reforms offers promising opportunities for enhancing early warning systems, risk communication, and overall disaster resilience. Advanced tools such as remote sensing, geographic information systems (GIS), artificial intelligence, and Internet-of-Things (IoT) devices can significantly improve hazard detection, monitoring, and response coordination. However, technology alone cannot achieve desired outcomes without parallel reforms that streamline institutional functions, foster inter-agency coordination, enhance resource efficiency, and build human capacity. India’s disaster governance urgently requires a strategic shift toward inclusive, adequately resourced, and technology-enabled preventive frameworks that balance structural investments with community engagement to reduce disaster risks sustainably and equitable

X. Conclusions and Recommendations

The analysis clearly indicates that India’s disaster management framework has benefitted significantly from the establishment of clear institutional roles and accountability mechanisms, as mandated by the Disaster Management Act of 2005 and subsequent policies. However, considerable gaps remain in operationalizing these mandates at state and local levels, leading to fragmented implementation. Strengthening institutional capacities across all tiers of governance is essential to ensure that roles and responsibilities are not only defined but executed with transparency and efficiency. This will enhance readiness and reduce duplication or gaps in disaster planning and response, fostering a more resilient governance model.

Given the persistent dominance of reactive relief over proactive prevention in disaster management, a strategic reorientation towards risk reduction and preparedness is imperative. Political and administrative challenges, including focus on short-term responses and electoral cycles, have traditionally hindered investment in long-term preventive infrastructure, community training, and ecosystem restoration. Future policy must

emphasize sustained funding streams dedicated to prevention, support evidence-based hazard and vulnerability assessments, and incentivize multi-sectoral collaborations that prioritize disaster risk reduction. Promoting a culture of prevention can reduce both human suffering and economic losses in recurrent disaster-prone areas.

The importance of community engagement and inclusive disaster governance has come into sharp focus in recent research and practice. Incorporating local knowledge and ensuring active participation of vulnerable populations in risk assessment, early warning dissemination, and planning will enhance the socio-ecological resilience essential for adaptation. Bottlenecks in last-mile connectivity and limited awareness reduce the effectiveness of even the most sophisticated early warning systems. Institutional mechanisms must prioritize capacity building for Panchayats, urban local bodies, and community volunteers, embedding participatory frameworks that can translate policy into local action effectively.

Innovative technologies offer vast potential to transform disaster risk reduction and response in India. Remote sensing, geographic information systems (GIS), artificial intelligence (AI), and real-time data analytics can significantly improve prediction accuracy, early warning dissemination, and coordination among stakeholders. However, technology deployment should be accompanied by institutional reforms that promote inter-agency collaboration, technical training for government personnel, and systems for data sharing. Bridging the gap between technological capability and operational readiness is crucial for fostering an adaptive and responsive disaster management system.

Another critical recommendation is to mainstream disaster risk considerations into development planning across sectors including urban development, infrastructure, agriculture, and environment. Environmental degradation—such as deforestation, unplanned urbanization, and mining—exacerbates disaster vulnerability and must be addressed as an integral component of risk reduction strategies. Policy coherence that aligns disaster risk reduction with sustainable development goals will ensure more holistic management of hazards, reducing exposure and enhancing ecosystem services that mitigate disaster impacts.

Finally, institutional reforms must focus on enhancing financial sustainability by earmarking dedicated funds for prevention and resilience-building at district and state levels, alongside effective monitoring and transparency mechanisms. Training and capacity development programs must be regularized to keep pace with emerging hazards and technological advances. Implementing comprehensive disaster management exercises, as advocated by NDMA guidelines, involving all stakeholders, will institutionalize preparedness culture. By embedding these elements into policy and governance, India can shift from fragmented, reactive disaster management to a robust, inclusive, and technology-enabled preventive framework, safeguarding its population and development gains against increasing disaster risks

Acknowledgment

My deepest gratitude goes to my professional network for their invaluable insights, feedback, and unwavering support throughout the writing of this paper. Their expert guidance was instrumental in shaping the analysis and perspectives presented. I am equally thankful to my family for their constant love, patience, and understanding, which provided essential strength and motivation. This endeavour would not have been possible without the collective support of my colleagues and loved ones.

Ethical Considerations

This research uses publicly available secondary data with ethical adherence to proper citations and avoiding confidentiality breaches.

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