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Article

Disaster Management Laws in India: Past, Present, and Future Directions

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ABSTRACT

Disaster management in India has significantly evolved over the years in response to the increasing frequency and severity of natural and man-made disasters. This paper examines the historical evolution of India's legal framework for disaster management, critically assessing its effectiveness and providing recommendations for future legal and policy reforms. The study utilises a qualitative historical analysis to examine key legal documents, statutes, and regulations, tracing the evolution from colonial-era, relief-based laws to the present, more comprehensive risk-reduction models. The findings highlight the transition from a reactive, relief-focused approach to a more proactive, comprehensive risk-reduction model that aligns more closely with international best practices. The paper identifies the challenges faced by current legal frameworks, particularly in integrating advanced technologies and involving local governance in disaster management. Moreover, it emphasises the incorporation of technologies like artificial intelligence (AI) into disaster management laws to enhance preparedness, response, and long-term recovery efforts. By focusing on the Sustainable Development Goals (SDGs), the study advocates for enhancing the effectiveness of disaster management strategies. The paper concludes with recommendations for future reforms to strengthen India's legal infrastructure and integrate emerging technologies, thereby enhancing disaster resilience nationwide.

KEYWORDS

Disaster management; legal framework; India; sustainable development; policy reform.

1. Introduction

Disasters are significant disruptions to the normal functioning of societies, resulting in widespread human, material, and environmental losses that exceed the capacity of affected communities to manage and recover using their existing resources (Vij, 2022). The United Nations Office for Dis-

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aster Risk Reduction (UNDRR) defines a disaster as "*a serious disruption of the functioning of a community or society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its resources*" (UNDRR, 2022). Disasters can be categorised into three broad types: natural, man-made, and hybrid. Natural disasters are those caused by environmental processes, including atmospheric, geological, and hydrological phenomena. These disasters include earthquakes, floods, cyclones, and pandemics, each requiring specific preparedness, response, and recovery strategies. Natural disasters can be further subdivided into geophysical events (e.g., earthquakes, volcanic eruptions), hydro-meteorological disasters (e.g., floods, droughts), and biological disasters (e.g., epidemics). Man-made disasters, also known as anthropogenic disasters, are caused by human activities, negligence, or deliberate actions. They include technological accidents, industrial mishaps, nuclear incidents, and socio-political events like terrorism and armed conflict. These disasters often result from systemic failures or inadequate regulatory measures and can have far-reaching consequences (Hanspal, 2024). Hybrid disasters are a combination of natural and human-induced events. For instance, environmental degradation, such as deforestation or poor urban planning, can amplify the severity of natural disasters like floods or landslides. These events highlight the complex interplay between human activities and the natural environment, which can exacerbate the impact of disasters (Jovičić, Gostimirović, & Milašinović, 2024). Disasters differ in terms of onset speed, geographical coverage, and duration. Some, such as earthquakes, are sudden and localised, while others, like climate change or pandemics, unfold over extended periods, affecting broader regions and populations. The unpredictability and scale of these events pose significant challenges for governments, communities, and global agencies in terms of disaster preparedness, response, and long-term recovery. In India, the frequency and intensity of natural and man-made disasters have underscored the need for an effective and adaptive disaster management system. The country's legal framework for disaster management has evolved significantly over the years, moving from a reactive, relief-based approach to a more proactive, risk-reduction model. However, challenges persist, particularly in integrating advanced technologies and ensuring the involvement of local governance in disaster management. Given India's diverse socio-economic and environmental landscape, the legal framework must be flexible and inclusive, addressing the needs of both urban and rural communities.

1.1 Objectives of the Study

This study aims to critically analyse the evolution of disaster management laws in India, assess their effectiveness in managing contemporary disaster risks, and propose recommendations for future reforms. The primary objectives of the research are as follows:

- Historical Analysis: To trace the evolution of disaster management laws in India, identifying key legislative milestones and policy developments from the colonial era to the present.
- Evaluation of the Current Framework: To assess the effectiveness of existing legal instruments in managing disaster risks, with particular emphasis on strengths and weaknesses.
- Future Outlook: To propose actionable recommendations for enhancing legal frameworks to address emerging and future disaster risks, focusing on technological integration and community-driven approaches.

2. Literature Review

Disaster management laws have undergone significant evolution, transitioning from reactive relief measures to proactive disaster risk reduction (DRR) strategies. Initially, disaster management focused on response and recovery, primarily framed as civil defence efforts during wartime. However, over time, the importance of prevention and mitigation emerged, leading to the development of integrated approaches that address both the immediate aftermath and long-term risk reduction (Rajabi et al., 2021). The Hyogo Framework (2005–2015) marked a pivotal moment, urging nations to incorporate Disaster Risk Reduction (DRR) into national policies and integrate community-based strategies into disaster management. This shift was further reinforced by the Sendai Framework

(2015–2030), which emphasised reducing disaster risks through collaborative, inclusive, and technologically advanced approaches. Globally, frameworks such as the Sendai Framework for Disaster Risk Reduction have shaped disaster management practices, establishing legal norms for countries to follow in mitigating the impacts of disasters. The Sendai Framework emphasises the importance of collecting real-time data through advanced technologies, such as Geographic Information Systems (GIS) and artificial intelligence (AI), to enhance the accuracy and efficiency of disaster response efforts (Vuckovic & Slavkovic, 2024). The framework also emphasises international cooperation, advocating for a multilateral approach that draws parallels with international human rights law to ensure global disaster preparedness (Browne, 2013). The Hyogo Framework, preceded by the Sendai Framework, laid the groundwork by focusing on resilience, governance, and public awareness, aiming to reduce disaster risks through education and investment. Japan and Indonesia present contrasting approaches to disaster management. With its long history of proactive disaster management laws dating back to 1941, Japan has developed an advanced framework emphasising disaster prevention, mitigation, and robust community engagement. Japan's disaster laws and advanced technological applications, such as early warning systems and evacuation drills, have contributed to its resilience (Lestari et al., 2020). In contrast, Indonesia's disaster management framework, established through Act No. 24 of 2007, is relatively newer and faces challenges in standardising disaster management practices. Although improvements have been made, including the adoption of GIS for risk mapping, Indonesia continues to struggle with clarity and consistency in disaster law, particularly in emergency definitions, which hinders effective disaster management (Kadir et al., 2024).

Technological advancements have revolutionised disaster management. AI, GIS, and the Internet of Things (IoT) have become integral to enhancing disaster risk reduction and response efforts. AI and machine learning technologies, such as support vector machines and convolutional neural networks, analyse vast datasets for predictive analytics and real-time decision-making during disasters (Nunavath & Goodwin, 2019).

Recent advancements in AI for disaster management have highlighted the importance of reinforcement learning (RL) and explainable AI (XAI) in enhancing real-time decision-making and ensuring transparency. RL (Reinforcement Learning), where agents learn optimal actions by interacting with their environment and receiving feedback, optimises disaster response strategies by adapting to dynamic conditions such as resource availability and evolving disaster intensities (Babaee et al., 2024). This flexibility is particularly useful in situations such as floods or wildfires, where traditional models often lack the responsiveness needed. On the other hand, XAI (Explainable Artificial Intelligence), which employs techniques such as LIME and SHAP, ensures that AI-driven decisions are transparent—a crucial factor in high-stakes environments such as disaster response. XAI has been applied in snow avalanche forecasting to clarify the decision-making process, enhancing the model's credibility (Reddy, 2024). The integration of RL and XAI enhances disaster management by enabling adaptive and transparent decision-making, thereby helping to overcome challenges such as resource limitations and public trust in AI-driven processes.

GIS facilitates the creation of risk maps, while IoT devices, such as sensors and cameras, provide real-time situational awareness, thereby improving evacuation planning and resource management (Manyuchi et al., 2023). These technologies enable disaster management systems to operate more efficiently, with AI enhancing predictive capabilities, GIS improving spatial data integration, and IoT offering continuous monitoring during disaster events. For instance, Long Short-Term Memory (LSTM) networks have demonstrated 87% accuracy in flood prediction, with a Root Mean Square Error (RMSE) of 12.4 mm, providing a critical lead time before disaster events occur (Hossain et al., 2023). GIS is crucial in spatial data analysis and risk mapping, as it integrates real-time data from IoT sensors to enhance situational awareness and inform decision-making. One study demonstrated that combining the Internet of Things (IoT) and Geographic Information Systems (GIS) with Convolutional Neural Networks (CNNs) enabled near real-time tracking of wildfire spread, thereby optimising evacuation strategies and resource allocation (Kılınç, 2024). Additionally, AI-driven optimisation techniques have been shown to reduce delays in resource distribution by up to 40% during emergencies (Diehr et al., 2025). These advancements underscore the increasing importance of AI, IoT, and GIS in developing more resilient and efficient disaster management frameworks. However,

challenges such as data quality, system interoperability, and ethical concerns regarding privacy and bias still need to be addressed (Albahri et al., 2024).

International experiences and comparative analysis increasingly shape disaster management laws. For instance, Turkey's disaster management approach integrates spatial data infrastructure, significantly improving the country's disaster preparedness and legal frameworks (Öcal, 2021). Similarly, community involvement in disaster management plays a critical role. Cruz and Ormilla (2022) highlighted how disaster risk reduction strategies have been implemented at the grassroots level in the Philippines, particularly in schools. This underscores the importance of local engagement, where disaster management efforts must be tailored to local vulnerabilities and capacities. Furthermore, strengthening institutional capacities is vital for the effectiveness of disaster management laws. Sudar et al. (2024) discuss how Montenegro harmonised its soft power and institutional capabilities to enhance disaster management governance. Additionally, understanding public perceptions of disaster risks is essential for effective management. Cvetković and Planić (2022) demonstrate that earthquake risk perception in Belgrade significantly influenced the development of disaster management policies, which could serve as a model for addressing public awareness and preparedness in disaster-prone areas.

Disaster Risk Reduction (DRR) theories emphasise the need for multi-faceted approaches to mitigate and manage disaster risks. The core principle of DRR is the integration of prevention and preparedness strategies into national policies and plans. DRR theories encourage a systemic, interdisciplinary approach addressing physical and socio-economic vulnerabilities. These theories emphasise the importance of risk assessment, community engagement, and international cooperation in mitigating disaster impacts (Vuckovic & Slavkovic, 2024). The Social-Ecological Systems (SES) approach is crucial for understanding disaster management laws and resilience. This framework focuses on the interactions between human societies and their surrounding environments, considering how these interactions influence vulnerability and resilience in the face of disasters. The SES approach advocates for adaptive governance systems integrating human and environmental factors into disaster management strategies. It highlights the necessity of addressing socio-ecological vulnerabilities, such as poverty and urbanisation, which exacerbate the impacts of disasters (Browne, 2013). Incorporating emerging technologies, such as AI, GIS, and IoT, into disaster management legal frameworks is increasingly recognised as vital for enhancing disaster preparedness and response. These technologies enhance decision-making processes, enabling data-driven legal frameworks that adapt in real time. Integrating technology into disaster management laws ensures more effective risk management and reduces the latency of response efforts during crises (Nunavath & Goodwin, 2019). Moreover, legal frameworks must evolve to address the ethical, privacy, and security implications of using advanced technologies in disaster management.

3. Methodology

This study employs a qualitative historical analysis to examine the evolution of disaster management laws in India. The research focuses on key legal documents and statutes from the colonial era, such as the Famine Code of 1883, the Epidemic Diseases Act of 1897, and the Disaster Management Act of 2005. A comparative approach contextualises India's legal frameworks against international standards, particularly in comparison to countries like Japan and Indonesia. This comparison provides insight into how India's disaster laws have evolved in alignment with global best practices. Additionally, case studies of major disasters (e.g., the 2001 Gujarat Earthquake, the 2004 Tsunami, and the COVID-19 pandemic) are analysed to assess the practical effectiveness and challenges of the legal frameworks in real-world situations. This methodology critically evaluates India's legal evolution in disaster management, from its historical roots to its current state, and offers recommendations for future reforms.

4. Overview of Disasters in India

With its vast and diverse geographical landscape, India is highly susceptible to various disasters. The unique geo-climatic and geological conditions of the Indian subcontinent make it prone to natural and man-made calamities. The most common types of natural disasters include floods, cyclones, earthquakes, droughts, and landslides, each of which significantly impacts the country's infrastructure. These events cause not only immediate destruction but also have lasting consequences for the nation's socio-economic structure. India frequently experiences floods, droughts, cyclones, and storms, which collectively account for approximately 80% of the country's natural disasters. Between 2000 and 2020, India faced 360 natural disasters, affecting over 1120 million people, with floods and storms being the most prevalent (Kumar & Kumar, 2024). India's long coastline makes it vulnerable to cyclones, which cause severe damage to coastal infrastructure, including ports, power lines, and communication networks. Cyclones like Phailin and Amphan have demonstrated the destructive potential of these storms (Mohanty, Dubey, & Singh, 2022). Historical data reveals a recurring pattern of devastating events, from the Bengal Famine of 1943 to the Gujarat Earthquake of 2001 and the Indian Ocean Tsunami of 2004. These events highlight the critical importance of effective disaster management strategies (NDMA, 2016). India's Disaster management is paramount due to the country's vulnerability to a wide array of natural disasters like floods, droughts, cyclones, earthquakes, and landslides (Jayaprakash, Reddy, & Istijono, 2023). Disaster management in India is of utmost importance. The country's socio-economic fabric, characterised by high population density, poverty, and rapid urbanisation, exacerbates the impact of disasters. India's coastline stretches over 7,500 kilometres and is highly vulnerable to cyclonic storms, particularly from the Bay of Bengal and the Arabian Sea. Similarly, the country's position in seismic zones IV and V, encompassing areas like the Himalayan region and parts of Gujarat, makes it susceptible to frequent earthquakes. Flooding, often caused by heavy monsoon rains, affects large areas, particularly along major river basins such as the Ganga and Brahmaputra. Additionally, regions such as Rajasthan and parts of Maharashtra regularly face droughts due to insufficient rainfall.

Table 1: Types of Disasters in India

Disaster Type	**Description**	**Examples**
Natural Disasters		
Floods	The most common natural disaster is causing widespread displacement and damage.	2008 Bihar floods, 2019 Kerala floods
Cyclones	Coastal regions, particularly in the eastern states, are highly vulnerable.	Cyclone Phailin (2013). Cyclone Fani (2019)
Earthquakes	High-intensity earthquakes occur in seismic zones IV and V, particularly affecting regions like Gujarat and Kashmir.	2001 Gujarat earthquake, Kashmir earthquake (2005)
Droughts	Arid and semi-arid regions frequently experience recurring droughts, which have a significant impact on agriculture and livelihoods.	Drought in Rajasthan (2016), Marathwada drought (2015)
Landslides	Mountainous regions, particularly in the Himalayas and Western Ghats, are prone to landslides.	Landslides in Kerala (2018), Uttarakhand (2013)
Man-Made Disasters		
Industrial Accidents	Industrial accidents, particularly in the chemical industry, can cause substantial damage.	Bhopal Gas Tragedy (1984)
Terrorist Attacks	Terrorist attacks in urban areas have caused extensive loss of life and infrastructure damage.	2008 Mumbai attacks
Environmental Degradation	Unregulated urbanisation, deforestation, and inadequate waste management exacerbate vulnerability to disasters.	Urban floods in Delhi (2019), Heatwaves in major cities

4.1 Impact on Infrastructure and Socio-Economics

The impact of disasters on India's infrastructure and socio-economic structure is profound. Disasters not only cause immediate damage to physical infrastructure such as roads, bridges, buildings, and communication networks but also have long-term economic effects. The destruction of vital infrastructure hampers recovery and delays economic revitalisation. In the aftermath of Cyclone Fani in 2019, Odisha suffered severe damage to its electricity lines, roads, and houses, affecting millions of people and hindering the recovery process (Kawyitri & Shekhar, 2021). Similarly, earthquakes and floods lead to the displacement of large populations, which in turn affects their livelihoods and access to essential services. India's socio-economic fabric is vulnerable to disasters due to the high proportion of the impoverished population. People with low incomes, who often live in hazard-prone areas such as floodplains or near industrial sites, bear the brunt of disaster impacts. A study by the National Disaster Management Authority (NDMA, 2016) highlighted that disasters disproportionately affect marginalised communities, further exacerbating socio-economic disparities. The economic cost of disasters in India is significant. Between 2000 and 2020, India faced 360 natural disasters that affected over 1.1 billion people (NDMA, 2016). In addition to the immediate loss of life and property, disasters result in long-term economic setbacks, particularly in agriculture, tourism, and industry sectors. The 2001 Gujarat earthquake, for instance, led to an estimated $5 billion in damages (Lecy, 2007). Similarly, the 2018 floods in Assam displaced over 2.3 million people and caused substantial damage to the region's agriculture, the backbone of its economy. The table below highlights the deadliest disasters in India between 2000 and 2024, illustrating their widespread impact on affected populations and areas.

Table 2 Deadliest Disasters in India (2000 – 2024)

Sl. No.	Event	Year	State	Affected
1	Gujarat Earthquake	2001	Gujarat	6.3 million
2	Tsunami	2004	Tamilnadu, Kerela, A.P.	2.79 million
3	Maharashtra Floods	2005	Maharashtra State	167
4	Kashmir Earthquake	2005	Kashmir State	156622
5	Kosi Flood	2008	North Bihar	33,29,423
6	Cyclone Nisha	2008	Tamil Nadu	
7	Flood	2008	Assam, Orissa and Other States	79,00,000
8	Flood	2009	Assam, Bihar, Gujarat, and other States	18,86,000
9	Flood	2009	Maharashtra	41,00,000
10	Flood	2010	Bihar, Uttar Pradesh	32,67,183
11	Flood	2011	Orissa	34,43,989
12	Flood	2011	Uttar Pradesh	55,49,080
13	Flood	2013	Bihar, Gujarat & Other States	5,04,473
14	Flood	2015	Madhya Pradesh, Manipur & Other States	1,37,09,887
16	Flood	2016	Bihar, Uttar Pradesh	16,00,000
17	Flood	2017	Uttar Pradesh, West Bengal & Other States	172,00,000
18	Flood	2018	Assam & Other States	232,20,000
19	Flood	2019	Himachal Pradesh & Other States	30,00,000
20	Cyclone 'Fani'	2019	Odisha province	20000000
21	Cyclone 'Bulbul'	2019	WB, Odisha	130000
22	Cyclone 'Amphan'	2020	Odisha, WB	18000000
23	Cyclone 'Nisarga'	2020	Maharastra	7500
24	Flood	2020	Arunachal Pradesh & Other States	13,00,000
25	Glacial Lake Outburst	2021	Uttarakhand	24
26	Tropical cyclone 'Tauktae'	2021	Kerala, Karnataka, Goa, Maharashtra, Gujarat, Rajasthan	700153
27	Cyclone 'Yaas'	2021	Bengale Occidental, Odisha	1625000
28	Cyclone 'Shaheen'	2021	Koraput and Malkangiri (Odisha); Andhra Pradesh	179000

29	Tropical storm 'Jawad'	2021	Andhra Pradesh, Odisha, south-western West Bengal, Tripura	2050
30	Cyclone 'Biparjoy'	2023	Rajasthan, Gujarat	10000
31	Tropical storm 'Michaung'	2023	Andra Pradesh, Telangana, Tamil Nadu States	4390000
32	Cyclone 'Remal'	2024	Aizawl (Mizoram state); Bengal, Assam, Nagaland, Meghalaya states; West Bengal, Telangana	2109143
33	Flash flood	2024	Tripura state	34000

Source: EM_DAT Natural Disasters India, 2024

Table 2 presents a chronological overview of the deadliest disasters in India between 2000 and 2024, highlighting significant events such as earthquakes, tsunamis, floods, and cyclones. The 2001 Gujarat Earthquake affected 6.3 million people, while the 2004 Tsunami impacted 2.79 million across Tamil Nadu, Kerala, and Andhra Pradesh. Floods and cyclones dominated the later years, with Cyclone 'Fani' in 2019 affecting 20 million people in Odisha. The table highlights the recurring devastation caused by natural disasters across various Indian states, reflecting the widespread vulnerability and the immense scale of affected populations over time. These events underscore the need for improved disaster management, resilient infrastructure, and tailored legal frameworks to address regional vulnerabilities.

5. Historical Development of Disaster Management Laws in India

5.1 Colonial Era: Pre-Independence Disaster Management Policies and Legislation

Disaster management as a formal field was essentially non-existent during India's colonial era. The approach to disaster management during this period was rudimentary, mainly focused on emergency relief and response rather than long-term preparedness or risk reduction. The British colonial administration's disaster management policies were shaped by the need to protect economic interests and maintain order rather than fostering a comprehensive disaster risk reduction strategy. Several legislative measures were enacted during this time, with a particular emphasis on addressing specific types of disasters, most notably famines, which were recurrent and devastating. One of the earliest pieces of disaster legislation was the Famine Code of 1883, which followed the recommendations of the Famine Commission in 1880. This framework provided guidelines for declaring famine and distributing relief (Sen, 1982). However, it was limited to managing food shortages during famines and did not address broader disaster risks such as floods, cyclones, or earthquakes. Similarly, the Epidemic Diseases Act of 1897 was enacted to control the spread of bubonic plague in Bombay. This law granted the government extraordinary powers to prevent epidemics, including the authority to implement quarantine measures and inspect passengers (Chakrabarti, 2019). However, it limited its scope to outbreaks and did not comprehensively address other types of disasters. These early colonial laws focused mainly on reactive measures rather than proactive disaster risk reduction or mitigation.

5.2 Limitations of Colonial Approaches

The colonial era's disaster management approach was criticised for being primarily ad hoc and lacking a comprehensive, proactive framework. The disaster response primarily focused on immediate relief and recovery rather than long-term preparedness, mitigation, or resilience. Furthermore, the top-down approach often excluded local communities from the planning and decision-making processes, limiting the effectiveness of disaster response (Rajabi et al., 2021). Colonial disaster management primarily focused on protecting economic interests, such as safeguarding infrastructure and trade routes, rather than addressing the broader social and environmental impacts of disasters. The absence of community engagement and a comprehensive disaster management framework left the Indian population vulnerable to recurring calamities.

5.3 Post-Independence: Disaster Management Developments

Post-independence, India faced numerous challenges in developing a robust disaster management framework. The partition of India in 1947 resulted in massive population displacements, creating immediate humanitarian crises that required urgent attention and relief efforts. This period emphasised the necessity for an organised approach to disaster management. The 1980s marked a significant transition, underscoring the importance of adopting a more proactive approach to disaster management. The Bhopal Gas Tragedy of 1984, one of the worst industrial disasters in history, underscored the inadequacies of the existing framework and the urgent need for comprehensive legislation (Dhara, 2023); this led to the enactment of the Environment (Protection) Act of 1986, which established a structure for protecting and improving the environment and indirectly contributed to disaster management by addressing industrial and environmental hazards (Dhara & Dhara, 2002). The Orissa Super Cyclone of 1999 and the Bhuj Earthquake of 2001 were pivotal events that further catalysed legislative reforms (Lakhani, 2021). These disasters exposed significant gaps in the disaster response mechanism, prompting the government to rethink its strategy. The government enacted the Disaster Management Act in 2005, marking a watershed moment in India's history of disaster management. The Act established the National Disaster Management Authority (NDMA) and State Disaster Management Authorities (SDMAs), creating a structured and standardised framework for disaster management in the country (NDMA, 2009).

5.4 Constitutional provisions (Articles 48A, 51A(g), 21, 14)

Post-independence, the Indian Constitution laid the foundation for environmental and disaster management. Article 48A obligates the state to safeguard and enhance the environment, while Article 51A(g) assigns a corresponding duty to citizens. Furthermore, Articles 21 and 14, which ensure the right to life and equality before the law, have been interpreted by the judiciary to include the right to a healthy environment and equitable disaster relief (Atapattu, 2002).

5.5 Environmental Protection Act (1986) and related notifications

The Bhopal Gas Tragedy of 1984 was a pivotal moment that catalysed significant legislative reforms, leading to the enactment of the Environmental Protection Act in 1986 (Dias, 1994). This comprehensive legislation provided a framework for environmental protection and regulation of activities that could lead to environmental disasters. It empowered the central government to take measures for controlling pollution and managing hazardous substances, thereby mitigating potential disasters (Fortun, 2009). Related notifications under this Act include the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989, which specify requirements for the safe management of hazardous chemicals, and the Bio-Medical Waste (Management and Handling) Rules, 1998, which aim to prevent health hazards by properly disposing of and managing biomedical waste (Singh & Singh, 2018).

5.6 Other Relevant Legislation

Several other legislations complement the disaster management framework in India. The Factories Act of 1948 includes provisions for the safety of workers in industrial establishments (Kumari & Dadwal, 2022). The evolution of disaster management laws in India from pre-independence famine codes to post-independence comprehensive legal frameworks reflects the country's growing recognition of the need for robust and proactive disaster management strategies. These laws collectively aim to mitigate risks, protect lives, and ensure swift and effective disaster response. India has marked the evolution of disaster management by introducing various legislations and policies to reduce risks and manage emergencies effectively. Table 3 presents a timeline of crucial legislation,

highlighting the progression from early reactive measures to more comprehensive and preventive strategies in disaster management.

Table 3. Timeline of Disaster Management Legislation in India

Year	Legislation/Policy	Key features
1860	Indian Penal Code	Sections related to negligence causing harm or death (e.g., Section 304A)
1880	Famine Relief Code	Early legislation established guidelines for systematic famine relief, including identifying famine conditions, distributing relief, and managing resources.
1897	Epidemic Diseases Act	Legal framework for controlling epidemic outbreaks.
1884	Indian Explosives Act	Regulated the safety and management of explosives to prevent accidents and disasters.
1908	Indian Ports Act	Managed safety and operations of ports to prevent and handle port-related disasters.
1948	Factories Act	Included provisions for worker safety in industrial establishments to prevent industrial accidents and disasters.
1958	Civil Defence Act	Preparedness for emergencies
1986	Environmental Protection Act	A comprehensive framework for environmental protection and regulating hazardous substances to prevent environmental disasters.
1989	Manufacture, Storage and Import of Hazardous Chemical Rules	Specified requirements for safe management of hazardous chemicals to prevent chemical-related disasters.
1998	Bio-Medical Waste (Management and Handling) Rules	Guidelines for proper disposal and management of biomedical waste to prevent health hazards and environmental contamination.
2001	HPC (High Powered Committee) Report on Disaster Management	Recommendations for Comprehensive Disaster Management
2005	Disaster Management Act	Establishment of NDMA, legal framework
2016	(NDMP) National Disaster Management Plan	Alignment with Sendai Framework for Disaster Risk Reduction 2015-2030

5.7 Judicial Contributions to Disaster Management Laws

India's Supreme Court has played a crucial role in shaping disaster management laws, often interpreting constitutional provisions to incorporate environmental and community protection. In *M.C. Mehta v. Union of India* (1987), the Court expanded the right to life under Article 21 to include the right to a healthy environment, thus laying the groundwork for integrating disaster risk reduction (DRR) into legal frameworks. The *Narmada Bachao Andolan case* (2000) further emphasised the necessity of environmental impact assessments (EIAs) and the protection of displaced communities, which are essential to disaster management. The Court reinforced the state's responsibility for prevention, compensation, and response to industrial and environmental disasters. More recently, in *M.K. Ranjitsinh & Ors. v. Union of India & Ors.* (2024), the Court highlighted the need to integrate disaster risk reduction with environmental protection, stressing the importance of sustainable development practices in disaster-prone areas.

5.8 The Disaster Management Act, 2005: A Paradigm Shift

The Gujarat Bhuj earthquake in 2001 and the Indian Ocean tsunami in 2004 catalysed a paradigm shift in disaster management in India. The enactment of the Disaster Management Act in 2005 marked a significant milestone, establishing a legal framework for a comprehensive, prevention- and mitigation-based approach to disaster management (Disaster Management Act, 2005). The Disaster Management Act, 2005, enacted on December 23, 2005, marks a significant shift in India's approach to disaster management, driven by the need for a comprehensive legal framework to address the growing frequency and severity of disasters. The devastating Indian Ocean tsunami of 2004 highlighted the inadequacies of existing disaster response mechanisms and served as a significant catalyst for the introduction of the Act (Ayele, 2014). The legislation aims to institutionalise disaster

management by establishing a structured, systematic, and proactive framework that includes the creation of the National Disaster Management Authority (NDMA) and State Disaster Management Authorities (SDMAs) (NDMA, 2009). These bodies are responsible for developing policies, plans, and guidelines to ensure a coordinated and effective response to disasters at all administrative levels. The Act emphasises the importance of preparedness and mitigation strategies, moving away from the traditional reactive approach. It mandates the creation of a National Disaster Response Force (NDRF) for specialised disaster response, reflecting a shift toward a more organised and professional emergency response mechanism (Kapur, 2010). Furthermore, it promotes community-based disaster management, recognising the critical role of local communities in disaster preparedness and response (Pandey & Okazaki, 2005). The legislation also includes provisions for financial mechanisms such as the National Disaster Response Fund (NDRF) and the National Disaster Mitigation Fund (NDMF) to ensure adequate financial resources are available for disaster response and mitigation activities. Overall, the Disaster Management Act 2005 significantly advances India's disaster management capabilities. It aligns with global best practices and emphasises a holistic approach that includes risk reduction, preparedness, and community involvement (Thomalla & Larsen, 2010).

5.9 Recommendations from the High-Powered Committee (HPC)

In the wake of major disasters, such as the Latur earthquake (1993) and the Orissa super cyclone (1999), the Indian government recognised the need for a comprehensive overhaul of the disaster management framework. The High-Powered Committee (HPC) on Disaster Management, chaired by Mr. J.C. Pant, was constituted in 1999. The HPC report, submitted in 2001, provided fundamental and practical recommendations, including the draft of the Disaster Management Act, a national response plan, and strategies for transitioning from disaster response to disaster preparedness (Pant, 1999). The committee has classified disasters into five categories, as shown in **Figure 1.** Each category encompasses specific types of disasters, highlighting the diversity of hazards that can occur.

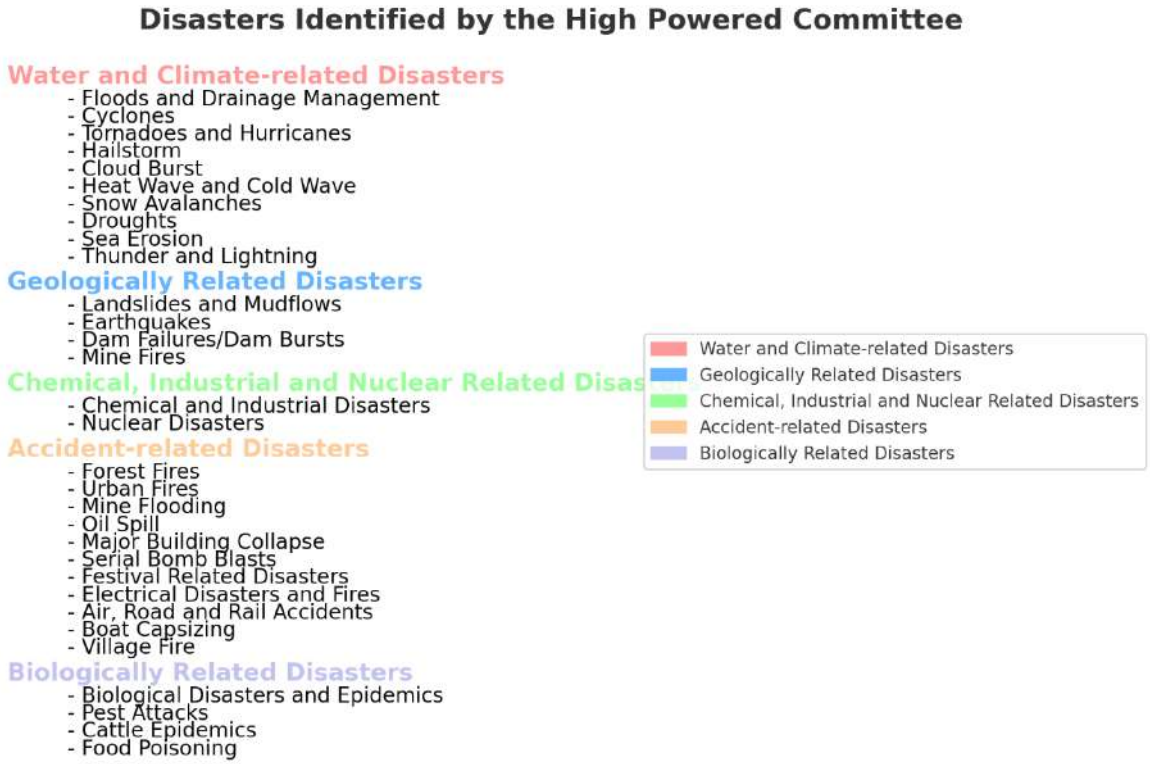

Figure 1. Disasters identified by the High-Powered Committee

(HIGH POWERED COMMITTEE ON DISASTER MANAGEMENT, HPC Report, Source: https://www.preventionweb.net/files/1633_ch3.pdf)

5.9 Influence of international frameworks (Yokohama Strategy, Hyogo Framework for Action)

India's participation in international initiatives, such as the Yokohama Strategy and Plan of Action for a Safer World (1994) and the Hyogo Framework for Action (2005-2015), further reinforced the need for a paradigm shift in disaster management. These global frameworks emphasised the importance of prevention, preparedness, and mitigation, influencing the country's approach to disaster risk reduction (Bhardwaj, Acharya, & Gupta, 2024).

6. Current Disaster Management Legal Framework

The Disaster Management Act 2005 (DMA, 2005) remains the cornerstone of India's disaster response framework, providing a structured legal approach to disaster management. This Act encompasses prevention, mitigation, preparedness, response, and recovery, outlining the roles and responsibilities of various stakeholders, including central and state governments, local authorities, and other relevant agencies. However, recent updates to the Disaster Management (Amendment) Bill 2024 aim to address emerging challenges in disaster risk reduction, enhance institutional coordination, and improve financial accountability (Government of India, 2024).

6.1 Establishment of national, state, and district authorities

The Disaster Management Act of 2005 created a hierarchical institutional framework for disaster management at the national, state, and district tiers. The Act required the establishment of the National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs), and District Disaster Management Authorities (DDMAs) to supervise and coordinate disaster management initiatives (Disaster Management Act, 2005, § 3).

6.2 Institutional mechanisms for policy, planning, and capacity building

The Act provided for the establishment of institutional mechanisms for policy formulation, planning, and capacity building in disaster management; this includes the National Institute of Disaster Management (NIDM) and its state-level counterparts, responsible for training, research, and advocacy in the field of disaster risk reduction (Disaster Management Act, 2005, § 42).

6.3 National Disaster Management Authority (NDMA) and its roles

The National Disaster Management Authority (NDMA), headed by the Prime Minister of India, serves as the nation's supreme disaster management entity. Its key responsibilities include formulating policies, approving national and ministerial plans, providing guidelines for state authorities, coordinating implementation, recommending funding for mitigation measures, and overseeing international cooperation in disaster management (Disaster Management Act, 2005, § 6-8).

6.4 State Disaster Management Authorities (SDMAs)

At the state level, State Disaster Management Authorities (SDMAs), headed by the respective Chief Ministers, are responsible for laying down policies and plans for disaster management within their jurisdictions. SDMAs are crucial in coordinating with district authorities and ensuring the implementation of national and state-level policies and plans (Disaster Management Act, 2005, § 14-16).

6.5 District Disaster Management Authorities (DDMAs)

District Disaster Management Authorities (DDMAs) function as the planning, coordinating, and executing entities for disaster management at the district level. Headed by the District Magistrate or Collector, DDMAs prepare district disaster management plans, conduct mock drills, and carry out prevention, preparedness, and mitigation activities within their respective districts (Disaster Management Act, 2005, § 25-30).

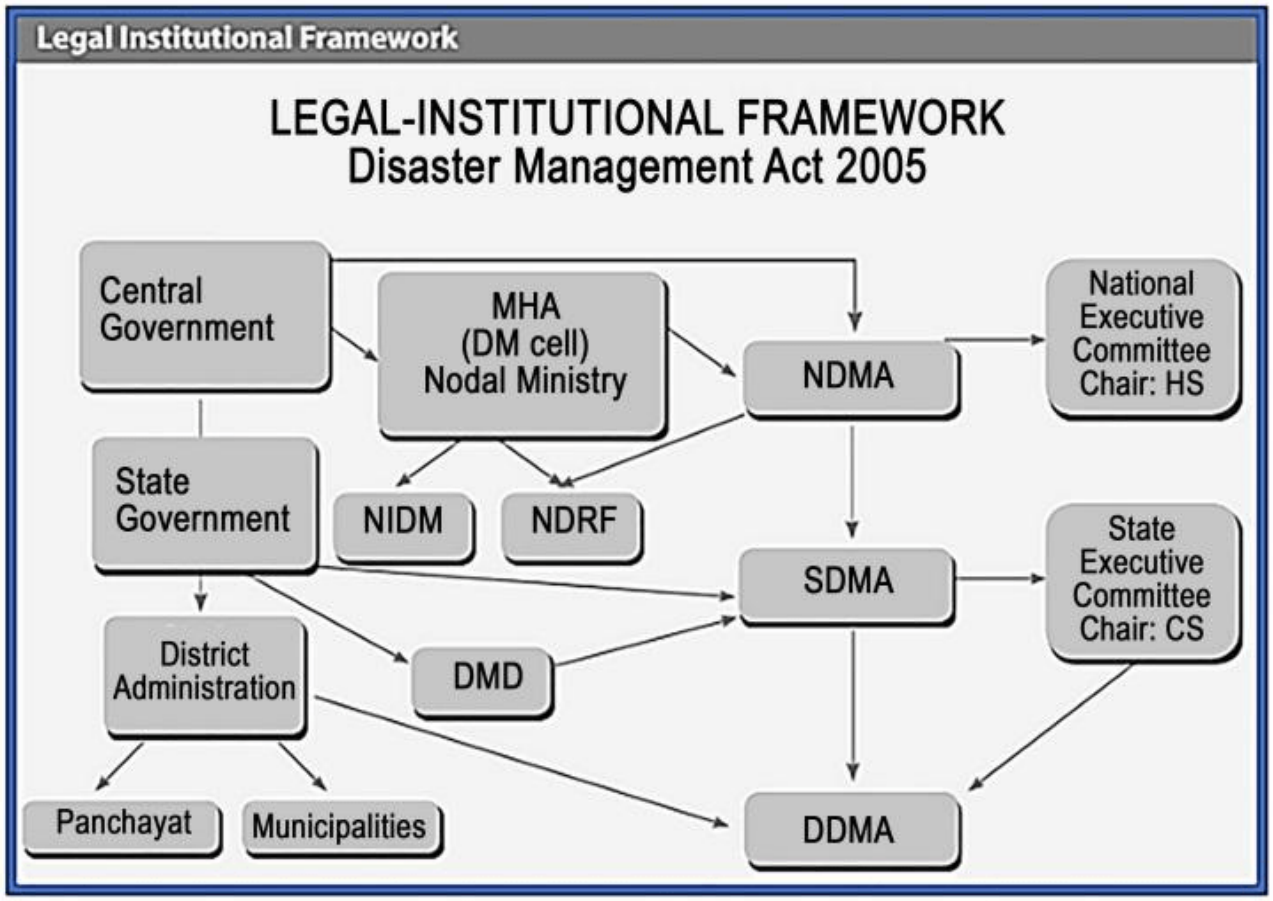

Figure 2. Legal-Institutional Framework of the Disaster Management Act (2005) in India

(Image source: https://compass.rauias.com/disaster-management/act-2005-2nd-arc-recommendations/)

6.6 Key Amendments to the Disaster Management Act, 2005

The Amendment Bill 2024 introduces significant revisions to the Disaster Management Act (DMA) of 2005, aiming to expand the scope of disaster governance and enhance India's disaster risk reduction (DRR) capabilities. These amendments aim to enhance the comprehensiveness, proactivity, and resilience of the disaster management framework. By revising key definitions and introducing new provisions, the amendment addresses the evolving challenges posed by natural and artificial disasters. These updates enhance disaster preparedness, response, and long-term recovery mechanisms, enabling India to better manage the increasing frequency and complexity of future disasters. One of the key features of the 2024 Amendment is the revision of critical definitions related to disaster management.

- **Disaster Risk Reduction (DRR):** The original Act defined DRR as relief and response. However, the amendment broadens this definition to include vulnerability analysis, mitigation strategies, and resilience-building measures. This shift emphasises a more proactive approach, focusing on reducing the underlying risks before disasters occur rather than solely on post-disaster response (GoI, 2024).

- **Man-Made Disasters**: The earlier definition of artificial disasters encompassed a wide range of events, from industrial accidents to terrorism. The amendment narrows this scope to exclude law and order issues, focusing specifically on industrial hazards, pandemics, and environmental crises. This refinement addresses modern challenges, including climate change, industrial safety, and health-related emergencies like pandemics (GoI, 2024).
- **Recovery & Rehabilitation:** Recovery and rehabilitation traditionally focused on immediate post-disaster relief efforts. The amendment expands this definition to include the socio-economic reintegration of affected communities. The updated approach recognises that recovery extends beyond restoring infrastructure and aims to rebuild livelihoods and ensure long-term community resilience.

6.7 National Disaster Database (NDD)

Another significant amendment introduced by the 2024 Bill is the creation of a National Disaster Database (NDD), which will play a pivotal role in improving data-driven disaster governance. The NDD streamlines disaster management by providing a centralised platform for risk mapping, financial tracking, and damage assessment. This shift towards evidence-based disaster management leverages data and technology to optimise resource allocation and recovery efforts.

Features of the National Disaster Database:

- **Risk Mapping:** The NDD will utilise AI-driven tools to identify disaster-prone regions, enabling more accurate and real-time risk assessments. Predictive analytics will enhance preparedness by providing early warning systems and helping authorities allocate resources efficiently in high-risk areas.
- **Financial Tracking:** A crucial function of the NDD will be to monitor disbursements from the State Disaster Response Fund (SDRF) and the National Disaster Response Fund (NDRF). The National Disaster Database (NDD) will ensure transparency and accountability in the allocation and utilisation of funds, thereby preventing misuse and delays in financial assistance.
- **Damage Assessment**: The NDD will also standardise the methodology for assessing damages following a disaster. This uniformity will help streamline recovery processes and enable more efficient coordination between the central and state governments during post-disaster relief and rebuilding.

6.8 Introduction of Urban Disaster Management Authorities (UDMAs)

A crucial institutional change introduced by the 2024 Amendment is the establishment of Urban Disaster Management Authorities (UDMAs). These authorities aim to address the challenges faced by rapidly urbanising areas, where disaster risks, particularly those related to infrastructure, industrial hazards, and environmental crises, are becoming increasingly prominent. The 2024 Bill mandates the creation of UDMAs in each state capital and large municipal corporations. These authorities will formulate city-specific disaster preparedness plans, focusing on urban risks such as floods, industrial hazards, and infrastructure resilience. UDMAs will be empowered to ensure that urban areas have robust disaster response systems and resilience measures tailored to the unique challenges of urbanisation (Government of India, 2024). The introduction of UDMAs marks a significant step in recognising the need for localised disaster management strategies in urban areas. These areas face unique vulnerabilities due to their high population densities and complex infrastructure systems.

6.9 Challenges and Gaps in Implementation

Despite the robust legal and institutional framework established by the Disaster Management Act, 2005 (DMA), several challenges and gaps persist in implementing disaster management strategies across India. These challenges undermine the effectiveness of disaster preparedness, response, and recovery efforts.

- **Implementation Gaps:** Despite the robust legal frameworks, significant implementation gaps persist, resulting in discrepancies between law and practice. One major issue is the uneven implementation of disaster management plans across states and districts, often due to varying administrative capacity and commitment levels. For example, while states like Odisha and Kerala have demonstrated effective implementation, others, such as Bihar and Assam, lag, reflecting inconsistencies in applying the Act's provisions. These gaps undermine the effectiveness of disaster management efforts, leading to suboptimal responses during disasters.
- **Overlap of authority and responsibilities:** A significant challenge is the overlap of authority and responsibilities among the diverse organisations and individuals involved in disaster management, which can lead to confusion, duplication of efforts, and inefficient resource utilisation, hindering effective coordination and response (Raju & Becker, 2013).
- **Issues with staffing and resource allocation:** Many agencies involved in disaster management face staffing and resource constraints, which can undermine their ability to carry out their mandated functions effectively. Some agencies may have an unsustainable workforce, while others may lack sufficient personnel and resources commensurate with their responsibilities (Sharma, 2003).
- **Lack of clarity on financial mechanisms:** Although the State Disaster Response Fund (SDRF) and the National Disaster Response Fund (NDRF) provide financial support, there is uncertainty regarding the Disaster Mitigation Fund and the impact of State Action Plans on Climate Change on reducing disaster risks (Revi, 2012).
- **Need for greater decentralisation and community involvement: Although the Disaster Management Act 2005 emphasises decentralisation and community involvement, further empowerment and capacity building are necessary at the local level**. Effective disaster risk reduction requires a bottom-up approach, with active participation and self-reliance of communities and regional institutions (Bhatt & Reynolds, 2012).

6.10 Case Study: COVID-19 Pandemic Response

The COVID-19 pandemic presented unprecedented challenges to India's disaster management legal frameworks (Jaiswal, Jha, & Patil, 2021). The government invoked the Disaster Management Act 2005 to facilitate a coordinated national response. Measures included lockdowns, resource allocation through the National Disaster Response Fund (NDRF), and the establishment of specialised task forces to manage the crisis (Nomani & Parveen, 2021). While the legal provisions enabled a swift policy response and resource mobilisation, several challenges emerged:

- **Coordination Issues:** The scale of the pandemic strained the existing multi-tiered institutional structures, leading to coordination bottlenecks between national and state authorities.
- **Resource Allocation Delays:** Despite the availability of funds, delays in fund disbursement and distribution hindered timely responses to the pandemic's evolving needs.
- **Public Compliance and Awareness:** Ensuring public compliance with health guidelines highlighted community engagement and awareness gaps, underscoring the need for more effective communication strategies to address these gaps.

Overall, the pandemic highlighted the strengths of the Disaster Management Act in facilitating a rapid response but also revealed critical areas for improvement in coordination and public engagement.

7. Future Perspectives and Recommendations

The evolution of disaster management laws in India has progressed significantly from colonial-era reactive measures to a more proactive, resilience-focused approach. This transformation reflects a broader shift towards improving disaster risk reduction (DRR) and aligning with international frameworks such as the Sendai Framework for Disaster Risk Reduction. As disaster risks evolve—shaped by technological advancements, climate change, and new types of hazards—there is an urgent need for ongoing legal and strategic reforms. These reforms should enhance resilience, improve the overall disaster management framework, and address emerging challenges. The continued development of India's disaster management system requires an emphasis on awareness-building, strengthening community and institutional capacity, and reforming laws to address contemporary challenges in disaster risk management (M.S. Hanspal & B. Behera, 2024).

7.1 Recommendations:

The recommended action points aim to address the challenges and enhance the efficacy of India's disaster management legal frameworks.

Legal Reforms:

- **Amend Existing Laws:** The Disaster Management Act of 2005 must be updated to incorporate precise definitions, clear delineations of roles and responsibilities, and provisions to address emerging threats, such as cyber disasters. A more comprehensive approach to non-traditional risks will ensure India's disaster management laws remain dynamic and responsive.
- **Enact New Legislation:** Introduce Specialised Legislation. It is crucial to enact specialised laws, such as a Cyber Disaster Management Act and a Pandemic Preparedness Act. These new laws would specifically address cyber and health-related disasters, which are increasingly prevalent in today's interconnected world.

Strengthening Institutional Capacities:

- **Capacity-Building Programs:** Develop and implement robust training modules for disaster management professionals and first responders. Comprehensive capacity-building initiatives will help enhance officials' preparedness and effectiveness in responding to disasters.
- **Improved Resource Allocation:** Increase and sustain budget allocations for disaster management. This approach would ensure that the necessary infrastructure, modern equipment, and technology are in place to tackle conventional and emerging disaster risks.

Policy Mainstreaming

- **Integrate DRR into Development Planning:** Integrating Disaster Risk Reduction (DRR) into all significant development projects is essential. By mainstreaming Disaster Risk Reduction (DRR) into infrastructure development, urban planning, and industrial growth, planners can mitigate disaster risks in the early stages rather than responding after an incident occurs.
- **Community-Based Approaches:** Empower local communities to participate actively in disaster preparedness and response. Community engagement is essential for building resilience and ensuring the sustainability of disaster management efforts.

Technological Advancements:

- **Enhance Early Warning Systems:** Investment in advanced meteorological and seismic technologies is critical. Improving forecasting accuracy and timeliness through AI-powered systems will help provide early warnings, reducing the impact of disasters on vulnerable populations.
- **Develop Centralized Information Systems:** Establish interoperable data management platforms that enable real-time data collection and analysis. The centralised data management platform enables agency coordination and enhances disaster response times.

- **Leverage Artificial Intelligence:** AI can enhance disaster management by enabling predictive analytics, optimising resource allocation, and automating response systems. AI tools can assist in modelling disaster risks, mapping vulnerabilities, and informing decisions on resource distribution.
    - **Strengthening AI capabilities:** Incorporate AI for vulnerability mapping, risk assessments, and enhanced disaster planning.
    - **AI in disaster response and relief efforts:** AI can enhance situational awareness, optimise resource allocation, and facilitate coordination among emergency responders.
    - **Ethical, legal, and governance issues with AI:** Implement ethical guidelines and governance frameworks to address challenges such as data privacy, algorithmic bias, transparency, and accountability in AI systems used for disaster management.

International Collaboration:

- **Forge Global Partnerships:** India should actively collaborate internationally, sharing knowledge and resources with other countries that are also prone to disasters. Bilateral and multilateral agreements can facilitate the exchange of best practices and technology.
- **Adhere to International Standards:** Align national disaster management strategies with international frameworks, such as the Sendai Framework for Disaster Risk Reduction and ISO standards, to help India refine its approach and ensure adherence to global best practices.

Enhancing Local Governance and Community Participation:

- **Decentralisation and Empowerment: Future legal reforms should empower local bodies by providing clear guidelines and resources for developing disaster management plans tailored to local vulnerabilities and needs**. Localised disaster management strategies will ensure communities are better prepared and equipped to handle disasters effectively.

Sustainable Development Goals (SDGs):

- **Link Disaster Management Policies to the SDGs: Align disaster management strategies with the broader Sustainable Development Goals (SDGs)**, particularly those focused on climate action, sustainable cities, and resilient infrastructure. Incorporating disaster risk reduction into sustainable development policies ensures that disaster management contributes to long-term socio-economic and environmental goals.
- **Link Legal Frameworks to SDGs:** Update existing disaster management laws to explicitly connect disaster risk reduction to sustainable development objectives, reinforcing that disaster resilience is critical to sustainable development.

Regular Review and Adaptive Legislation:

- **Establish a Legislative Review Body:** Create a dedicated body to periodically review disaster management laws, ensuring they remain up-to-date with emerging risks, technological advancements, and global standards. Regular reviews would ensure India's legal framework remains adaptive and resilient to changing disaster dynamics.

Education and Training:

- **Strengthen Preparedness Through Education:** Incorporate disaster risk reduction education into schools, higher education, and professional training programs to strengthen disaster preparedness at all societal levels. Building a culture of preparedness within society is key to effective disaster risk reduction.
- **Incorporate Legal Requirements:** Integrate disaster management education into academic curricula to cultivate a generation well-versed in disaster risk reduction strategies, laws, and community-based preparedness.

7.2 Future Research Directions

While this study provides a comprehensive analysis of India's disaster management legal frameworks, several areas warrant further research to ensure the continuous improvement and adaptation of the country's disaster management systems:

- **Impact Assessment of Legal Reforms:** Future research should assess the effectiveness of recent legal reforms, particularly those related to new disaster types such as cyber disasters or pandemics.
- **Technological Integration in Disaster Management:** Investigate the impact of AI, GIS, and IoT on disaster preparedness, response, and recovery. Assessing the integration of these technologies in India's disaster management system will help identify both benefits and challenges.
- **Community Resilience Metrics:** Develop metrics to measure community resilience and evaluate the effectiveness of community-based disaster risk reduction programs.
- **Inter-Agency Coordination Models:** Comparative studies on coordination mechanisms between various disaster management agencies can provide valuable insights into optimising collaboration for improved response outcomes.
- **Climate Change Adaptation:** Research on integrating climate change adaptation strategies within disaster management frameworks will help enhance resilience to future climate-induced disasters.

Addressing these research gaps will contribute to the evolution of India's disaster management framework, ensuring it remains responsive to current and emerging risks. By integrating innovative technologies, community engagement, and robust legal reforms, India can continue to develop a resilient disaster management system that effectively mitigates risks and protects its people from the devastating impacts of disasters.

8. Conclusion

This study examines the evolution of disaster management laws in India, tracing the historical development of legal frameworks from colonial times to the enactment of the Disaster Management Act (DMA) 2005. Over the years, India's approach to disaster management has transitioned from reactive relief-focused strategies to more proactive and comprehensive frameworks aimed at risk reduction, preparedness, and resilience. Despite the significant advancements, challenges such as overlapping authorities, resource constraints, and the need for greater community involvement persist. Key findings highlight the evolution of disaster management laws in India, the ongoing challenges in their implementation, and the need for legal reforms to address emerging threats, including cyber disasters, pandemics, and the impacts of climate change. While the Disaster Management Act of 2005 was a landmark reform that established a structured framework for disaster management, the country's disaster resilience still requires continued adaptation to new challenges posed by rapidly changing socio-economic conditions, technological advancements, and environmental shifts. The study underscores the importance of technological integration, particularly the role of Artificial Intelligence (AI), Geographic Information Systems (GIS), and the Internet of Things (IoT), in enhancing early warning systems, resource management, and data-driven decision-making.

Additionally, integrating AI into disaster management systems can revolutionise risk modelling, vulnerability mapping, and real-time disaster response, optimising resource allocation and improving situational awareness during emergencies. However, robust ethical frameworks and governance mechanisms must accompany these technological advancements to ensure fairness, accountability, and transparency in their application. Future research should examine the impact of AI in disaster management, focusing on the socio-economic effects, the role of community resilience in disaster risk reduction, and how to further integrate climate change adaptation into disaster management policies. Additionally, researchers need to explore the effectiveness of the legal reforms introduced by the DMA 2005 and its amendments, as well as their alignment with international frameworks, such as the Sendai Framework and the Sustainable Development Goals (SDGs). Strengthening capacity building, improving resource allocation, and fostering inter-agency coordination are crucial to enhancing India's disaster management capabilities and ensuring its ability to respond effec-

tively to future challenges. In conclusion, a robust, adaptive, and forward-looking legal framework for disaster management is crucial for mitigating risks, protecting lives, and promoting sustainable growth. Integrating advanced technologies and aligning national policies with global standards will play a critical role in building a disaster-resilient India that can effectively face the emerging challenges of climate change, technological disruptions, and evolving disaster risks.

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