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I have completed my Bachelors in Geography from Loreto College, Kolkata. then perused my master from TISS Mumbai in disaster management. I have worked with the communities at the grassroot level at central tribal belt of India focusing on field work. I had the opportunity to work at with National Institute of Disaster Management (MHA) New Delhi and after 5 years of professional experience I have perused my career to join as PhD Scholar at Centre for Disaster Management and Research (IIT Guwahati)

Design for Sustainability in Disaster Risk Management

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2.1. How is the community-based Disaster Risk Management approach a sustainable way of dealing with hazards?

Incorporating Community-Based Disaster Risk Management (CBDRM) principles into settlement planning is crucial for enhancing community resilience and readiness for disasters. Why do we think of only making the community resilient but not sustainable? Is it enough to have a community that can withstand disaster or reduce the risk of it or can we think beyond that as well? The community must become resilient but the focus should also be on the overall well-being of society so that they can flourish and sustain long-term resilience. Sustainable settlement design is a bigger picture or goal and incorporating the CBDRM principle not only helps the community to be better prepared but can see through long-term resilience. Often during a disaster, the communities are the ones devastated and facing maximum loss.

This integration ensures that settlements are better equipped to withstand and recover from various calamities. By adopting CBDRM

principles, settlements can enhance their resilience through active community engagement, implementation of risk reduction measures, promotion of social cohesion, and adoption of flexible planning strategies. This approach allows settlements to adapt to changing risks and emerge stronger in the face of disasters. Overall, integrating CBDRM principles into settlement design enables communities to better prepare for, respond to, and recover from disasters by utilizing local knowledge, implementing proactive measures, and fostering community cohesion.

This approach allows settlements to adapt to changing risks and emerge stronger in the face of disasters. Overall, integrating CBDRM principles into settlement design enables communities to better prepare for, respond to, and recover from disasters by utilizing local knowledge, implementing proactive measures, and fostering community cohesion (Nguyễn et al., 2023). The CBDRM approach presents a sustainable means of addressing disasters by emphasizing local engagement and empowerment. (Dube, 2015). Unlike hierarchical methods, CBDRM acknowledges the significance of utilizing the knowledge, assets, and bottom-up approach to decision-making. Why do we look at communities to be victims when they can be the first responders? By involving community members in all stages of disaster risk management, including readiness, reaction, and recuperation, CBDRM cultivates a sense of ownership and accountability among residents. Moreover, the people residing in the area will know about the critical condition of the place which they face in everyday life. This participatory strategy not only enhances the efficacy of disaster management endeavours but also encourages long-lasting sustainability by fostering resilience from grassroots levels (Van Niekerk et al., 2018). Additionally, CBDRM promotes the

establishment of robust social networks within communities, which play a crucial role in coordinating responses and offering mutual aid during emergencies. The residents will also know about the shortcut roads, road map, and whereabouts of the area which can be very helpful during an emergency. Overall, CBDRM emerges as a sustainable approach to mitigating disaster risks by harnessing local strengths, nurturing community cohesion, and advocating self-reliance in challenging circumstances. In Thailand, there is a rampant growth of Community-based disaster management organizations tackling urban floods in the vulnerable community.

Fig. 10 Disaster Management Cycle consist of four phase (i)Mitigation phase (ii)Preparedness (iii)Relief (iv) Response, which is divided into Pre-Disaster management phase and Post Disaster Management Phase.

Here are some examples illustrating how CBDRM is practiced:

- 1. In South East Europe, it focuses on safeguarding critical medical infrastructure.*
- 2. In New Zealand indigenous knowledge/practices for community-owned DRM strategies are practiced.*
- 3. Nepal's CBDRM includes awareness raising, climate data use, and specialized training.*
- 4. Georgia employs participatory methods for assessing vulnerabilities and responding to debris flow hazards.*
- 5. The Philippines utilizes CBDRM as a community organizing tool to mitigate flood and landslide damages.*
- 6. In South Africa's informal urban areas, CBDRM follows a collaborative risk governance model.*

- 7. Community participation was pivotal in the reconstruction efforts following the Gujarat earthquake of 2001 (Samaddar, 2016)**
- 8. In Orissa, community-based early warning systems were established, proving effective during subsequent cyclones (Parida et al., 2021)**
- 9. Local communities (fisherperson and boatperson) played a vital role in rescue and relief operations during the Kerala floods of 2018 (Joseph et al., 2020)**

These examples demonstrate diverse ways in which CBDRM is practiced at different geographical location. CBDRM takes on various forms worldwide, adapting to the specific circumstances and needs of different area. Therefore integrating Sustainable Settlement Design with focus on reducing the risk of disaster through community interventions.

2.1.1. Conceptually Similar Terminologies

There are other terms may resemble CBDRM in ideology and are sometimes interchangeable, but they possess unique characteristics. These concepts all aim to engage local communities in disaster risk management, but they vary in their emphasis, scope, and the nature of their activities.

- 1. Community-Based Disaster Risk Reduction (CBDRR):**
Aims to reduce the impact of disasters on communities' lives and livelihoods.

- 2. Community-Based Disaster Preparedness (CBDP):** Primarily concerned with developing emergency plans, conducting drills, and providing training.
- 3. Community-Based Vulnerability Assessment (CBVA):** Focuses on assessing community vulnerabilities to hazards.
- 4. Community-Based Adaptation (CBA):** Empowers communities to take action using their own knowledge to increase resilience to climate change.
- 5. Community Resilience Framework:** Aims to enhance communities' ability to adapt to new situations and recover quickly from disasters.
- 6. Local Disaster Risk Reduction (LDRR):** Focuses on building resilience and capacity to recover from disasters with minimal external assistance

2.2. CBDRM - A Bottom-up Approach

A bottom-up approach is often seen as more sustainable due to several factors. This method prioritizes local ownership and empowerment, fostering community responsibility and long-term commitment. Especially in rural India institutions at grassroots like panchayat, self-help groups, mahila mandal, and farmer producer organizations have played a very important role in decision-making and social reform. Customized solutions tailored to the specific needs and contexts of each community increase effectiveness and relevance. By utilizing local resources and knowledge, interventions become integrated into existing community systems, reducing dependence on external aid (Tanwattana, 2018). Additionally,

focusing on internal resilience building strengthens social networks, fosters cooperation, and enhances local capacities for future challenges. The inherent adaptability and flexibility of bottom-up approaches allow communities to continuously evaluate and adjust strategies in response to changing circumstances, further enhancing their sustainability and effectiveness in addressing complex issues (Osti & Miyake, 2011)

One of the key strengths of the bottom-up approach lies in its ability to tailor solutions to the specific circumstances of individual communities. By recognizing and leveraging local resources, knowledge, and cultural norms, interventions are not only more effective but also more relevant and sustainable in the long term. This integration of local assets not only reduces dependency on external aid but also fosters a sense of self-reliance and resilience within the community (James & Paul, n.d.). In Iran, school drills have been the most relevant method of awareness generation of earthquakes in the context of school safety resilient communities.

Moreover, the bottom-up approach facilitates the strengthening of social networks and the promotion of cooperation within communities. By focusing on internal resilience-building measures, such as community capacity building and the establishment of support networks, this approach enhances the community's ability to withstand and recover from challenges (Pal et al., 2021). These strengthened social ties not only facilitate more effective responses to disasters but also contribute to the overall well-being and cohesion of the community. In Honduras, community-based soil-bioengineering techniques are used for the effective mitigation of soil erosion and shallow landslide.

Furthermore, the inherent adaptability and flexibility of bottom-up approaches equip communities with the capacity to respond dynamically to changing circumstances (Ceptureanu & Ceptureanu, 2019). This agility allows for continuous evaluation and adjustment of strategies, ensuring that responses remain relevant and effective in the face of evolving challenges. Ultimately, these characteristics enhance the sustainability and effectiveness of bottom-up approaches in addressing complex issues, including disaster management, by fostering local empowerment, resilience, and adaptability.

2.3. Dimension of Sustainability on social, economic, environmental, multi-dimensional Resilience

CBDRM encompasses multiple dimensions including social, economic, environmental, and governance aspects. Social resilience, characterized by community involvement and local knowledge, is consistently highlighted. Economic resilience often involves resource allocation and long-term planning, while environmental resilience focuses on risk assessment and sustainable land management. Governance, crucial for effective management, underscores the importance of local institutions and stronger frameworks. Papers increasingly recognize the interconnectedness of these dimensions. Future efforts to enhance resilience prioritize technological advancements, financial stability, and social well-being.

- *Social resilience is emphasized, highlighting community involvement, awareness, and local knowledge.*
- *Economic resilience is linked to resource allocation and long-term planning.*
- *Environmental resilience focuses on risk mapping and*

sustainable land use.

- *Governance is crucial, with emphasis on local institutions and institutional frameworks.*
- *There's a trend towards recognizing the interconnectedness of different sustainability dimensions.*
- *Future resilience efforts prioritize technological advancements, financial stability, and social sustainability.*

Social capital and local institutions play vital roles in enhancing disaster preparedness, response, and recovery capacity within communities. Social capital, which encompasses the networks, relationships, and trust among community members, forms the bedrock for effective disaster management(Bhandari, 2014). These social connections facilitate communication, coordination, and cooperation during all stages of a disaster, enabling communities to mobilize resources and provide mutual aid in times of need, thus bolstering resilience. Poor communities have strong mechanisms to manage disaster such as windward island communities they have been able to put forward the efforts to address Disaster Risk Reduction.(Partelow, 2021).

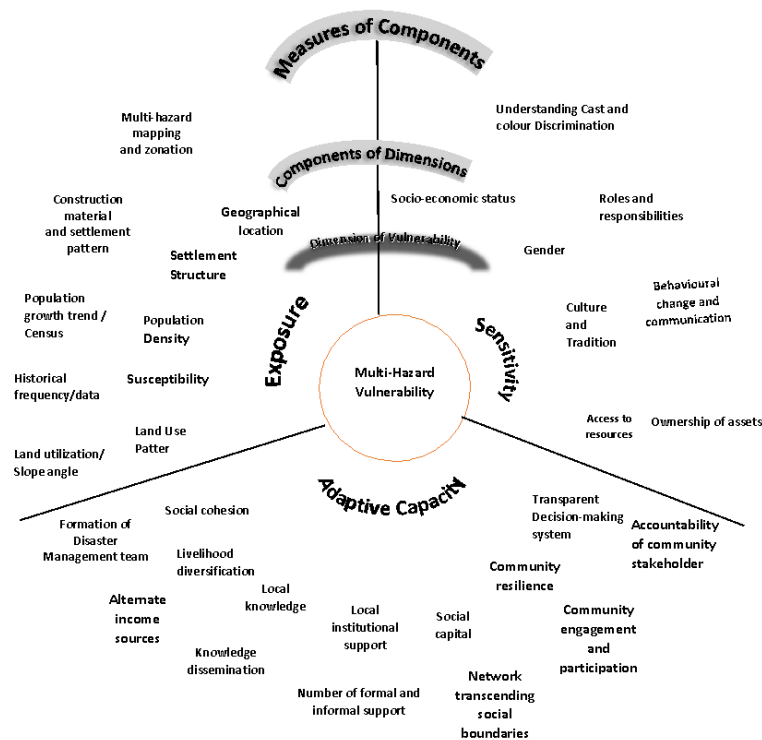


Fig. 11 The Vulnerability Scoping Diagram (VSD) is a conceptual framework that breaks down vulnerability into three main dimensions: exposure, sensitivity, and adaptive capacity. It also outlines the specific elements within each dimension.

2.4. Capacity building in CBDMR

Local institutions, including community groups, governmental bodies, and non-governmental organizations (NGOs), contribute significantly to capacity building in disaster management. (Abarquez Imelda & Murshed Zubair, 2008) With their intimate knowledge of local dynamics, these institutions develop tailored strategies for disaster risk reduction and response. Additionally, they serve as conduits for information dissemination, implementation of preparedness measures, and coordination of response efforts, providing essential guidance and support during emergencies. In Australia project led by a community called "Be Ready Warrandyte" to control bushfires

where the community was able to develop tools and resources more safely to reduce the risk.

2.5. Social capital in CBDRM

In concert, social capital and local institutions synergize to strengthen community resilience to disasters. Social capital fosters trust and collaboration among community members, while local institutions provide the organizational structure and resources necessary to translate these social connections into effective actions (Behera, 2023). By harnessing the power of social capital and leveraging the capacities of local institutions, communities can navigate disasters more effectively, mitigate risks, and facilitate coordinated responses, ultimately enhancing their overall resilience to future hazards (R. Shaw (Eds.) L. William, 2012). The main agenda of CBDRM is to transform vulnerable communities into resilient communities for the long term. The Kerala floods of 2018 are a classic example of a community resilience mechanism where the majority of the respondents who participated in the rescue activities were fisherperson and boatpersons.

2.6. Conclusion

The integration of Design for Sustainability (DfS) studies within Disaster Risk Management (DRM) offers a comprehensive approach, blending environmental, economic, and social dimensions to fortify infrastructure and communities against disasters. DfS prioritizes the development of systems, processes, and products that meet current needs while safeguarding resources for future generations, thus enhancing resilience to disasters. Recognizing the significance of this holistic approach, initiatives like CBDRM have emerged, emphasizing community participation and empowerment in disaster risk reduction

endeavors. Moving forward, continued investment in research, exemplified by endeavors at the Centre for Disaster Management and Research (CDMR) at IIT Guwahati, will be pivotal in advancing sustainable practices in disaster management. Through collaborative efforts and engagement across sectors, we can collectively strive toward creating more resilient and sustainable communities capable of confronting the challenges of the future.

2.8. Reference

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