



Regular Article

Empowering Communities: A Bottom-Up Approach to Disaster Risk Reduction

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Abstract Conventional, top-down approaches have dominated disaster risk reduction (DRR) initiatives for decades, with central governments coordinating disaster preparation and recovery efforts, fortifying coasts, and building large-scale gray infrastructure such as levees and seawalls to mitigate potential threats. Critics have questioned the usefulness and applicability of this strategy, especially given the mixed results from recent shocks, including Japan's 3/11 triple disasters. To investigate the degree to which experts in the field embrace traditional or alternative DRR models, we conducted 15 in-depth interviews with DRR specialists from the U.S. and Japan and systematically coded their responses using the NVivo software. Three key themes emerged from our analysis: 1) Leveraging community-based DRR and addressing issues such as tokenism; 2) prioritizing support networks; and 3) harmonizing top-down and bottom-up structures where national planning and local efforts are synergized, and decision-making is conducted through multi-stakeholder participation. Our results suggest that top-down policies alone cannot control disaster response; rather, a more inclusive governance structure that makes use of both institutional capacity and local knowledge will enhance DRR moving forward.

Keywords: disaster risk reduction, qualitative, community engagement, bottom-up

1. INTRODUCTION

Over the past decade, the world has witnessed a vast number of devastating disasters, resulting in countless fatalities, widespread displacements, and severe economic and

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infrastructural damages. Two recent events exemplify these challenges. In January 2025, California had 17 destructive wildfires, which collectively burned over 37,000 acres, destroyed more than 16,000 infrastructures, required 51,818 total emergency responses, and resulted in 29 fatalities. The economic impact has also been substantial, with estimated damages exceeding \$250 billion, making this one of the most devastating disasters in history (California Fire, 2025). Similarly, in January 2024, Japan's Noto Peninsula faced a 7.6 magnitude earthquake, which caused 241 fatalities, 1,300 injuries, and an estimated \$17.6 billion USD in economic damage (Center for Disaster Philanthropy, 2024). These events offer a stark glimpse into a developing crisis where countries must contend with the consequences of a changing planet and the increased frequency and consequences of natural disasters (Mark et al., 2023).

Traditionally, disaster risk reduction (DRR) has been dominated by a top-down approach led by central governments, assuming that higher-level expertise and national resources are best suited to address the issues. According to this approach (Figure 1), experts at the central level create procedures for DRR, which flow through state or prefectural agencies and are then subsequently carried out at the local level. With this command-and-control concept, this approach emphasizes the notion that these authorities are expected to oversee and be accountable for disaster and emergency management. Moreover, the traditional top-down method assigns most of the accountability to formal organizations, considering the general people as no more than recipients of preparedness information and evacuation strategies (Scolobig et al., 2015; Aldrich, 2012b; Aldrich, 2019b; Siawsh et al., 2023). These strategies, engaged by frameworks like the National Disaster Recovery Framework in the United States and the Disaster Countermeasures Basic Act in Japan, have been remarkably successful in coordinating responses and mobilizing resources.

While the top-down approach provides an efficient procedure for decision-making and can mobilize large resources, it can also discourage community involvement and local adaptation (Cabinet Office of Japan, 2021; Department of Homeland Security, 2011). Experts in academia and civil society advocate for bottom-up DRR approaches that prioritize community participation and foster resilience through grassroots engagement. DRR experts no longer see communities as passive recipients of resilience; instead, their knowledge and vulnerabilities serve as invaluable assets in the decision-making process. Bottom-up strategies distribute DRR duties among multiple tiers of stakeholders, including local communities, to ensure that no single party holds the entire responsibility and decision-making duties are carried out cooperatively (Enenkel et al., 2017; Gaillard & Mercer, 2012; Scolobig et al., 2015).

The Sendai Framework for Disaster Risk Reduction (2015-2030) also emphasizes "citizen-centered" approaches for effective DRR. This framework brings a multi-layered approach to mitigating the impacts of disasters, highlighting the interaction between hazards and vulnerabilities within populations. The framework outlines four priorities for DRR: 1) understanding disaster risk in all its dimensions; 2) strengthening disaster risk governance to manage disaster risk; 3) investing in disaster risk reduction for resilience; and 4) enhancing

disaster preparedness for effective response and “Building Back Better” in recovery, rehabilitation, and reconstruction (UNDRR, 2015).

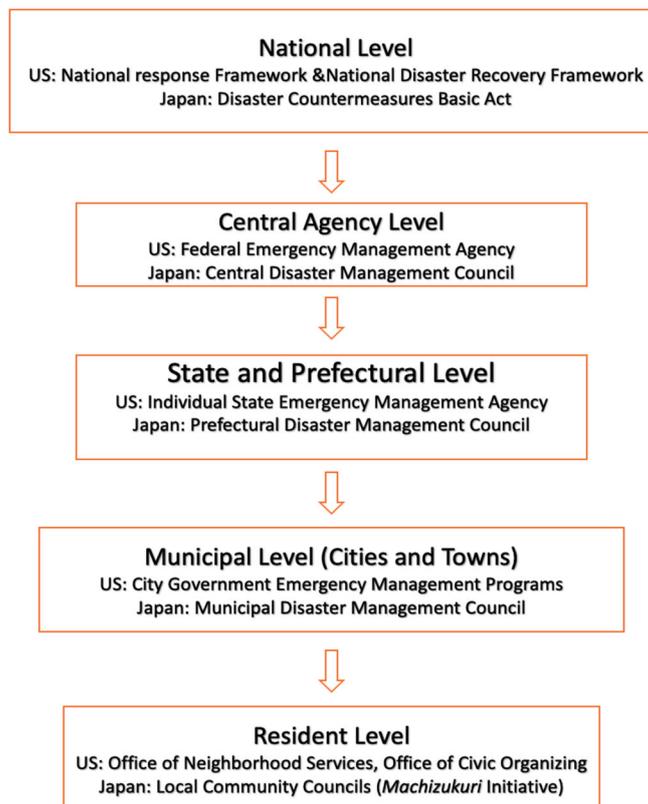


Figure 1. Basic disaster management structure with examples from U.S. and Japan (Federal Emergency Management Agency (training), n.d.; Homeland Security, 2016; Cabinet Office of Japan, 2021)¹

While this shift from top-down to bottom-up approaches reflects a growing consensus around community-driven disaster resilience, implementing these principles in practice remains a challenge. Community-based DRR often struggles with systematic barriers. These include resource limitations, power imbalances, and even cultural biases that undermine effectiveness as well as equity. Prior research has also cited a lack of consistent funding, misaligned priorities between central authorities and local stakeholders, and unequal access to decision-making processes as factors weakening the overall positive impact of bottom-up approaches (Barrios, 2016; Clark-Ginsberg, 2021).

¹The Disaster Countermeasures Basic Act of 1961 in Japan emphasizes proactive disaster mitigation and prevention, creating the Central Disaster Management Council. This council develops disaster management policies, advises government agencies, and organizes recovery efforts. In the U.S., the National Disaster Recovery Framework and Federal Emergency Management Agency oversee state disaster management plans, with community engagement at the bottom.

To better understand the evolving narrative, this paper examines the role of community in Disaster Risk Reduction (DRR) through the lens of expert perceptions in Japan and the United States. We have gathered knowledge from specialists in the fields in the US and Japan, which have distinctive disaster challenges and management approaches. Thus, this study aims to contribute to the existing literature in the following ways. First, we determine the degree of CBDRR integration in the initiatives in both countries and investigate existing systemic barriers to its success. Second, we look at the importance of decentralization and social capital to the success of DRR. Third, we provide a comparative analysis of the U.S. and Japan's attempts to harmonize top-down and bottom-up DRR. Finally, we advance a refined structural guide that takes criticism into account and emphasizes institutional and community cohesion in bridging the current gap.

2. THEORY

This section lays out the theoretical framework for understanding why the bottom-up approach in DRR matters significantly today. By examining the principles of community-based DRR, decentralization, multi-stakeholder participation, and social capital, the framework offers a foundation for analyzing expert insights on the evolving narrative of community-driven resilience.

2.1 Community-Based DRR

Community-based disaster risk reduction (CBDRR) emphasizes the active participation of the local community in the planning and implementation of disaster preparedness, response, and recovery. CBDRR is essential to building local knowledge, enhancing disaster resilience through active participation, and ensuring local needs are met with tailored strategies (Shaw, 2012; Gero et al., 2011; Liu et al., 2016). Key elements of CBDRR include risk evaluation, developing capacity, preparedness planning, and collaboration. Collectively, these elements involve integrating communities in the analysis and identification of regional risks, limitations, and resources; training them to conduct their own DRR and execute plans according to unique needs; and finally, fostering partnerships between local communities, authorities, and civil society (Andrew, 2018; Shaw, 2012).

In practice, the success of CBDRR often depends on the balance between community-led efforts and institutional support. Japan, for instance, has long had local communities actively engage in preparedness and response efforts (Ishiwatari & Sasaki, 2022). In the early 1960s, with the introduction of the Urban Planning Act, Japan launched the concept of *machizukuri*, a term combining *machi* (town) and *zukuri* (to make), intending to enhance a community's social structure and collaborative urban planning (Murakami et al., 2014; Okada et al., 2018; Siawsh et al., 2023).

The DRR efforts by *machizukuri* were apparent during the 1995 Kobe earthquake. For instance, small business owners and landowners in Kobe, utilizing *machizukuri*, effectively pooled resources to aid disaster victims. These efforts extended beyond the immediate response period, organizing events to help residents manage trauma and engage in proactive recovery (Mavrodieva et al., 2019). Similarly, during the 2011 Great East Japan Earthquake, *machizukuri* played a crucial role in uniting communities, prioritizing survivor safety, and supporting vulnerable groups while rebuilding homes (Siawsh et al., 2023).

The adoption of community-centric approaches is also seen in Western contexts (Colten et al., 2008; Burton, 2014). For example, during Hurricane Katrina, local Vietnamese communities in Louisiana initiated reconstruction efforts through their churches well before governmental intervention. While these communities had long-term goals, their collaboration with societal institutions enabled them to quickly reoccupy damaged areas (Patterson et al., 2009).

Despite the success of DRR initiatives, critics often note the potential of CBDRR to unintentionally create power imbalances. This often happens when marginalized groups are excluded from decision-making. This type of power dynamic leads to unequal representation, where some voices are overrepresented, while those with lower socioeconomic backgrounds, who are more prone to displacement and other vulnerabilities of disaster, are left without a voice in the matter (Barrios, 2016). Moreover, there is the issue of resource constraints and gaps in technical knowledge. The challenges often increase when communities lack funding, infrastructure, and training that make it difficult to translate local knowledge into actionable strategies. Thus, closing such gaps through more inclusive institutional support is necessary for CBDRR projects to be effective (Clark-Ginsberg, 2021).

2.2 Decentralization and Multi-Stakeholder Participation

The incorporation of community-centered methodologies like *machizukuri* in DRR reflects broader efforts toward decentralization and multi-stakeholder involvement, both key to effective risk management. In DRR, decentralization refers to the movement of resources and decision-making authority from the central to local levels, thereby enabling communities to take charge of their concerns. Multi-stakeholder participation allows engaging distinct groups in decision-making spanning from the central government to local government to civil society (NGOs and NPOs working independently) and the residents. Overall, this improves broader support, resource mobilization, and transparency (Quader et al., 2023; Graveline & Germain, 2022).

The Maldives' response to the 2004 tsunami exemplifies these two concepts. The government of the Maldives launched the "Community-Based Disaster Risk Management" project to develop disaster mitigation and recovery strategies for four islands in the northern Haa Alifu and Haa Dhaalu Atolls. First, they involved local communities to proactively

recognize risks and create unique plans to improve readiness. Embracing the multi-stakeholder approach, the Maldivian government also worked with the NGO Care Society to enhance these DRR initiatives and prepare for any upcoming crises. Local governments played the role of resource allocators. Overall, this initiative benefited about 15,500 people. (Zubir & Amirrol, 2011).

Similarly, the “Dutch Water Authority Model” has a decentralized and multi-stakeholder approach that emphasizes bottom-up DRR. The Netherlands is divided into 23 regional water authorities, responsible for water management in each region. This decentralized structure ensures strategies are context-specific and adaptive (Bergsma et al., 2012; van Ast & Gerrits, 2016). Each regional water authority's governing board is composed of representatives from a variety of groups, including residents, growers, businesses, and managers of natural areas (van der Brugge et al., 2005; Dutch Water Authority, 2015).

2.3 Social Capital

While decentralization empowers local authorities, civil society, and communities to construct adaptive disaster mitigation measures, social capital complements this by promoting community resilience through support networks. Social capital is the collective goodwill, solidarity, shared empathy, and social interactions within a community forming a cohesive social entity (Farr, 2004). Unlike physical capital, social capital is an invisible set of goods that are formed through relationships among individuals (Coleman, 1988). In the context of DRR, promoting social connections has become a vital instrument for enabling vulnerable communities to access crucial support, information, and resources (Aldrich, 2012a).

Social capital is categorized into three types: bonding, bridging, and linking. Bonding refers to the close connections within specific groups that provide personal assistance and strong emotional support during disasters. Bridging refers to the looser ties across diverse social groups, which are more heterogeneous. Such social groups often provide communities with novel information related to ongoing disasters and resources (Aldrich, 2019a). Finally, linking connects regular citizens with those in power. This comes in the form of trust-building between citizens and government authorities, enabling access to aid during disasters (Aldrich & Meyer, 2014). Social capital also plays different roles throughout a disaster cycle, with bonding social capital enabling communities to provide rapid support during the response phase and mobilizing labor and resources during the recovery phase. In the prevention and mitigation phase, communities with higher levels of social capital engage in building resilient physical infrastructure, as well as social infrastructure that would harness community involvement (Behera, 2021).

In recent years, social infrastructure has also brought a new strength to social capital by providing physical spaces to foster trust, interactions, and collaboration within communities. Creative and well-designed social infrastructure, such as community centers, parks, and shared

public spaces, encourages collective disaster resilience and builds mutual support during crises. Investing in social infrastructure also helps bridge social divides. Social infrastructure has also been utilized as accessible meeting points to coordinate disaster response efforts. An example is community schools in the US, where educational institutions integrate academics with social services to support students and extended communities in the area (Klinenberg, 2019).

However, social capital can also serve as a double-edged sword, bringing negative consequences for outgroups (Zahnow et al., 2018). Strong, homogenous social networks tend to inadvertently impede the recovery of marginalized or out-group communities (Meyer, 2017). Social ties within the dominant population can sometimes impede marginalized groups' attempts to recover, leading to prejudice (Aldrich, 2019a; Aldrich, 2012a).

2.4 Research Gaps and Novel Contributions

While much literature emphasizes the theoretical benefits of CBDRR, there are significant gaps remaining in practical implementation, even in countries with higher levels of local disaster-resilient structures (e.g., Japan). Existing research largely focuses on case studies that are successful community-led initiatives but has not addressed the systematic barriers that limit them from achieving their full potential (Barrios, 2016; Clark-Ginsberg, 2021). Furthermore, the interactions between local and centralized structures remain highly unexplored. Thus, there is a critical gap in how both structures could coexist effectively. While centralized systems are required for standardization and scalability, local knowledge truly adds more context-specific insights that are valuable in addressing the nuanced challenges. By combining the two approaches, creative solutions that capitalize on the advantages of both paradigms may become possible.

Thus, this study aims to contribute to this discourse by analyzing the gaps and providing a nuanced understanding of expert perspectives on CBDRR, as well as the contemporary action plans in place to tackle these gaps. It hypothesizes that effective DRR necessitates the incorporation of CBDRR into current initiatives by tackling structural barriers, utilizing social capital and decentralization, and combining top-down and bottom-up approaches, as demonstrated in a comparative analysis of the United States and Japan. It does this by:

1. Understanding the level of CBDRR integration today, identifying structural obstacles to its application, and examining how experts acknowledge and address critiques of CBDRR.
2. Investigating the importance of social capital and decentralization in an effective DRR.
3. Providing a comparative perspective on the U.S. and Japan in their efforts towards synthesizing top-down and bottom-up DRR.
4. Advancing a refined structural guide that highlights the vital importance of community and institutional collaboration to move beyond the contemporary divide.

3. METHODOLOGY

3.1 Data Collection

To understand the evolving narrative of DRR with a focus on a bottom-up approach, this study employs an exploratory research design. Our primary data derives from a systematic series of interviews with experts deeply immersed in the field of disaster recovery. The experts were gathered through snowball sampling, where initial participants referred us to other experts in the field. This allowed us to gather hard-to-reach specialized populations. We explored various disaster mitigation and prevention projects, including their primary focus (physical or social infrastructure), government involvement, local community engagement, and project success. This interview methodology enabled us to collect a diverse range of perspectives and informed opinions.

To ensure inclusivity and capture a broad spectrum of insights, we took a global approach to the interviews. Experts come from the U.S. and Japan, where they have dealt with a significant number of disasters and are at the forefront of DRR efforts. Both countries are OECD members, operating within advanced economies and possessing strong institutional frameworks for DRR. This allows comparative analysis to investigate how well-resourced nations tackle DRR strategies and provides insights into the strengths and limitations of these approaches.

The series of Delphi interviews was conducted in English and Japanese to accommodate participants' language levels. The authors, proficient in Japanese, translated the Japanese interviews into English. While language and vocabulary for certain concepts, such as community-based DRR, differed among experts from the two countries, follow-up questions were asked to confirm these points. The interview process included semi-structured, open-ended questions aimed at understanding the role, contribution, and importance of bottom-up strategies. The questions also captured the experts' perspectives on the role of decentralization and social capital in enhancing DRR. The ultimate goal was to determine how each expert utilizes community engagement in their contemporary DRR efforts (APPENDIX I).

3.2 Participant Information

Table 1 contains information about the participants, including their country of origin, gender, professional title, affiliation, field of work, and areas of expertise. To safeguard participant confidentiality, the level of specificity regarding their organizational affiliations is reduced, categorizing them broadly as governmental, non-governmental, or private sector institutions and the fields they work.

Table 1. Participant information

No.	Country	Gender	Organizations	Professional title	Fields	Areas of expertise
	Boston, MA, USA	F	Global Non-Profit	Director of Science and Strategy	Practitioner	Collaborates across borders to create and execute comprehensive plans to save healthy rivers, estuaries, and seas.
2	Japan	M	Faith-Based Organization	General Secretary	Practitioner	A major actor in regional and international resilience projects, a humanitarian leader, and a champion for catastrophe risk reduction.
3	Baton Rouge, LA, USA	M	US Non-Profit	Senior Research Scientist (Human Dimensions)	Researcher and Practitioner	Lead researcher who focuses on community resilience and climate adaptation, assessing the social value of ecosystem restoration, and incorporating local knowledge into resilience evaluations.
4	New Orleans, Louisiana, USA	M	US Non-Profit	Chief Architect and Chairman	Architect and Practitioner	Works on a co-design studio for architecture, planning, and community-focused engagement in New Orleans that is committed to encouraging harmony and cooperation in urban planning and development.
5	<i>Aoi</i> Ward, Shizuoka, Japan	M	Local Government	Director	Policymaker	Works on local disaster resilience and community building in <i>Aoi</i> Ward
6	Boston, Massachusetts, USA	M	US Non-Profit	Director	Practitioner	An urbanist and social developer who uses design social spaces to tackle equality, long-term viability and social well-being
7	<i>Aoi</i> Ward, Shizuoka, Japan	F	Local Government	Not specified	Policymaker	Housing construction support for <i>Aoi</i> Ward
8	New Orleans, Louisiana, USA	F	US Non-Profit	Chair of Public Health	Academic and Practitioner	Teaches community participation in public health, provides leadership institutions with community resilience advice, and matches philanthropic initiatives with the requirements of regional government organizations and charities.
9	Cambridge, MA, USA	F	US Non-Profit	Founder and CEO	Practitioner	An advocate and social innovator who started and directs programs that include a wellbeing

						perspective into systems that deal with social justice, trauma, and homelessness.
10	Japan	M	National Assembly of Disabled Peoples' International	Deputy Secretary General	Policymaker	Works on building pre- and post-disaster recovery for disabled people.
11	Kasumiga seki, Tokyo Japan	M	National Government Agency	Deputy Director, Construction of Infrastructure Section	Policymaker	Works on housing reconstruction for disaster survivors.
12	Massachusetts, USA	M	Research Institution	Senior Climate Resiliency Specialist	Researcher and Practitioner	A senior climate resiliency planner with an emphasis on coastal flooding who uses important funding programs to help communities with assessment and project execution.
13	Higashimatsu, Miyagi, Japan	N/A	Local Government	Recovery Planning Division Team	Policymaker	Works on pre- and post-disaster rebuilding efforts for Higashimatsu.
14	Japan	M	Research Institute	Professor	Academic and Practitioner	A tsunami modeling specialist who supports national disaster response and policy development by focusing on warning systems, mitigation plans, and public awareness.
15	USA	M	Faith-Based Partnership with National Government	Director	Policymaker	Leads a Center for Faith-Based Partnerships, which was created by a presidential order during Hurricane Katrina to coordinate administration-to-administration faith-based programs in the White House.

Ethical considerations were paramount in our research. As such, this study received approval from the Northeastern University Institutional Review Board (IRB) under approval number 21-03-32 to ensure that all aspects of data collection and participant interactions adhered to the highest ethical standards.

3.3 Data Analysis

Our team conducted a systematic qualitative analysis of 15 expert interview transcripts using NVivo, a qualitative data analysis software. We coded key themes and relationships related to DRR governance. In our coding scheme, we separated data first into federal/central, state/prefectural, and local/community levels to capture the hierarchical and grassroots

structures. Utilizing both inductive and deductive coding methods, we first allowed emerging themes to surface organically from the data and then created predefined categories for investigation. These redefined categories included community-based DRR efforts, decentralized governance, and social capital-driven resilience strategies. This approach enabled us to identify key areas of synergies, complexities, and gaps between top-down and bottom-up structures.

4. RESULTS

4.1 Theme 1: Contemporary CBDRM

A recurring theme in our interviews was the vital role of CBDRR in cultivating resilience for disaster-prone communities. The expert discussions revealed that CBDRR emphasizes leveraging local knowledge, encouraging more collaboration, and enabling better community-led decision-making. Furthermore, the strengths and limitations of CBDRR emerged from the discussions. This theme investigates three core perspectives related to the utilization of local knowledge, challenges faced by CBDRR with power imbalance, tokenism, and the need for meaningful community engagement, drawing comparisons between the U.S. and Japan.

4.1.1 Leveraging Local Knowledge

Both experts from the U.S. and Japan highlight local knowledge as a cornerstone of DRR. Experts emphasize that residents, with their deep ties to the environment, hold crucial insights that can inform disaster preparedness and response strategies. Participant 1 from the U.S. said, “We really need to be working with people, finding out. No one knows more than the people who live in a place what the issues are, or what they want... Understanding where people are coming from and presenting options to help them meet their goals,” emphasizing the need to prioritize local perspectives when designing DRR strategies (December 2022). Similarly, Participant 2 from Japan reflected on his experience as a practitioner in the field: “There are definitely people regarded as leaders in their community. Whenever we make plans for assistance or recovery, we need *fukkouiinkai* (recovery committees). They should not be experts from outside but rather identified local leaders who form the committees with them.”² These perceptions align with the principle that local knowledge and involvement are not just supplemental to disaster resilience but rather essential for disaster management (September 2022).

Participant 2 also said, “One of the things I think is still a gap is that each community requires different strategies for recovery, and that needs to bind people together.” This concern shows

² This discussion demonstrates the core of CBDRR in Japan, where mutual aid and local leadership are essential to disaster response and recovery. Okayama officials' prompt and coordinated reaction to Typhoon 19 shows how incorporating community-focused tactics into recovery plans can improve effectiveness and resilience. Japan highlights the value of grassroots leadership by giving local leaders, such as store owners, educators, and physicians, priority through organizations like recovery committees.

that contemporary strategies to tackle disasters tend not to be uniquely implemented for the necessities of distinct communities but rather as bulk strategies. He further argued that there is a need to bring in “people who are actually going to lead the recovery efforts—teachers, doctors, in the area,” emphasizing the importance of involving community leaders who will continue to shape disaster recovery decisions in their communities long after these plans are implemented. This concept underscores the need for flexible and community-specific recovery approaches that are not one-size-fits-all (September 2022).

Thus, these expert perceptions note that community members are uniquely positioned to offer not just a precise assessment of the issues they confront but also practical solutions. When properly utilized, their experiences and local knowledge provide a wealth of useful knowledge that can greatly increase a community's ability to bounce back from disaster setbacks.

4.1.2 Challenges of Tokenism, Power Imbalances, and Resource Constraints

An important critique of the contemporary structure of CBDRR lies in the persistence of tokenism, power imbalances, and resource constraints, which limit its effectiveness. Tokenism, the practice of making only a symbolic effort to represent citizens' views, often manifests in superficial participation processes where communities feel undervalued. Participant 3 highlighted an example in St. Bernard Parish, Louisiana, where residents initially felt dismissed in discussions about freshwater diversions: “Residents feel disenfranchised, fatigued by policymakers, and find the process exclusionary and undemocratic.”³ He argues that in many cases, residents feel excluded from decision-making, and the final decision remains in the hands of technical experts. He also argued that this changed when residents were reframed as “local experts,” and their input was integrated into project models, making the process more inclusive and collaborative (November 2022). Similarly, Participant 4 highlighted the need for the community engagement process to be more authentic and transparent. Discussing the post-Katrina gentrification, he stated, “The process has to be clear, to feel genuine, and to make people feel that they are being listened to. The moderator has to be independent, ideally funded from the outside. If the government funds it, it looks like it controls it”⁴ (November 2022).

In Japan, the top-down structures that are heavily involved in shaping community engagement can also exacerbate the power imbalance. To ensure that recovery plans are in line with community requirements, Participant 2 emphasized the significance of including local leaders in decision-making, such as teachers and shopkeepers, emphasizing that their participation in recovery committees is essential. Similarly, it was noted that “While in conversation with the community, earthquake insurance in Japan needs more detailed risk

³ This conversation emphasizes the conflict between scientific and local knowledge in DRR, especially with relation to St. Bernard Parish's freshwater diversion initiatives. Feeling left out and worn out by top-down decisions, local councils and residents oppose these projects unless they are guaranteed no irreversible harm.

⁴ This discussion demonstrates how New Orleans' post-Katrina recovery resulted in gentrification, as rising real estate prices drove impoverished residents to neighborhoods like St. Bernard Parish. It also emphasizes how transparent, independent facilitation is necessary for effective community engagement, ideally involving diverse institutions like historically Black universities to promote inclusivity and trust.

information and pricing options for residents. Currently, it operates at the prefectural level with only four categories of damage classification, which is insufficient”⁵ (September 2022). This highlights the power imbalances in the centralized systems, like earthquake insurance, that, even while taking notes from citizen needs, impose standardized structures that fail to recognize the unique needs of disaster survivors, leaving communities with limited support for recovery.

Resource constraints also further hinder the effectiveness of CBDRR. For instance, in Japan, post-3/11 disaster recovery efforts by communities faced significant logistical and funding challenges. Participant 5 explained that while the government provided financial resources, including 3 million yen to residents whose houses were destroyed, the survivors found themselves in “double loans” for both destroyed homes and relocation. Even with partial forgiveness, many survivors struggled, and tsunami insurance had low penetration, leaving many without adequate financial support⁶ (July 2022). Similarly, in the US, lower-income communities were faced with this issue. Participant 1 noted that when residents are thinking about moving, they frequently worry about gentrification: “If I go, someone with more resources will come and take this space. You can make me safer here, just like you can make them safer when those wealthy people come here”⁷ (December 2022). The resource allocation process itself can also exacerbate inequality. Participant 12 explained how “communities had to put in a 25% match (in kind, like staff time or cash) with the other 75% from the state,” a requirement that often disadvantages communities that are under-resourced.⁸ These challenges highlight the systematic inequalities that often prevent vulnerable populations from fully benefiting from disaster recovery programs (December 2022).

4.1.3 Policy Suggestion

Expert participants argued that impactful DRR hinges on the active and powerful participation of local communities in shaping their unique recovery strategies. Thus, it requires moving beyond top-down structures to create more effective approaches that empower communities to take the lead. Explaining an example from Boston/Cambridge, Massachusetts, U.S., Participant 6 described how his organization created social infrastructure to foster further

⁵ This conversation emphasizes how disaster recovery planning in Japan needs to be more flexible and involve the community more. Experts stress giving locals more choices and comprehensive information, whether it's for earthquake insurance, which presently lacks sophisticated classifications to adequately handle a range of local demands, or seawall designs.

⁶ This discussion demonstrates the logistical and financial difficulties that survivors of the 3.11 earthquakes in Japan experienced. Many victims suffered from "double loans," old loans for destroyed homes and new loans for reconstruction or relocation despite the central government's substantial financial aid, which included tax rebates for displaced households and 3 million yen for wrecked properties.

⁷ This conversation brings to light the conflict in low-income areas over relocation or "retreat" in the event of a calamity. Residents worry that gentrification, in which affluent people or developers occupy the vacant places, may result from them leaving their homes because of the danger of disasters. Instead of displacing existing inhabitants in favor of wealthy immigrants, the feeling expresses a desire for fair measures in safety and resilience.

⁸ The financial and procedural obstacles that American communities confront when attempting to mitigate disasters and build resilience are highlighted in this conversation. Although financing is provided by federal and provincial programs such as CZM (Coastal Zone Management) and MVP (Municipal Vulnerability Preparedness), towns are frequently asked to match 25% of the funds, which can be difficult for areas with limited resources.

community engagement. He said, “We also look at community development. This is tied to the way that we bake into our projects involving the community in our space. A lot of traditional development processes can lead to the displacement and exclusion of locals from the process. Letting people be the determinant of their space helps spur conversations and builds capacity for communities to have agency” (July 2022).

Similarly, in Japan, participatory efforts are apparent in models like *Aoi* Ward, where grassroots community groups focus on “Bring back the smiles, take care by checking on each other, participatory event in the city follow the rules, independence development” (Participant 7). These efforts are taken to establish self-resilience and involve the whole community. Participant 7 emphasized that “When asked how the community is ready for the next disaster ... the importance of localized, layered protection and the proximity of safe housing compared to other towns.” In contrast to other shock-affected areas, *Aoi* promotes inclusivity by allowing residents to directly participate in neighborhood associations, home design, and community events (November 2022).

To enhance meaningful community engagement, experts argued the need for more active steps to institutionalize participatory approaches.

1. Design localized frameworks with community-led solutions: Contemporary policies should focus on formalizing the inclusion of community representatives in the disaster planning committees. This will ensure that DRR decision-making reflects local perspectives and their needs.
2. Provide funding for grassroots organizations: To tackle the resource constraints faced by communities in mobilizing, the governments should also allocate resources to support community-led projects that promote resilience through training programs and events.
3. Strengthen local leadership: Initiatives should allow local leaders (business leaders, educators, doctors) who are trusted by the communities to be involved in disaster resilience committees at the municipal or regional level.

Implementing such policies will help address the gap between theory and practice, ensuring CBDRR is not only encouraged but is also structurally supported.

4.2 Theme 2: Support Network

Support networks are a critical element of bottom-up DRR, as social cohesion fosters resilience and effective recovery. These networks emphasize trust, collective action, social infrastructure, and cultural practices in shaping preparedness and recovery.

4.2.1 Social Networks for Recovery

In Japan and the U.S., experts emphasized social networks as the backbone of effective DRR. Participant 8 (US) observed, “People do know best, so that social networks are the core of effective recovery. The social network that created Lower9.org was much more effective than the mayor’s program” (November 2022). Lower9 is a nonprofit working towards the long-term recovery of the 9th Ward of New Orleans in the wake of hurricanes Katrina and Rita. She argues that such grassroots initiatives succeeded because they were deeply rooted in trust, cultural understanding, and shared experience among residents.⁹

Similarly, in Japan, Participant 2 underscores the importance of the mutual support that played a role in Okayama’s response to Typhoon 19. He argued that the municipality officials in Okayama dispatched teams and provided swift action, and shared knowledge. The neighborhoods tightly believe in the local dispatch teams, as social networks are strong and people trust them: “When it happens, we go It generates these experience and knowledge levels. Mutual support, someone who can work with people on the forefront” (September 2022). This highlights that existing social networks and mutual aid significantly strengthen disaster response by creating collaboration

4.2.2 Social Infrastructure

Experts also recognized that social infrastructure, physical spaces, and systems that advance interactions and build trust between people also play a critical role in strengthening community resilience. Participant 6 (US) discussed the lack of barrier-free social infrastructure, noting that coffee shops, schools, or even parks come with financial and cultural barriers. To address this, Participant 6’s institution transformed vacant spaces into public “living rooms” where people can build connections with the community. He stated, “People would walk in and say, ‘I’ve always wanted a place like this but didn’t know it could exist’” (July 2022). While still developing, he said these projects have helped improve an inclusive environment where people can collaborate in preparedness efforts.¹⁰

In Japan, social infrastructure is heavily incorporated into cultural and recreational activities. Participant 5, explaining the case of *Aoi* Ward, cited schools, city halls, and parks as vital community hubs for hosting *matsuri* (festivals), sports competitions, and especially disaster drills. These infrastructures exist to serve all age groups, from young children who come to playgrounds to the elderly who come to neighborhood associations. He said, “The spaces are designed for young children to play and for community enjoyment, such as viewing winter lights from the train.” Emphasizing the role of parks, he said, “For parks, there are different

⁹ This discussion highlights Local social networks powered grassroots initiatives like Lower9.org were considerably more successful in promoting rehabilitation in Louisiana than top-down programs. The Lower Ninth Ward's reconstruction process became more resilient and responsive as a result of this community-led strategy that gave local knowledge and needs first priority.

¹⁰ This conversation focuses on a non-profit urban design organization in the Boston region that is lowering membership and cost barriers to create accessible social spaces. In Union Square, Somerville, they implemented a project in 2018 that turned abandoned shops into free community centers.

concepts, parks focused on creating health activities for the elderly. The parks are designed for young children to play and for community enjoyment” (November 2022). He finally noted that *Aoi* Ward has found that this community building has helped communities to trust and work together during crises.¹¹

Participant 2 further highlighted how social infrastructure allows local ideas to be integrated into recovery projects. He stated, “Instead of technical people coming in, or construction people coming in, why not say, out of 1 billion yen of the recovery, some percent will be spent based on the local idea; local students, women, and *machizukuri* groups can advocate for their plans” (September 2022). He argued that this approach not only ensured the recovery plan reflected the communities’ priorities but also encouraged a sense of ownership and connection to the project. In contrast, he argued that having external experts come in and build massive constructions often feels foreign to the residents, failing to build trust in society.¹²

4.2.3 Bridging and Linking Social Capital

Beyond physical spaces, social capital also enables trust, cooperation, and mutual aid pre- and post-disasters. Participant 9 (US) emphasized the bridging and linking capital that connects communities across distinct social and institutional boundaries. She noted, “We (non-profit) use participatory process... Imagine that the housing will damage people in the community who have an ethnic market there every Monday, it is the place where I belong, where I get my food. And the idea is that you have to take that data seriously. That is a historically underheard community” (November 2022). This non-profit bridged and linked social capital by utilizing a participatory process where developmental projects, such as affordable housing, considered residents’ cultural needs and sense of belonging. They brought in people through trusted networks to listen to the voices of historically underrepresented communities instead of basing it on economic measures.¹³

A key example from *Edogawa*, Japan, on bridging and linking social capital is the efforts to include disabled communities in DRR planning. Before the 3/11 disaster, organizations that were working on disabled community resilience, like DPI Japan or Step *Edogawa*, were excluded from national and local disaster planning (Participant 10). While a headquarters was established to provide input, disabled communities still struggled for representation in local DRR committees, limiting their capacity for decision-making. One of the biggest elements missing from welfare shelters was staff who could assist disabled communities with trust.

¹¹ Through activities and get-togethers, community-managed parks in *Aoi*, Japan, promote social cohesiveness, intergenerational connection, and well-being. They improve self-governance and rapid crisis response, which are essential components of catastrophe resilience, while fortifying local bonds.

¹² This discussion emphasizes the necessity of community-led recovery from disasters in Tohoku and Kumamoto, where local engagement is frequently not sustained by top-down initiatives. In order to ensure community ownership and long-term participation in restoration, Komino supports allocating recovery funding to women, *machizukuri* groups, students, and local leaders.

¹³ This non-profit makes sure that community development, like affordable housing, puts social ties, culture, and well-being ahead of economics. They collect information on the effects on disadvantaged groups, through a participatory approach, favoring fairness and community-driven planning above conventional cost-benefit analysis.

Participant 10 argued, “Fukushi *hinanjo* (welfare evacuation shelters) lack staff, requiring family members to assist disabled evacuees. While barrier-free locations exist, helpers must be arranged locally, which is often challenging due to shortages”¹⁴ (September 2022). Bridging social capital is exemplified by the establishment of organized networks that link government agencies and disability organizations, encouraging collaboration between sectors. Linking social capital is also demonstrated by the emergence of new partnerships between local governments and disability advocates, which enhance disaster preparedness and accessibility for underserved populations.

4.2.4 Policy Recommendations

To maximize the role of support networks in bottom-up DRR, there should be targeted policy interventions. The following are some suggestions by the expert participants.

1. Strengthen local and cross-sector networks: The networks among local leaders, nonprofit, and government agencies are key to improving pre- and post-disaster responses. Providing long-term funding and technical support while also ensuring these networks remain active beyond immediate recovery efforts is important.
2. Invest in shared spaces: Public spaces play a vital role in community activation in disaster preparation. The idea of “living rooms” in the U.S. and community parks in Japan serve as vital gathering locations for people from different social and generational backgrounds.
3. Inclusive and culturally responsive planning: As disasters often gentrify vulnerable populations, such as lower-income or disabled communities, the experts emphasized the need to embed inclusivity into recovery efforts. Policies must focus on planning models that prevent exacerbating existing inequalities.

4.3 Theme 3: Harmonizing Top-Down and Bottom-Up Approaches

The final theme was the challenge of coordination between top-down and bottom-up approaches. While national and local governments often provide vital strategic oversight and resources, community-led efforts in resilience enhance and expedite recovery.

4.3.1 Synergizing National Planning and Local Efforts

Participant 3 (US) highlighted how designing disaster resilience projects with local communities has led to better outcomes. Explaining the case of Louisiana, he said the Coastal Protection and Restoration Authority (CPRA) involved local fishermen and residents in Plaquemines Parish, where the locals were allowed to submit their unique ridge restoration

¹⁴ This discussion highlights Disabled Person organizations like DPI-Japan and STEP EDOGAWA were excluded from disaster preparedness due to a social welfare gap, resulting in poor evacuation planning and challenges like accessibility, lack of shelter staff, and confusing protocols.

proposals. Through iterative collaboration, the locals redefined the existing structures through their proposals that met their actual needs. He noted, “They wanted something more systematic... siphons to pull sediment out of the river, constructing a proposal on the fly, siphons and sediment pipelines feeding ridge restoration projects. We did it again, and that was what they wanted, and we gave it to the parish, and they submitted to CPRA, and it was modeled in the 2023 CPRA master plan”¹⁵ (November 2022). This example indicates how top-down agencies can provide structures and resources while the bottom-up engagement enhances DRR strategies.

Participant 11(Japan) highlighted how the local communities in *Kesennuma* and *Onogawa* (Miyagi prefecture) successfully influenced the designs of seawall constructions, improving safety while maintaining community access to the coastal environment. He said, “In Onagawa, the prefecture planned standard-sized seawalls, but the local community pushed for a more open plan. Similarly, in Kessenuma, a *machizukuri* committee sought to reduce the height of seawalls to make the sea more visible, balancing top-down planning with local vision” (November 2022). Participant 2 (Japan) also emphasized this idea by suggesting “Instead of technical people coming in, or construction people coming in, why not say, out of 1 billion yen of the recovery, some percent will be spent based on the local idea - local students, women, *machizukuri* groups can advocate for their plans. When those plans are being implemented, I don't think people would leave the idea. Because massive construction projects are designed by, built by, people whom they don't know, it is foreign” (September 2022). Thus, instead of following the usual national structures set by technicians, they followed participatory urban planning, leading to more balanced solutions.

4.3.2 Multi-Stakeholder Participation

Experts from both countries also emphasized the importance of civil society organizations like NPOs in bridging the gaps between the government and local communities. Participant 12 emphasized the role of NPOs in the US, which serve as “safety nets” for communities during crises. Talking about NPOs in Massachusetts related to coastal resilience, he argued that these organizations are often connected at both the institutional and community levels. He said, “I think the focus has been on non-profit institution building, as non-profits provide safety net services. So, they are the best place, knowing the people and their problems, and can speak to and engage with the most vulnerable populations among us.”¹⁶ Participant 12 said civil society groups not only mobilize resources and coordinate aid but also function as an advocate for collaboration between top-down and bottom-up. He discussed how environmental consulting groups also enhance this synergy: “We have two large grant programs available through Coastal Zone Management and the Municipal Vulnerability Preparedness (MVP) program -

¹⁵ This discussion highlights how Louisiana's CPRA collaborated with Plaquemines Parish fishermen and residents on a ridge restoration project, incorporating local knowledge into coastal resilience measures, highlighting bottom-up participation in top-down environmental policy.

¹⁶ Massachusetts' Mystic River Watershed Association is promoting citizen science in heat monitoring, emphasizing the role of social cohesiveness and non-profits in coastal resiliency.

these have been a big catalyst for almost everything that is going on in terms of climate resiliency. Most coastal communities have done something - planning, first steps, but fewer have gone all the way from vulnerability assessments to implementing a slate of projects” (December 2022).

Similarly, in New Orleans, Participant 8 said that NPOs play a crucial role in democratizing the recovery process. Providing a post-Katrina example, she said “With the support of the Open Society Foundation and the LA Discovery Foundation, Ford Foundation started a collaborative called the NOLA Coalition on Open Governance... to increase the government data available to people in the community so they could be meaningfully involved in decision making” (November 2022). These examples from the U.S. demonstrate how involving multiple stakeholders is important for building better synergy between the two approaches.

Similarly, in Japan, religious and civic organizations like Soka Gakkai International (SGI) have become the moderator between the national and local government to facilitate long-term disaster resilience. Participant 2 said, “Including NCC, there are Catholics, Buddhist organizations, and SGI, and what I've seen from SGI is that they're very genuine in working with disaster-hit communities... Their political connection with Komeito is always helpful, because they will pick up a phone and try to make things happen for the NGO community”¹⁷ (September 2022). He highlighted how government authorities can better connect with communities, tap into local knowledge, and provide necessary resources through the support of civil society organizations.

4.3.3 Challenges of Coordination and Resource Allocation

Despite the benefits of collaboration between top-down and bottom-up approaches, experts also noted that structural challenges often hinder effective synergy. Participant 13 highlighted how local governments in Japan are understaffed, making it very difficult for them to properly implement national DRR policies or tailor them according to local needs. He said, “The local government has to make many decisions without sufficient references and material to utilize. Staff is not enough (more than double is needed)”¹⁸ (November 2022). He noted there is a long-standing confusion regarding collaboration levels between the two approaches, as local governments are uncertain about the expected support from the national government. He said, “Since the time before the disaster, urban planning has been regarded as a thing that the local authorities should do rather than a responsibility of the national government.”

Similarly, in the U.S., Participant 8 explained how post-Katrina recovery in New Orleans faced political resistance when the local government tried to incorporate community input into DRR decision-making. She said, “We designed a plan that did not go through the conventional political structure, setting up a Community Support Organization and asking the city council

¹⁷ This discussion highlights how religious organizations and local networks in Japan provide disaster relief through pre-disaster agreements, demonstrating collaboration between government, academia, and civil society.

¹⁸ This discussion highlights how In Higashimatsuyama, local administrations must make important decisions on recovery planning, without enough resources, guidance, or reference materials.

to nominate people from the communities to serve from their districts... (1500 evacuees participated) The mayor was insulted by the big government because he had wanted to receive the money directly and include the community”¹⁹ (November, 2022). This indicates how there is often a challenge of balancing the two approaches, as community-driven efforts can sometimes be perceived as a local government trying to receive more money from the national government.

Furthermore, funding limitations also create imbalances between national agencies and local communities. Participant 14 said, “Earthquake insurance in Japan needs more detailed risk information and pricing options for residents. Currently, it operates at the prefectural level with only four categories of damage classification, which is not insufficient”²⁰ (August 2022). He emphasized that in order to empower local governments and guarantee that recovery plans are both efficient and fair, there needs to be more flexibility in disaster planning and funding distribution.

Similarly, in the US, DRR funds often come with financial barriers where cost-sharing structures put forth by the national government require states and local governments to cover more than 25% of mitigation and recovery costs. Participant 15 said, “Barriers to mitigation are the cost-share question. From a mitigation context, states and localities can technically record volunteer hours, donated resources, and use that against the 25% cost share.” Additionally, Participant 15 said that even while the Biden administration prioritized funding for underserved populations execution of projects, it remained extremely complex: “40% of funding is supposed to be intended for historically underserved populations, decided by Executive Order.” An example of “Princeville, NC, a historically Black town prone to flooding and hurricanes, demonstrates these funding challenges. Princeville, NC, wiped out by Hurricane Floyd, wiped out again received \$1 billion to do some relocation of the community, working with the national preservation trust. Initially, it was said to move the entire town, but they responded by pushing back” (December 2022). These examples indicate the tension between funding among the two approaches, and there needs to be more flexible, inclusive funding mechanisms that would create more equitable disaster resilience.

4.3.4 Policy Recommendations

The expert also focused on the number of policy recommendations that would further improve the harmonization of top-down and bottom-up approaches.

1. Institutionalization of collaborative decision-making: Experts argued that the government should implement a formal structure with a feedback loop where local input reaches the national level. While some programs exist through FEMA or *machizukuri*,

¹⁹ This discussion highlights despite opposition from the mayor and city council, the Rockefeller Foundation and Greater New Orleans Foundation contributed \$3.5 million for Hurricane Katrina recovery preparations, creating a Community Support Organization.

²⁰ The 3/11 earthquake made it clear that thorough risk assessments and flexible emergency response plans are essential, since Japan's insurance system was unable to appropriately categorize damage.

one such potential policy suggestion is co-design or participatory project design (Federal Emergency Management Agency, n.d., & Kusakabe, 2013). This method allows us to involve all stakeholders throughout the entire process. Key principles of co-design are inclusivity, collaboration, empowerment, and the iterative process (Haque & Etkin, 2006). Civil society can act as mediators between the local populations and government agencies.

2. Long-Term Engagement Beyond Emergency Phases: Disaster recovery must extend beyond preparedness and immediate crisis response, involving long-term processing and community-led initiatives. Most experts argued that the memory and trauma of a disaster is a long-term negative impact that societies face, and these need to be addressed with the communities.

4.4 Comparative Analysis of U.S. and Japan

Experts from the U.S. and Japan emphasized the importance of community-based DRR, social networks, and integrating top-down and bottom-up approaches. While both nations share these priorities, their implementation differs. Japan's participatory *machizukuri* methods shape local DRR, but decision-making remains centralized. In contrast, the U.S. grants more autonomy to state and local governments, yet political resistance and funding constraints hinder community engagement, as seen in post-Katrina New Orleans. Both countries emphasize social capital, Japan through neighborhood associations (*chonaikai*) and the U.S. through non-profits. Public-private collaboration is also key, with Japan working with religious groups like Soka Gakkai and the U.S.'s CPRA partnering with fishermen in Plaquemines Parish. Experts note Japan struggles with bureaucratic conservatism limiting community decision-making, while the U.S. lacks sustained institutional support for local projects. The next section aims to develop a dynamic, integrated DRR framework.

5. TOWARDS A DYNAMIC AND INTEGRATED FRAMEWORK FOR DRR

The conventional structure of DRR is characterized by standardized solutions and institutional rigidity, often reinforcing a divide between top-down and bottom-up approaches. While academics and practitioners have long highlighted the importance of social capital and CBDRR in disaster resilience, these views often remain marginalized within policymaking. This has limited the capacities of communities to meaningfully shape unique DRR efforts (Aldrich & Meyer, 2014; Wolff, 2021). Findings of this study suggest that existing models still prioritize technical expertise, centralized decision-making, and standardized structures, which leave local actors with very little authority over a process that directly affects their lives. Thus, top-down policies alone cannot control disaster response; rather, a more flexible and inclusive governance structure that makes use of both institutional capacity and local knowledge is

required. The following is a four-step structure (Figure 2) that will help implement a more integrated DRR framework in the future.

1. Inform: Facilitate and Integrate
 - Utilize distinct community channels to ensure accessible and transparent information sharing occurs between communities and authorities.
 - Incorporate community opinions into official DRR frameworks so that they are not merely passive information consumers but actively involved in the planning and execution stages.
 - Governments serve as facilitators rather than sole decision-makers, and communities play the key role of sharing unique knowledge and are integrated into the formal DRR structure from planning through implementation.
2. Consult: Feedback-Driven Adaptation
 - Establish continuous dialogue with community members and co-define vulnerabilities and risks, ensuring that DRR structures are responsive to local needs.
 - Utilize participatory tools such as community meetings, citizen assemblies, and digital platforms where the authorities can collect and integrate feedback into decision-making.
 - As DRR initiatives develop, make sure consultation is an ongoing process that allows local actors to impact policy changes.
3. Collaborate: Institutionalizing Community Leadership
 - Move beyond advisory roles for communities by institutionalizing community participation. Let local leaders jointly develop procedures, early warning infrastructure, and recovery processes.
 - Create specialized local DRR agencies that serve as focal points for ongoing cooperation between governmental entities, local governments, and grassroots groups.
4. Support: Resource Access
 - Develop a participatory budgeting structure where local governments and local actors have direct access to funds without excessive bureaucratic restrictions.
 - Create a flexible funding mechanism that prioritizes equitable access for historically marginalized groups.
 - Provide logistical and technical support for community initiatives. where they need help.

This integrated approach must move beyond one-size-fits-all policies to context-specific governance models that emphasize local autonomy, continuous learning, and cross-sector partnerships.

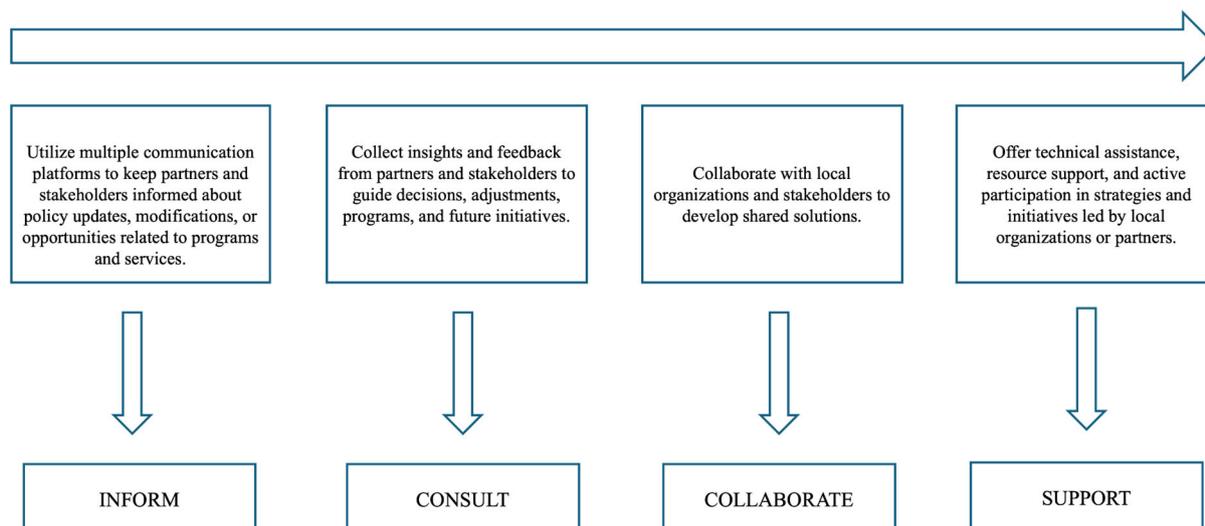


Figure 2. Integrated Framework for DRR

6. LIMITATIONS AND FUTURE DIRECTIONS

While the study highlights important elements of bottom-up DRR, it comes with several limitations. A significant limitation is the geographical representation, as this study focused on the United States and Japan, lacking representation from Europe and developing regions such as South America and Africa. This imbalance could potentially limit the diversity of experiences and provide a biased interpretation. Additionally, this is a small-N study, which, while sufficient for the study’s goal, limits the depth of insights. We were also limited in fully confirming a strong relationship between community engagement and long-term recovery.

Future research could benefit from focusing on these limitations and expanding the geographical reach, including a more diverse and representative sample of expertise. This will enhance the generalizability of the findings. Furthermore, looking into ways to include on-ground local roles, including community groups, NGOs, NPOs, or local businesses, possibly using scalable techniques like digital questionnaires or decentralized interviews, could help to confirm and amplify the knowledge of the themes found. These steps will allow a more representative and nuanced understanding of the bottom-up approach in DRR.

In conclusion, community-based strategies that cater to the local needs are essential in DRR. When institutional and governmental actions are taken separately, they often fall short and provide reactive responses to crises. Top-down strategies frequently ignore the needs, insights, and priceless contributions made by local resources and skills. The people who are most vulnerable to risks should be actively involved in all stages of DRR initiatives, from planning and decision-making to implementation. Thus, a system that fosters grassroots involvement can be established and promoted to greatly improve DRR frameworks worldwide.

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APPENDIX I: Interview Questions

Aspect	Question
Interviewee information	Please tell me your name and position in your organization.
Related organization(s)	What kinds of work do you and your organization do in (area) to mitigate climate change?
Projects/efforts related to climate mitigation	What major projects/efforts involved with climate mitigation are you and your institution pursuing?
Disaster risk reduction efforts	What is the main disaster risk reduction action plan in place for (area)?
Recovery planning	What type of recovery plans exist post disaster in (area)?/ How did the (area) recovery planning process evolve after (specific disaster)?
Type infrastructure	Would you characterize these efforts as primarily focused on physical infrastructure or social infrastructure?
Different government level support	What role does your organization play in coordinating with other federal and local agencies? Any harmony between the levels?
Bottom-up?	Do these efforts include top-down strategies/bottom-up strategies? Give us an example.
Local community engagement	Do these projects involve local residents, community organizations, or civil society?/ What was the role of community engagement in the recovery efforts?
Resources for communities	How are resources distributed among communities? What challenges did low-income communities face in accessing disaster recovery resources?
Social networks	How have social networks contributed to the recovery process?
Status at the time of interview	What is the current status of the project?