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Article

Differential Risk and the Elements of Resilience: A Framework for Advancing Disaster Risk Reduction

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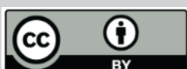
ABSTRACT

Traditional Disaster Risk Reduction (DRR) models often cconceptualize risk as a uniform condition affecting populations and assets equally. This article challenges that paradigm by introducing the concept of differential risk—a framework that recognizes risk as a variable, context-specific phenomenon experienced at distinct, quantifiable levels by various elements at risk. These elements—ranging from individual lives and livelihoods to infrastructure and ecosystems—possess differing capacities to withstand and recover from hazards, even under identical physical impacts. The core argument is that an element's intrinsic capacity to survive and bounce forward, together with the state of support systems and structures (its "resilience capacity"), fundamentally determines its risk profile. By integrating this understanding into DRR practice allows for a shift from generalized, top-down approaches towards more precise, capacity-based strategies that yield nuanced, targeted, and ultimately more effective risk-informed plans and solutions. The paper elaborates the theoretical foundations of differential risk and presents a practical framework for its application in DRR policy, planning, and implementation.

KEYWORDS

Differential risk; vulnerability; capacity; disaster risk reduction; resilience; climate change adaptation; hazard; preparedness; risk management.



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1. Introduction

1.1. Background: The Evolution of Disaster Risk Reduction (DRR) from Reactive Response to Risk-Informed Development

Over the past decades, DRR has undergone a paradigm transformation from a reactive response toward proactive, anticipatory, and risk-informed development approach. While this evolution is well documented, prevailing models still tend to aggregate risk uniformly across population, often overlooking local capacity differentials that shape real disaster risk and resilience outcomes. The transformation should reframe disasters not as inevitable "natural events" but as the outcome of hazard interaction with the degree of vulnerability of the Element at Risk and capacity shaped by social, economic, and political choices. Understanding this trajectory is essential for situating current debates on precision and equity in DRR.

Historically, global DRR thinking evolved through three overlapping paradigms: (1) hazard-centric models of the 1970s–1980s, (2) vulnerability and socio-economic analysis during the 1990s, and (3) the integrated resilience paradigm emerging in the 2000s. Frameworks such as Hyogo (2005–2015) and Sendai (2015–2030) institutionalized the idea that effective risk governance must be systemic, multilevel, and participatory. Despite this progress, risk models remain generalized and tend to mask intra-community disparities in exposure and capacity. Recognizing these differential conditions is crucial for achieving the Sendai priorities of precision and inclusion.

1.1.1. From Emergency Response to Prevention

For much of the 20th century, disaster management was dominated by post-event response—focusing on rescue, relief, and reconstruction once a hazard struck. While life-saving in the short term, this model failed to address underlying drivers of vulnerability, and later we called it disaster risk and offered limited long-term protection (UNDRR, n.d.).

A major turning point came with the International Decade for Natural Disaster Reduction (IDNDR, 1990–1999), which introduced prevention as a core element of development and was codified in the Yokohama Strategy and Plan of Action for a Safer World (1994) (UN-SPIDER, n.d.). This era marked a conceptual pivot away from purely reactive measures toward prevention and preparedness.

1.1.2. Institutionalizing Resilience: The Hyogo Framework

The Hyogo Framework for Action (HFA, 2005–2015) built on this momentum by providing the first global blueprint for resilience building. Its five priorities—such as making DRR a national and local priority and reducing underlying risk factors—mainstreamed DRR into policy and development planning worldwide (UNISDR, 2005).

1.1.3. The Rise of Risk-Informed Development

The transition matured with the Sendai Framework for Disaster Risk Reduction (2015–2030), which extends beyond hazard mitigation to advocate systemic risk management integrated into all sectors of development and investment. Sendai's four priorities—understanding risk, strengthening governance, investing in resilience, and enhancing preparedness to "build back better"—redefined recovery not merely as reconstruction but as an opportunity to increase resilience to future shocks.

1.1.4. DRR and climate change adaptation: Converging goals and shared policy space

Disaster Risk Reduction and Climate Change Adaptation (CCA) are fundamentally identical in their core objective: to enhance societal resilience by reducing disaster risk to hazards. They occupy a

shared policy space, driven by the fact that many disasters are exacerbated by climate change. As all climate-related extreme events are considered hazards from a DRR perspective, the two fields are inextricably linked. Climate change intensifies hydrometeorological hazards like floods and droughts by altering their frequency and intensity, directly increasing disaster risk. This relationship is mutually reinforcing: DRR strategies such as early warning systems and resilient infrastructure serve as critical components of climate adaptation, while climate projections inform DRR planning, enabling a forward-looking approach to risk management. Both fields share the common goal of building resilience by addressing vulnerability **(Schipper, 2009)**, ultimately making their practices indistinguishable in the face of escalating global risks.

1.2. Problem Statement: ***Disproportionate capacity and differential risk***

Despite advancements in hazard and exposure mapping, traditional DRR has focused heavily on reducing hazards and exposure while neglecting the critical roles of vulnerability and capacity (Cardona et al., 2012; Lavell et al., 2012). Academic literature supports this critique: Prevailing one-size-fits-all strategies are fundamentally flawed because communities and individuals are not homogeneous; their resilience is determined by diverse social, economic, and institutional factors (Cutter et al., 2008; Norris et al., 2008). A strategy effective for a wealthy, well-resourced community may be entirely inadequate for a low-income or marginalized population lacking social capital, financial resources, or institutional support (Karim & Noy, 2015; UNISDR, 2015). This mismatch leads to misallocation of resources and failures to build genuine resilience where it's most needed.

The core issue isn't a lack of data on hazards, but a lack of understanding and integration of human and systemic capacity into risk assessment (Hagelsteen & Becker, 2019). Shifting to a capacity-centric framework is crucial for developing more equitable and effective DRR policies (Peck et al., 2022). Such a framework would not only assess potential threats but also evaluate and enhance the inherent ability of populations to adapt, cope, and transform in the face of disaster.

Indeed, evidence from disaster-prone communities shows that conventional aid often fails to address differential needs. For example, a recent study in the Philippines and Bangladesh found that traditional post-disaster cash assistance was fragmented and not aligned with local recovery priorities, underscoring the need for risk-informed, inclusive approaches.

Statement of the problem: Modern DRR's and climate change adaptations (CCAs) have the fundamental problem that uniform, one-size-fits-all strategies fail to address the disproportionate and unequal outcomes of hazard events. While significant progress has been made in mapping hazards and exposure, this approach overlooks the crucial variable of capacity—the ability of individuals, communities, and infrastructure (any elements at Risk) to survive and bounce forward, along with the support systems and structures in place. As a result, interventions often misallocate resources, overprotect some groups while under-serving others, and fail to reflect the real spatial and social heterogeneity of risk.

This paper therefore advances a *differential-risk framework* that explicitly measures the gap between required and existing capacities—the point where risk becomes actionable. By redefining vulnerability and capacity as dynamic, interacting elements rather than fixed states, the model allows for more precise prioritization of DRR actions.

1.2.1. The Conceptual Gap in Disaster Risk Reduction: From Uniform Models to the Analysis of Differential Risk

The discourse on disaster risk has evolved significantly from a singular, physical-technical model to a more nuanced, social-ecological framework that acknowledges the differential impacts of a hazard event. The fundamental flaw in traditional models lies in the assumption that risk is a uniform, absolute force, which often conflates a hazard's intensity with a population's mere presence in a hazard-prone area (exposure). This oversimplification leads to generic, one-size-fits-all interven-

tions that fail to address the specific and varied risks that determine a disaster's true impact. A single flood, for example, will have vastly different consequences for a low-income family in a poorly constructed home compared to a high-income family in a resilient structure, even within the same geographic zone. This highlights that a disaster's outcome is not solely a function of the hazard but of the complex interplay between the hazard and the inherent characteristics and capacities of the exposed elements.

Academic thought has been instrumental in dismantling this uniform risk paradigm. Piers Blaikie et al. (1994), in their seminal work, challenged the notion of "natural disasters," arguing instead that they are a product of the interaction between a natural hazard and a vulnerable population. Their Pressure and Release (PAR) model provided a conceptual breakthrough by linking a disaster's outcome to the root causes of vulnerability, such as political and economic processes, and acknowledging that risk is inherently a product of social and economic factors, not just physical location. Building on this, Susan Cutter (1996) and others developed the concept of social vulnerability, which posits that a person's susceptibility to harm is a function of their socioeconomic status, age, gender, race, and access to resources. This perspective solidifies the argument that a community's capacity to survive and bounce forward is the true determinant of its risk profile, thereby highlighting the inadequacy of any model that ignores these social dimensions.

This evolution in academic thought is reflected in and validated by major international policy frameworks. The United Nations Office for Disaster Risk Reduction (UNDRR, 2017), through the Sendai Framework, has adopted a comprehensive definition of risk that explicitly separates its components: hazard, exposure, vulnerability, and capacity. This framework formalizes the distinction between being located in a hazard zone (exposure) and having the susceptibility to be harmed (vulnerability). It also introduces capacity as a critical, measurable variable that can be strengthened to reduce risk. This widely accepted framework provides the theoretical and practical foundation for a more precise, nuanced, and effective approach to DRR, moving beyond a flawed uniform model to one that can design targeted interventions based on a deeper understanding of a population's differential risk.

1.3. Thesis: Proposing a new framework centered on differential risk to improve the precision and effectiveness of DRR strategies.

To improve the precision and impact of DRR strategies, we propose a fundamental shift from the conventional uniform-risk model to a framework centered on **differential risk**. This approach acknowledges the varying degrees of vulnerability and capacity among different elements at risk. By identifying how specific individuals, households, infrastructure, and ecosystems differ in their exposure to a given hazard and in their capacity to survive and bounce forward, and the effective and efficient support system and structure, we can design targeted, equitable, and efficient interventions. In short, focusing on differential risk allows DRR planning to move beyond generic assessments and develop solutions tailored to the distinct needs of the most at risk, ultimately building more resilient communities.

2. Methods

This study employs a grounded-theory design integrating both experiential and documentary data to examine how risk and resilience are conceptualized and operationalized in disaster contexts.

2.1. An Iterative Grounded Theory Approach

The development of this conceptual framework on differential risk is based on an iterative qualitative methodology, primarily employing a grounded theory approach (Strauss & Corbin, 1998). This process was not linear but **cyclical**, involving a continuous interplay between empirical obser-

vation, theoretical analysis, and conceptual synthesis. Such methodology is well-suited for generating novel theory from real-world data and experience, effectively moving from the specific to the general through repeated refinement.

2.1.1. Phase 1: Inductive Data Collection and Open Coding (30-Year Longitudinal Study)

The author's thirty-year professional practice in disaster management, humanitarian coordination, and policy implementation serves as a longitudinal field study providing real-world data on the evolution of DRR thinking across Asia, Latin America, and Africa. Rather than following a formal research design, the author's extensive professional engagements served as the primary "field site," offering a natural laboratory for observing and documenting real-world dynamics of risk and resilience. An iterative process of open coding was employed to identify key patterns, recurrent challenges, and implicit relationships emerging from disaster scenarios and community responses. These insights were systematically captured in professional notes, project reports, and institutional reflections. Data from diverse field contexts including United Nations engagements, community initiatives and facilitator training materials such as the *Risk-Informed Local Governance: Enhancing Resilient Communities Training Facilitators' Manual (Philippines)*—enabled the organic emergence of core concepts that would later shaped the foundation of the differential risk framework.

SPS-DRM

Triangulation was achieved by comparing and cross-validating findings from field observations with academic literature, national DRR frameworks, facilitator tools, and policy documents, thereby ensuring analytical rigor and reducing subjectivity. Primary data included reflective field notes, project documentation, stakeholder feedback from programs conducted across Southeast Asia (1995–2024). Secondary data encompassed peer-reviewed studies, global DRR frameworks, national policy documents, and facilitator guidance manuals, providing comparative reference points and deepening theoretical refinement.

2.1.2. Phase 2: Deductive and Comparative Analysis (Selective and Axial Coding)

A rigorous desk review was conducted to formally analyze the "raw" insights from Phase 1. This phase served a dual purpose: (a) a deductive review of the author's own prior work (e.g. books, articles, reports), and (b) a comparative analysis against established academic literature on DRR, vulnerability, and resilience (e.g., Wisner *et al.*, 2004; UNISDR, 2017; Adger, 2006). In grounded theory terms, this corresponds to selective and axial coding – initial ideas were refined, categorized, and linked to existing theoretical constructs. The goal of Phase 2 was to identify and articulate the conceptual gaps in mainstream approaches, thereby validating the need for a new framework. For example, the review highlighted how conventional models often treated risk uniformly, overlooking the nuanced differences in vulnerability and capacity that Phase 1 had revealed.

2.1.3. Phase 3: Theoretical Integration and Conceptualization

Phase 3 represents the core of the research: the synthesis of empirical data and theoretical analysis into a coherent conceptual framework. The "sudden realization" mentioned by the author is framed as a moment of theoretical integration, where the coded concepts from Phase 2 converged with the experiential patterns from Phase 1. This led to the development of the novel, cohesive framework of differential risk. In this phase, the researcher formalized the core definitions, propositions, and even a fundamental equation for disaster risk (presented later in the paper). The emphasis was on moving beyond descriptive insight to proposing a new explanatory model for understanding risk. In practical terms, Phase 3 yielded the key components of the framework—including refined definitions of vulnerability and capacity and the recognition of risk as a non-uniform, dynamic variable.

2.1.4. Phase 4: Dissemination and Articulation

The final phase focused on structuring and articulating the research findings into an academic form. The framework developed in Phase 3 was organized into a logical, persuasive narrative suitable for publication. Illustrative case examples and personal anecdotes from the inductive Phase 1 were woven in as empirical evidence, grounding the theory in practical reality. References to prior scholarly work were strategically incorporated not only to provide context but also to demonstrate how the new framework addresses existing theoretical inconsistencies while building upon a recognized intellectual lineage. The outcome of Phase 4 is a personalized yet rigorously articulated lens on disaster risk, intended to resonate with both practitioners and an academic audience.

3. Results and Analysis

The analysis generated the *Differential Risk Framework*, comprising interlinked elements: hazards, exposure, elements at risk, capacities, and capacity gaps.

3.1. The conceptual framework of differential risk

SPS-DRM

3.1.1. Defining "Element at Risk". A comprehensive typology that goes beyond static physical assets to include dynamic social, economic, and ecological systems.

In Disaster Risk Reduction (DRR), an *element at risk* define as any unit —human, material, institutional, or environmental—whose exposure to hazard is influenced by its adaptive capacity and susceptibility to loss. The concept has evolved from a narrow inventory of exposed physical assets to a holistic understanding that includes a community's entire ecosystem of people, livelihoods, and environments that collectively determine a community's resilience.

The United Nations Office for Disaster Risk Reduction (UNDRR) defines these elements as "people, their livelihoods, environmental services, and economic and social assets" (UNDRR, 2017). They can be categorized into three key areas:

- *People:* Individuals, communities, and particularly at-risk groups (e.g., children and the elderly).
- *Physical & Economic Assets:* Built infrastructure like homes, roads, bridges, and hospitals, and economic resources like crops, livestock, and businesses.
- *Ecological Services:* Natural systems such as forests and coral reefs that are vital for both the environment and human well-being.

Understanding and mapping these elements is the foundational step for effective risk assessment. The elements at Risk is the subject matter of the risk assessment and analysis. The level of risk is a function of the hazard, determining the degree of vulnerability of the specific elements at Risk to the hazards and defining the required capacity to prevent and mitigate the hazards and what capacity the elements at Risk requires to survive, bounce forward, and support systems and structures in place. Ultimately, a modern DRR approach recognizes the differential risk of each element, moving beyond a generic strategy to one that is targeted and equitable, ensuring protection and preferential options for the most at risk.

Disaster Risk = Hazard x Vulnerability / Capacity

There are capacities that address the hazard, which are hazard prevention capacity and mitigation capacity.

There are specific capacities that address the degree of vulnerability (high, medium, and low), which is the capacity of an individual to survive and bounce forward and the capacity of the systems and structures to effectively and efficiently support the survivability and bouncing forward of a specific elements at Risk.

3.1.2. What is differential risk?

In the evolving conceptual framework of Disaster Risk Reduction (DRR), "differential risk" refers to the critical understanding that various "element at risk" within a community—ranging from individuals and households to livelihoods such as crops and livestock, infrastructure such as houses, roads, and bridges, ecological services, and institutions such as the systems and structures—experience distinct and quantifiable levels of risk from a specific hazard. This framework highlights that risk levels vary (high, medium, and low risk) among similar elements at risk, such as young females in hazard-prone areas aged 6-18, due to their individual capacities and the state of the support system and structures in place, challenging the notion of uniform risk exposures. Similarly, for example, within the same flood zone, a house with a higher elevation and access to better building materials has a greater capacity to resist damage, resulting in a lower risk classification. On the other hand, a nearby house with a lower elevation and fewer protective measures would be considered high-risk. While a hazard's physical impact might be widespread, the intrinsic ability of each element to survive, "bounce forward," and effectively use enabling support systems varies profoundly based on its own existing capacities. This difference highlights the critical need to recognize the diversity and resilience of each elements at Risk in areas prone to hazards for effective risk-informed plans and solutions.

Therefore, differential risk is the concept that the level of risk from a specific hazard isn't uniform, even within a single vulnerable area. Instead, it varies significantly among similar elements, whether they're houses, individuals, or businesses. This variation is a direct result of the specific socio-economic, political, and cultural capacity of each element to withstand a hazard. This deeper insight goes beyond static, one-dimensional risk assessments to acknowledge that results are primarily influenced by the distinct capacities, resilience, and systemic factors intrinsic to each entity.

3.1.3. Revisiting the disaster risk formula

The A basic model often used to express disaster risk is:

Many trace this formulation to Blaikie et al. (1994), who reframed disasters as a product of natural hazards and human vulnerability rather than purely natural events. Building on this foundation, modern frameworks include capacity as a crucial factor that can *reduce* risk, often incorporating it into the formula as:

This evolution is reflected in the practices of The United Nations Office for Disaster Risk Reduction (UNDRR), formerly UNISDR, and other international bodies, including the European Commission's Disaster Risk Management Knowledge Centre (DRMKC), have adopted this more holistic view. The formula is a simplified representation of the complex interactions that determine risk, highlighting that by increasing capacity and reducing vulnerability, a community can significantly lower its risk, even if the hazard remains the same.

The formula is not tied to a single, verifiable origin but rather represents the consensus of a body of academic work and institutional practice in disaster risk reduction. The concepts and terminology are widely used in frameworks like the Sendai Framework for Disaster Risk Reduction 2015-2030 to guide global and national efforts in managing disaster risks even in the face of persistent hazards.

3.2. Beyond the standard model: Toward differential risk assessment

3.2.1. Reframing risk assessment and analysis

Traditional risk assessments typically model risk as a simple product of hazard probability and the exposed assets within an area. This approach has been criticized for failing to capture the nuanced reality of disaster impacts (Cardona et al., 2012). By treating vulnerability as a uniform attribute and ignoring existing capacities, such assessments miss differential risk – the fact that even under the same physical event, different elements experience very unequal outcomes (Wisner et al., 2004; Adger, 2006).

For example, a standard flood risk map might label an entire neighborhood as high-risk based on flood depth, but it won't reveal which families have boats or elevated homes that mitigate their risk, or which families lack the resources to recover from even minor flooding. As a result, conventional assessments can mislead policymakers, leading to oversimplified, one-size-fits-all mitigation plans that overlook who or what is most at risk.

In summary, while traditional assessments are useful for initial hazard and exposure mapping, they are fundamentally limited. They often overgeneralize vulnerability and ignore the varying levels of resilience (capacity) among affected elements (Cutter et al., 2008). A shift is needed toward more sophisticated frameworks that disaggregate risk and recognize vulnerability as dynamic and context-specific (Gallopín, 2006). Only then can DRR strategies become more precise, equitable, and effective in safeguarding the most at risk members of society.

A telling example comes from community-level studies: Vulnerability and Capacity Assessments (VCAs) often reveal intra-community differences that generic models overlook. One household might have savings, insurance, or strong social networks to draw on during a disaster, while a neighbor has none of these buffers. Ignoring these differences leads to response plans underprepared to aid those who need help the most.

3.2.2. Strengths and weaknesses of VCA

A Vulnerability and Capacity Assessment (VCA) is a participatory method that provides a grassroots perspective on risk by identifying both vulnerabilities and existing capacities in a community. Its strengths lie in its holistic, bottom-up approach: VCA moves beyond hazard-centric models to uncover social, economic, and institutional factors contributing to risk **(Cardona et al., 2012)**. It empowers communities by involving them in identifying their own risks and resources, often revealing differential risk among community members (for example, highlighting how a disaster might affect women, children, or the elderly in unique ways) (Wisner et al., 2004; Hagelsteen & Becker, 2019). This leads to targeted and more equitable interventions, as the process inherently acknowledges that a single hazard can have varied impacts across different groups (UNISDR, 2015).

However, VCA's qualitative, localized nature also presents weaknesses. The data can be subjective and difficult to compare across communities or scale up to national planning (Cutter et al., 2008). The process is time-consuming and resource-intensive, and it can raise community expectations that, if unmet, lead to disillusionment (Hagelsteen & Becker, 2019). Moreover, while VCA can pinpoint local vulnerabilities, it often fails to address broader systemic drivers of risk, like governance or economic inequality, which require higher-level policy action (Lavell et al., 2012). In practice, the rich insights of VCA sometimes remain underutilized, as translating community-specific findings into large-scale policy or investment decisions can be challenging.

3.3. An integrated approach: Combining qualitative and quantitative risk assessment

While VCA provides invaluable qualitative insights, there is a need for an integrated approach that also quantifies risk differences among specific elements at risk. Traditional community risk

mapping tools—such as the *Building Resilient Communities* manual **(IIRR & Cordaid, 2007)** and participatory mapping guides—were seminal in promoting community engagement, but they highlighted the need for systematic data to complement local knowledge. Our framework advocates collecting both qualitative narratives and quantitative indicators for each elements at Risk.

By quantifying aspects like income, building integrity, social support networks, and access to early warnings for each household or asset, we can create a matrix of differential risk. This matrix captures how a specific hazard (say, a 6.0 earthquake or a Category 4 cyclone) would likely impact each elements at Risk differently. Combining this with qualitative context (e.g., why a particular household is more at risk or what coping mechanisms it has) yields a comprehensive risk profile.

3.3.1. Redefining Risk: The Resilience Paradigm

The author, Rustico "Rusty" Biñas (2018), in his work on The Resilience Paradigm: Facts for Transformation, offers a powerful critique of traditional, generalized disaster risk models. The central argument is that resilience is not a generic concept but is highly specific and dynamic, determined by a complex interplay of individual, collective, and contextual factors. The core of the framework rests on the idea that a hazard is the anchor of risk assessment because it dictates the specific capacities needed for the survivability and the ability to "bounce forward" for a specific elements at Risk and the responsive support system and structures. In addition, the capacity to address the hazard, which is the hazard prevention and mitigation.

- **Hazard-specific:** Capacity to handle one hazard (e.g., flooding) does not automatically translate to another (e.g., earthquakes); each requires distinct preparations and resources.
- **Element at risk-specific:** Resilience varies by elements at Risk. For instance, a healthy three-year-old girl and a chronically ill three-year-old girl will not have the same resilience needs in the face of the same flood. This exemplifies differential risk: inherent characteristics of each individual lead to different outcomes despite identical hazard exposure.
- **Space-specific:** Location matters. The resilience of a person in an urban area with robust infrastructure and services differs greatly from that of a person in a remote rural area. Local environment, governance quality, and socio-economic conditions influence the capacity to manage risk.
- **Time-specific:** Resilience is not static. It can be strengthened or weakened over time. The time of day a disaster strikes, or a sequence of events (like multiple disasters in quick succession), or the harvest season can alter community resilience by either allowing recovery or compounding capacities.

Biñas contends that a lack of resilience often stems from capacity deficits either at the individual level (mental, physical, and spiritual knowledge, well-being, livelihood and resources) or the collective level (governance systems, community networks, and infrastructure). By recognizing the specificity of resilience along these four dimensions, interventions can be tailored more precisely. A uniform risk model fails here because it might assume all residents in a floodplain face identical risk, whereas a differential risk lens identifies who has a boat or savings (lowering their risk) versus who is bedridden or socially isolated (heightening their risk).

3.3.2. Unpacking Vulnerability: Proximity vs. Conditions

In our refined framework, we simplify the concept of vulnerability to focus on proximity or exposure to the hazard. Essentially, vulnerability is determined by how directly an element is in harm's way (categorized as high, medium, or low exposure). All other aspects traditionally lumped into "vulnerability" (building quality, social networks, preparedness, etc.) are reclassified under capacity. This separation avoids double-counting and clarifies analysis:

- Vulnerability = Hazard proximity of a specific element at risk: How exposed the element is (e.g., living in a floodplain = high vulnerability to floods).

- Capacity = Resilience factors: The qualities enabling the element to survive and bounce forward and the enabling systems and structures (e.g., a house on stilts, an evacuation plan, savings and insurance, and community support groups).

Risk can then be expressed as:

We further distinguish capacity into two parts: (1) capacity to *prevent or mitigate* the hazard impact (e.g., flood defenses, retrofitted buildings) and (2) capacity to *survive and bounce forward (individual capacity and the state of the responsive systems and structures (collective capacity)* (e.g., basic rights, well-being and livelihood, ecosystems, systems and structures—social safety nets, local, national, and international policy)).

This reframing means we no longer say a community is vulnerable because it's poor (poverty becomes a lack of capacity). Instead, we say the community is highly exposed (e.g., living on an eroding coastline) and has low capacity (e.g., limited resources and support). This distinction is practical because exposure is usually fixed in the short term (you live in a hazard zone or you don't), whereas capacity can be built up.

By defining vulnerability strictly as physical exposure, our risk assessment becomes clearer and more actionable. If a village is highly exposed to landslides (steep, denuded slopes) and currently has low capacity (no early warning, fragile houses), the differential risk framework pinpoints *what specific capacity to build* to reduce risk—perhaps reforestation to stabilize slopes (hazard mitigation capacity) and constructing evacuation shelters (survival capacity).

This approach aligns with and builds upon established ideas but makes them operational. It resonates with community-based DRR practices, such as focusing on the most exposed households for relocation or reinforcement while strengthening community organization and response systems (collective capacity).

In essence, our paradigm shift is to define the risk problem in terms of solvable components: reduce exposure where possible, and systematically build the capacities needed for the exposure that remains. By doing so, we offer a more precise and empowering path to resilience than broad notions of vulnerability that often lead to generic solutions.

3.4. Capacity as the determinant of risk

The resilience framework illustrated the capacity interaction in the resilience framework, showing that **individual capacity** and **collective capacity** are inextricably linked. An individual's ability to survive and bounce back from a hazard depends not only on their personal resources but also on the strength of the systems and structures around them. The framework demonstrates that a person's resilience is a product of their personal foundation of safety, which is then reinforced and sustained by the resilience of their community, environment, and the broader policy and global systems.

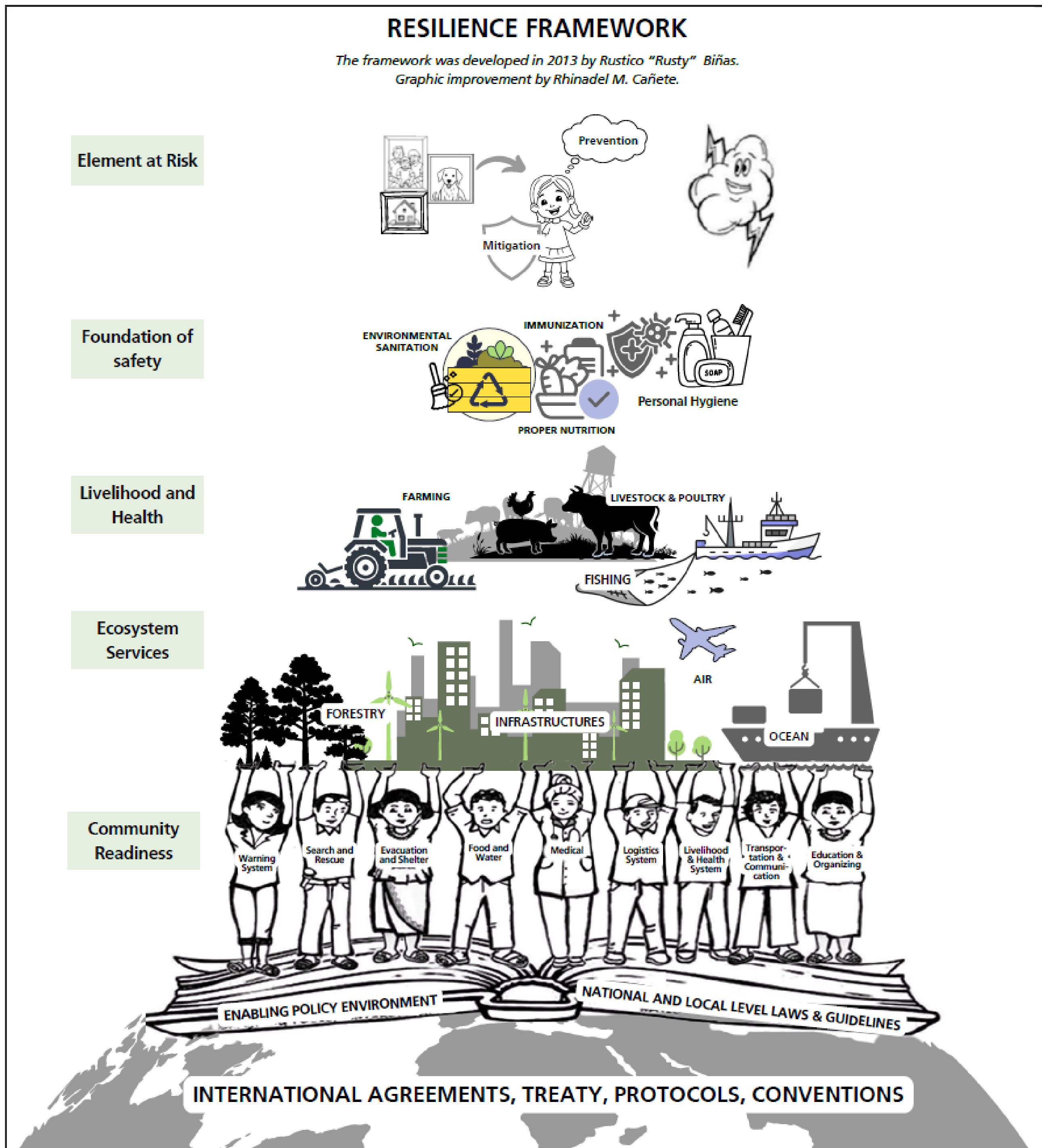

Figure 1. Practical Interaction in the Resilience Framework. The resilience framework. This illustrates the interaction between individual and collective capacity as a series of interlocking, hierarchical supports. This "ladder" of support shows that an individual's resilience is built from the bottom up, with each level depending on and reinforcing the others.

Table 1. Understanding the Resilience Framework

Elements	Thematic representation	Element-at-risk specific measures	Hazard-specific measures	
Elements at Risk	The subject	Center of unit of analysis		
Foundation of safety	Survivability	**First-level capacity support:** food, water, sanitation & hygiene, clothing, shelter		
Livelihood and health realm	Bouncing back	**Second-level capacity support:** ecosystem-based livelihood, healthy living for strong labor force (well-being)		
Ecosystem services	Supports survivability and bouncing back	**Third-level capacity support:** water quantity & quality, air quality, food, shelter materials, fodder for animals		
Community readiness	Systems and structures that help individual elements at risk survive and bounce back	**Fourth-level capacity support:** early warning, evacuation, search & rescue; prepositioned food & water; medical & sanitation supplies; transport & communication; community health workers; ecosystem restoration		
Enabling policy environment	Ensuring human security	**Fifth-level capacity support:** local governance rules/regulations, customary laws		
International treaties, protocols, calls for action	Global order	**Sixth-level capacity support:** aligned & non-aligned agreements	Prevention	Mitigation

3.4.1. *Individual Capacity: The Foundation*

- **Level 1: Foundation of Safety.** This is the most basic level of individual capacity. It's about a person's access to basic needs like food, water, shelter, and sanitation. The text notes that these needs are crucial for an individual to survive the first 72 hours after a hazard events.
- **Level 2: Livelihood and Health.** This level supports an individual›s ability to «bounce back.» A healthy person with a stable livelihood is better equipped to recover from a hazard events. This is still largely an individual-focused capacity, but it's directly influenced by external factors like access to healthcare and employment opportunities.

3.4.2. Collective Capacity: The Systems and Structure

The next levels of the framework represent the collective capacities—the systems and structures that support individuals.

- **Level 3: Ecosystem Services.** This is a critical collective resource. A healthy ecosystem provides essential services like clean water, air, and materials for survival and bouncing forward

(well-being and livelihood). A person's individual capacity to survive and bounce forward is directly tied to the health of the shared environment.

- **Level 4: Community Readiness.** This level is where collective action becomes most apparent. It includes systems like early warning, evacuation plans, and search and rescue teams. An individual's survival and recovery are vastly improved by the presence of these organized community efforts. A person with strong individual capacity can even contribute to these systems, thus strengthening the collective.
- **Level 5: Enabling governance and policy.** Supportive policies, responsive governance, and rule of law ensure that communities have external support and resources. This includes enforced building codes, social protection schemes, and equitable disaster response policies.
- **Level 6: Global systems.** International frameworks, aid mechanisms, and knowledge-sharing platforms represent the broadest support structure. Global initiatives (like climate funds or international humanitarian assistance) can bolster national and local efforts in resilience-building.

These levels interact as an interlocking hierarchy: a failure at a higher level can undermine the levels below. For example, poor governance (Level 5) can negate community efforts (Level 4) by failing to provide resources or by corruption. Conversely, a strong community (Level 4) can compensate to some extent for gaps at Level 5 by self-organizing and advocating for their needs.

Practically, to assess risk via capacity, one asks: for a given hazard, what capacity levels are required for an individual or community to not just survive (Level 1) but also "bounce forward" (Levels 2 and up)? The **degree of risk** then correlates with the gap between needed capacity and existing capacity:

- **High risk:** A large capacity gap. The Elements at Risk lacks many of the necessary supports at multiple levels.
- **Medium risk:** A moderate gap. Some supports are in place, but key weaknesses remain.
- **Low risk:** A small or negligible gap. The element has most capacities covered, making it resilient.

For example, consider a coastal village facing cyclones. If the village has an effective early warning system (Level 4), a mangrove forest buffer (Level 3), and most households have sturdy houses and savings (Levels 1–2), the overall risk is low despite high exposure. But if another similar village lacks those supports (no warnings, degraded mangroves, poor housing, no savings), its capacity gap is huge—hence its risk is high.

By systematically evaluating each capacity level for each Elements at Risk, practitioners can pinpoint where interventions are needed most. Perhaps a community has strong social networks (Level 4) but a poor water supply (Level 1) that fails in droughts—addressing that water supply can drastically cut risk. Or an individual might be healthy and skilled (Level 2) but lacks access to markets or jobs due to broader economic issues (Level 5)—the solution might lie in infrastructure improvements or policy changes.

It emphasizes this dynamic relationship: a person with a strong foundation of safety (individual capacity) can actively participate in community organizations, helping others and strengthening the entire system (collective capacity). Conversely, a weak collective system—marked by an ineffectual justice system, unequal access to resources, or a disregard for human rights—weakens an individual's foundation of safety, making them more at risk to a hazard. Therefore, to truly assess and build resilience, you must look at both the individual's inherent strengths and the robustness of the interlocking systems and structures that support them.

The resilience framework can therefore serve as a guide for determining the capacity needed for a particular hazard, which gives you a better understanding of how to direct the risk assessment because capacity is what determines the degree of risk.

3.5. Applying differential risk: Community risk mapping in practice

Since its publication in 2007, the *Building Resilient Communities* training manual has helped thousands of DRR practitioners worldwide **(IIRR & Cordaid, 2007)**. One of its key contributions is a community risk assessment process that inherently uses differential risk principles to prioritize actions. In a typical community risk mapping exercise:

- The hazard is characterized (e.g., the cause/origin, the force, the early warning signs and signals, forewarning, speed of onset, frequency, period of occurrence, and duration).
- The community maps elements at risk (households, infrastructure, crops, etc.) and identifies the degree of vulnerability of the specific Elements at Risk (e.g., houses the flood zones are highly vulnerable to flood).
- For each element, participants discuss capacity: what capacities required to address the hazard prevention and mitigation, and capacities to address the individual and collective capacity, what is existing per Elements at Risk and what are the gaps) .

The output is often a table or map highlighting which specific people or assets are at **high risk**, **medium risk**, or **low risk** for the given hazard. High-risk elements have large capacity gaps relative to the hazard (for instance, a family living by a river in a flimsy house with no savings or support network), whereas low-risk elements have small or no capacity gaps (perhaps a family in the same flood zone but with a raised, reinforced house and a boat, plus relatives in a safe area).

Table 2. Sample Differential Risk Assessment by Elements at Risk *(for Floods)*

The subject of risk assessment and analysis	Quantitative Data			Qualitative Data	Quantitative Data			Qualitative Data	Quantitative Data			Qualitative Data	Total Number
Elements at Risk in proximity to the hazard	Highly Vulnerable			Capacity Gaps	Medium Vulnerable			Capacity Gaps	Low Vulnerability			Capacity Gaps	
Degree of Risk	High Risk	Medium Risk	Low Risk		High Risk	Medium Risk	Low Risk		High Risk	Medium Risk	Low Risk		
Boys 0-2 years old	5	2	3		3	3	1		1	0	2		18
Girls 0-2 years old	9	2	2		2	1	1		0	1	3		20
Preschool girl	3	0	1		3	0	0		2	2	0		11
Preschool boy	2	0	1		4	4	0		0	0	2		13
Female 6-18 years old	5	2	1		3	0	0		0	0	4		15
Male 6-18 years old	2	2	2		1	1	0		1	1	1		11
Female, 18-60 years old	4	2	2		3	0	1		3	2	1		18
Male, 18-60 years old	10	0	2		2	2	2		1	1	2		22
Female above 60 years old	3	2	4		4	1	0		0	0	1		15
Male above 60 years old	2	3	2		1	1	1		2	2	0		14
Primary School Building	0	1	2		2	0	0		0	0	1		6
House	7	2	1		0	3	0		0	0	2		15
Bridge (river crossing)	2	0	0		0	0	1		1	0	0		4
Rice Crops	5 hectares	3 hectares	2 hectares		2 hectares	2 hectares	1 hectares		3 hectares	0	0		18 hectares
Livestock (Cattle)	5	2	1		2	0	2		1	0	1		14
Etc.													
Total													
Note: “Capacity gaps” represent the difference between the *required capacity* and the *existing capacity* of an individual or group. Larger gaps indicate higher differential risk, even under similar levels of exposure. Importantly, the degree of risk also varies according to the specific hazard being analyzed. Sample findings are presented in Table 3.													

3.5.1. Precision through Differential Risk

Differential risk provides a **granular and data-driven method** of assessing disaster risk. It moves beyond a generalized, community-level view to focus on the specific *elements at risk*—such as individuals, households, infrastructure, and livelihoods.

The process begins by **characterizing the hazard's behavior** and then determining the degree of vulnerability of each element based on its proximity to that hazard. For example, a house directly adjacent to a river is highly vulnerable to flood events. The assessment then identifies the **specific capacity required** to survive and bounce forward, together with the state of the enabling systems and structures. Existing capacity is measured and compared to the required level; the **difference is the "capacity gap."**

The results demonstrate that risk differentials emerge not only from hazard intensity but from uneven distribution of coping and adaptive capacities. The framework quantifies this as:

This formulation allows planners to visualize where investments should be concentrated to close resilience gaps, thereby operationalizing equity in DRR decision-making.

Risk is thus determined by this capacity gap: an element may be highly vulnerable due to proximity but will not necessarily be high-risk if its capacity is strong. For example, a household requiring 10 "units" of capacity to withstand a flood but having only 2 units has a **high risk (gap = 8)**; a household with 5 units would have **medium risk (gap = 5)**; and one with 8 units would have **low risk (gap = 2).**

Table 3 shows **precision planning by differentiating risk across population groups, assets, and sectors**, allowing resources to be directed where they yield the highest risk reduction impact. It illustrates that not all elements at risk face the same type or degree of risk, even within the same hazard zone or degree of vulnerability.

Table 3. An example from an assessment of how it looks like after the risk determination for floods

Element at Risk	Exposure (Vulnerability)	Required Capacity	Existing Capacity	Capacity Gap	Risk Level
Elderly woman 1 (≥ 60 years)	High (proximity constraints within flood-prone zone)	1. Mobility aid (e.g., cane or wheelchair) 2. Accessible evacuation transport 3. Companion or carer assistance 4. Regular medication supply 5. Nearby safe shelter 6. Access to water, food, clothing	5. Nearby safe shelter6. Access to water, food and clothing	1. No mobility aid 2. No transport during floods 3. Limited access to medication 4. No companion or carer assistance	Out of 6 required capacities, 4 gaps were identified = **High Risk**
		1. Mobility aid (e.g., cane or wheelchair) 2. Accessible evacuation transport 3. Companion or carer assistance 4. Regular medication supply 5. Nearby safe shelter 6. Access to water, food, clothing	4. Regular medication supply 5. Nearby safe shelter 6. Access to water, food, clothing	1. Mobility aid (e.g., cane or wheelchair) 2. Accessible evacuation transport 3. Companion or carer assistance	Out of 6 required capacities, 3 gaps identified = **Medium Risk**
		1. Mobility aid (e.g., cane or wheelchair) 2. Accessible evacuation transport 3. Companion or carer assistance 4. Regular medication supply 5. Nearby safe shelter 6. Access to water, food, clothing	2. Accessible evacuation transport 3. Companion or carer assistance 4. Regular medication supply 5. Nearby safe shelter 6. Access to water, food, clothing	1. Mobility aid (e.g., cane or wheelchair)	Out of 6 required capacities, 1 gap identified = **Low Risk**

Elderly woman 2 (≥ 60 years)	Medium (resides near but not within flood-plain)	1. Accessible transport plan 2. Consistent medication supply 3. Early warning information 4. Safe temporary shelter 5. Basic food and water access	3. Early warning information 4. Safe temporary shelter 5. Basic food and water access	1. Accessible transport plan 2. Consistent medication supply	Out of 5 required capacities, 2 gaps identified = **Medium Risk**
		1. Accessible transport plan 2. Consistent medication supply 3. Early warning information 4. Safe temporary shelter 5. Basic food and water access	5. Basic food and water access	1. Accessible transport plan 2. Consistent medication supply 3. Early warning information 4. Safe temporary shelter	Out of 5 required capacities, 4 gaps identified = **High Risk**
		1. Accessible transport plan 2. Consistent medication supply 3. Early warning information 4. Safe temporary shelter 5. Basic food and water access	2. Consistent medication supply 3. Early warning information 4. Safe temporary shelter 5. Basic food and water access	1. Accessible transport plan	Out of 5 required capacities, 1 gap identified = **Low Risk**
Elderly woman 3 (≥ 60 years)	Low (lives in an elevated area, away from direct flood impact)	1. Communication access for alerts 2. First aid kit and medication 3. Regular welfare monitoring 4. Social connection with community responders 5. Basic food and water access	3. Regular welfare monitoring 4. Social connection with community responders	1. Communication access for alerts 2. First aid kit and medication	Out of 4 required capacities, 2 gaps identified = **Low Risk**
		1. Communication access for alerts 2. First aid kit and medication 3. Regular welfare monitoring 4. Social connection with community responders 5. Basic food and water access	4. Social connection with community responders5. Basic food and water access	1. Communication access for alerts 2. First aid kit and medication 3. Regular welfare monitoring	Out of 4 required capacities, 3 gaps identified = **Medium Risk**
		1. Communication access for alerts 2. First aid kit and medication 3. Regular welfare monitoring 4. Social connection with community responders 5. Basic food and water access	5. Basic food and water access	1. Communication access for alerts 2. First aid kit and medication 3. Regular welfare monitoring 4. Social connection with community responders	Out of 4 required capacities, 4 gaps identified = **High Risk**

Note: This reflects differential risk for one (1) elderly woman under varying proximity and capacity conditions. Other individuals in the same demographic may have different risk levels depending on their capacity. Even elements at risk in the same category and with the same level of vulnerability can face different risks because of variations in their capacity to survive and bounce forward and the state of support system and structure. The degree of vulnerability is defined by the element's proximity to the hazard. We must accurately measure this proximity because the capacity requirements needed to mitigate the risk are highly specific to each vulnerability level. In a flood context, required capacities may differ in typhoon or heatwave (e.g., structural safety, ventilation, hydration). This individualized approach ensures that interventions are hazard-specific and equity-driven, addressing real gaps rather than generalized demographic assumptions.

Element at Risk	**Exposure (Vulnerability)**	**Required Capacity**	**Existing Capacity**	**Capacity Gap**	Risk Level
Primary school building 1	High (located in low-lying area near river; frequent flooding)	1. Elevated foundation 2. Structural reinforcement 3. Flood barrier or embankment 4. Functional drainage system 5. Emergency access and evacuation plan 6. Early warning and communication system	1. Elevated foundation	2. Structural reinforcement 3. Flood barrier or embankment 4. Functional drainage system 5. Emergency access and evacuation plan 6. Early warning and communication system	Out of 6 required capacities, 5 gaps identified = **High Risk**
		1. Elevated foundation 2. Structural reinforcement 3. Flood barrier or embankment 4. Functional drainage system 5. Emergency access and evacuation plan 6. Early warning and communication system	1. Elevated foundation 2. Structural reinforcemen t3. Flood barrier or embankment	4. Functional drainage system 5. Emergency access and evacuation plan 6. Early warning and communication system	Out of 6 required capacities, 3 gaps identified = **Medium Risk**
		1. Elevated foundation 2. Structural reinforcement 3. Flood barrier or embankment 4. Functional drainage system 5. Emergency access and evacuation plan 6. Early warning and communication system	1. Elevated foundation 2. Structural reinforcement 3. Flood barrier or embankment 4. Functional drainage system 5. Emergency access and evacuation plan	6. Early warning and communication system	Out of 6 required capacities, 1 gap identified = **Low Risk**
Primary school building 2	Medium (situated on higher ground but within catchment area)	1. Structural reinforcement 2. Functional drainage system 3. Early warning access 4. Safe evacuation route	1. Structural reinforcement 2. Functional drainage system	3. Early warning access4. Safe evacuation route	Out of 4 required capacities, 2 gaps identified = **Medium Risk**
		1. Structural reinforcement 2. Functional drainage system 3. Early warning access 4. Safe evacuation route	1. Structural reinforcement 2. Functional drainage system 3. Early warning access	4. Safe evacuation route	Out of 4 required capacities, 1 gap identified = **Low Risk**
		1. Structural reinforcement 2. Functional drainage system 3. Early warning access 4. Safe evacuation route	1. Structural reinforcement	2. Functional drainage system3. Early warning access4. Safe evacuation route	Out of 4 required capacities, 3 gaps identified = **Medium Risk**

Primary school building 3	Low (located on elevated terrain outside flood impact zone)	1. Maintenance plan for drainage 2. Communication system for alerts 3. Access to backup power4. Connection with community disaster plan	1. Maintenance plan for drainage	4. Connection with community disaster plan	Out of 4 required capacities, 1 gap identified = **Low Risk**
		1. Maintenance plan for drainage 2. Communication system for alerts 3. Access to backup power4. Connection with community disaster plan	1. Maintenance plan for drainage 2. Communication system for alerts	3. Access to backup power4. Connection with community disaster plan	Out of 4 required capacities, 2 gaps identified = **Medium Risk**
		1. Maintenance plan for drainage 2. Communication system for alerts 3. Access to backup power4. Connection with community disaster plan	1. Maintenance plan for drainage	2. Communication system for alerts 3. Access to backup power 4. Connection with community disaster plan	Out of 4 required capacities, 3 gaps identified = **High Risk**
Note : This reflects differential risk assessment for three school buildings, each analysed as a single unit. Despite serving similar functions, their risk levels vary based on capacities regardless of their degree of vulnerability.					

Risk is individualized and defined by the intersection of proximity-based vulnerability and unique coping capacity. To ensure equity and effectiveness, we must accurately measure an element's proximity to the hazard—as this defines its specific vulnerability—and then tailor highly context-dependent and hazard-specific capacity interventions (e.g., for flood vs. heatwave) to address individual, rather than generalized, risk gaps.

- **Core Principle: Individualized Risk.** Risk is differential, meaning that even individuals within the same demographic group or vulnerability class (e.g., elderly women) may face different degrees of risk. This variation is primarily driven by differences in capacity—the ability to anticipate, withstand, and recover from hazard impacts—as well as the strength of support systems and structural conditions.
- **Defining Vulnerability and the Measurement Imperative.** Vulnerability is determined by proximity; the closer an element is to a hazard, the higher its inherent exposure. Therefore, accurate measurement of proximity is critical, as the *required coping capacity* needed to reduce risk is highly specific to the degree of vulnerability identified. Without this precision, interventions risk being misdirected or inequitable.
- **Tailoring Capacity and Interventions**. Required capacities are hazard-specific and context-dependent. The capacities needed to manage flood risk (e.g., structural safety, drainage, evacuation systems) differ markedly from those required for heatwaves (e.g., ventilation, hydration, cooling access). This individualized, context-sensitive approach ensures that interventions are equity-driven and gap-focused, addressing real capacity deficits rather than relying on broad demographic assumptions.

Overall, this differential approach demonstrates that risk is not uniform it varies according to *who or what is exposed*, the *degree of existing capacity*, and the *feasibility of protective measures*. Such precision enables evidence-based targeting of preparedness, mitigation, and recovery investments, ensuring that interventions prioritize those most at risk for equitable and efficient resilience-building outcomes.

One crucial observation, despite the power of differential risk assessments to create targeted plans, their sustained application faces institutional barriers. The methodology often remains within the temporary project cycles of organizations from UN, INGO, NGO, and among other actors, and its deeper integration into local government planning is limited by technical complexity and bureaucratic inertia.

Where it *has* been applied, differential risk mapping has improved outcomes. Resources are used more efficiently, and communities feel plans are fairer because they see clearly why certain house-

holds or areas get prioritized (those with the biggest capacity gaps). It also fosters collaboration – people at lower risk often support higher-risk neighbors in preparedness activities, understanding that everyone's safety is connected.

3.6. Summary of Differential Risk Derivatives

Disaster Risk Assessment and Analysis. Risk assessment and analysis is a logical process of (1) characterising a hazard, (2) determining the degree of vulnerability of the Elements at Risk to the hazard, (3) establishing the required capacity to address the characteristics of the hazard and the required capacity to address the different degree of vulnerability in reference to the hazard, and evaluating your existing capacity to determine the capacity gaps of the Elements at Risk being assessed. The more capacity gaps you have the degree of risk is higher.

"Vulnerability" is defined as the degree of exposure of the element-at-risk to the hazard. The "vulnerability assessment" process entails the following: (i) identification of the hazard as a reference point, i.e., flood; earthquake; COVID-19; (ii) determination of the element-at-risk as the subject of the assessment, i.e., male, female, child, elderly, animals, bridges, livelihood, property; and (iii) measurement of the degree/differential degree of vulnerability, i.e., low, medium, or high, on the basis of proximity to the hazard. The UN Office for Disaster Risk Reduction (UNDRR) defines "capacity" as the combination of all the strength, attributes, and resources available within an organisation, community, or society to manage and reduce disaster risk and strengthen resilience. "Capacity assessment" refers to the determination of capacities that address (i) the hazard as to prevention and mitigation and (ii) the vulnerability as to individual survivability, bouncing back (individual strength), and systems and structure (collective strength).

These risks can be minimised. Some hazards can be prevented or mitigated. While there are certain hazards that cannot be prevented or mitigated, individuals and communities can still be empowered to deal with them and bounce forward from their effects. Therefore, resilience is based on the capacity of the Elements at Risk. The higher the capacity, the lesser the risk; the lesser the risk, the lesser the probability of a disaster. Applying differential risk at the community level brings **precision** ("who exactly needs what?") and **equity** ("help the most at risk first") to the forefront. It turns a broad community disaster plan into a set of targeted actions and investments. The next challenge is scaling this approach – embedding it into official local governance so that it becomes a standard practice in DRR planning. This approach allows planners to allocate the **right resources to the right people**, improving disaster response and disaster risk reduction (DRR) effectiveness, while ensuring equity in preparedness and recovery.

3.7. From assessment to action: Integrating differential risk into planning

"Precision through Differential Risk" describes a methodology for a more granular and targeted approach to risk assessment. It moves beyond a general, community-wide view of risk to focus on specific "element at risk," such as individuals, households, or infrastructure. This approach identifies the degree of vulnerability based on factors like proximity to a hazard and then assesses the existing capacity of the element to survive and bounce forward and the responsive support systems and structures. The difference between the required capacity and the existing capacity is defined as the capacity gap, which determines the level of risk. This method allows for the creation of more precise and effective development and contingency plans.

3.7.1. Linking Differential Risk to Planning and M&E

The results of a differential risk assessment directly inform the various stages of disaster risk reduction (DRR) and resilience-building. By identifying specific capacity gaps for different elements, planners can create targeted strategies that are more effective and efficient. A differential risk as-

sessment should directly inform development plans, emergency contingency plans, and ongoing monitoring and evaluation (M&E). Once we have a clear picture of who or what (element at risk) is high, medium, or low risk – and why (quality) and how many (quantity) – we can link these findings to concrete actions:

- *Development Plan.* Differential risk assessment serves as the foundation for targeted development planning. Instead of a one-size-fits-all approach, resources can be allocated with precision.
    - **High-Risk Elements**: High-risk elements with large capacity gaps are prioritized for capacity-building interventions. For example, if certain households are high risk because their homes are poorly built, a development plan might include housing retrofits or relocation to safer land. If areas lack access to healthcare (raising risk for residents), the plan might include building a clinic or improving transportation infrastructure. In one Southeast Asian project, local governments used community risk maps to decide which villages received funds for new flood embankments and which received livelihood training, based on each village's specific risk profile.
    - **Medium- and Low-Risk Elements: The plan for these elements would focus on strengthening their existing capacities to prevent them from becoming high-risk. This might include providing access to information, enhancing community early warning systems, or offering training on preparedness and resilience building. The goal is to build upon their existing strengths.**
- *Contingency Plan.* Emergency response plans benefit from knowing differential risk. Identified high-risk groups and assets become priorities for early warning, emergency response such as the evacuation, and relief.
    - **Targeted Response: Knowing which households or individuals are at high risk allows emergency responders to preposition resources and prioritize their search and rescue efforts. Instead of a blanket response, the contingency plan can focus on the most at-risk individuals.** For example, if a community map shows a particular hamlet has the most at risk population (e.g., an informal settlement of very poor families), responders can plan to deploy more boats, rescue teams, or relief goods there first when a flood warning comes.
    - **Resource Allocation: The plan can specify the type and quantity of resources (e.g., medical supplies, shelter, food) needed for different zones based on their assessed capacity gaps. This prevents the misallocation of resources and ensures that the right help gets to the right people.**

In practice, this approach was exemplified by Project DINGGIN – pilot research for a decision-making tool in one of the subnational levels in the Philippines and Bangladesh, where disaster-prone communities co-developed a response plan with local government. Households in high-risk zones (identified via participatory mapping) received larger emergency cash grants for shelter reinforcement and livelihood recovery, aligning assistance with locally identified needs **(Cañete et al., 2025)**

- *Monitoring and Evaluation (M&E).* The differential risk framework provides a clear baseline for monitoring and evaluation.
    - **Measuring Progress: M&E can track whether the interventions outlined in the development plan are actually reducing the capacity gaps. For example, after providing emergency kits to high-risk households, the M&E process would reassess their capacity to determine if the gap has shrunk.** The differential risk framework provides a clear baseline for M&E. We can track whether interventions actually reduce capacity gaps. If a community had 50 high-risk households and, after certain projects, only 20 remain high-risk (with others moved to medium or low risk through capacity-building), that's tangible evidence of success.

- **Learning and Adaptation: This data-driven approach allows for a feedback loop. If an intervention isn›t effectively closing a capacity gap, the M&E results can inform adjustments to the development plan.** Conversely, if high-risk numbers aren't improving, it signals a need to adjust strategy. Using this approach, success isn't measured by generic outputs (like "10 trainings conducted") but by outcomes – how those trainings helped move specific households from high risk to lower risk categories.

Linking assessment to action also requires vertical and horizontal integration. Community findings must be communicated upward to influence provincial and national plans, and across sectors. For example, if a risk assessment reveals that a certain district's hospitals and schools are high flood risk, both the health and education sectors should collaborate on a resilience project for that district. Similarly, if certain families are persistently high-risk due to extreme poverty, social welfare programs should target them for support like conditional cash transfers or micro-insurance.

Ultimately, integrating differential risk into planning ensures that DRR and resilience-building efforts are **data-driven, transparent, and impact-focused**. It fosters a proactive risk management culture that responds to actual needs on the ground and builds public trust, as communities see that resources are allocated based on clear evidence and fairness by linking the precise data from a differential risk assessment to a development plan, a contingency plan, and a robust M&E system, organizations can move from a reactive, general response to a proactive, targeted, and highly effective approach to building community resilience.

4. Discussion

The discussion expands on the operational value of the framework, emphasizing that differential risk provides a decision-support tool for inclusive and evidence-based governance. By quantifying capacity gaps, authorities can align interventions with real community needs rather than assumed averages.

4.1. Critique of Traditional Disaster Risk Reduction (DRR)

The traditional disaster risk reduction (DRR) frameworks have long relied on a **uniform risk model**, treating risk as a single, undifferentiated variable across populations and assets. This approach prioritizes **hazard and exposure mapping** while underestimating the equally critical—and highly unequal—dimensions of **vulnerability** and **capacity**. Such a focus tends to privilege technical hazard models while overlooking how socio-economic and institutional disparities shape real-world outcomes (Cutter et al., 2008; Cardona et al., 2012). As a result, resource allocation is often misaligned, and interventions that are effective for one group may fail for populations with fewer coping capacities, deepening existing inequalities (Karim & Noy, 2015; UNISDR, 2015).

4.2. Differential Risk as a Core Concept

This paper advances **differential risk** as a more **precise and equitable** alternative to traditional models. Differential risk challenges the assumption of homogeneity by recognizing that risk is experienced in **distinct, quantifiable levels** by various elements at risk—people, livelihoods, physical infrastructure, and ecological systems. Instead of defining risk solely through exposure, the concept reframes it as a function of the **capacity gap**—the difference between the capacity an element requires to survive and recover and the capacity it currently possesses, including support systems and structures (Biñas, 2018; UNDRR, 2017).

This reframing offers a critical insight: **high vulnerability due to proximity to a hazard does not automatically imply high risk** if an element has sufficient capacity to withstand and recover. Conversely, low physical exposure may still lead to severe outcomes when coping capacity is weak.

4.3. The Central Role of Capacity

Capacity emerges as the **primary determinant of an element's risk profile**. The proposed framework conceptualizes capacity through a **hierarchical structure**, spanning both individual and collective levels. At the individual level, capacity includes the **foundation of safety** (basic needs such as food, water, shelter), as well as **livelihood stability and health** that enable recovery. Collective capacity, by contrast, encompasses the **ecosystem's ability to support life**, **community readiness systems** (early warning, evacuation, search and rescue), and the **policy and governance environment** that sustains resilience.

This multi-layered view underscores that resilience is not purely personal but deeply dependent on **supportive systems and structures**. Weak governance, inadequate social protection, or fragile ecosystems can erode individual capacity and escalate risk, even when people themselves possess basic coping skills. The framework bridges conceptual understanding and policy implementation by providing measurable indicators of where and why risk persists. Its adaptability allows integration with cash-transfer targeting (Cañete et al., 2025), climate adaptation planning, and local resilience scorecards. Comparative insights from Serbia and Southeast Europe (Nikolić et al., 2025; Cvetković & Šišović, 2024; Milenković et al., 2024; Cvetković et al., 2024) reinforce the universality of differential risk dynamics and support cross-context application.

SPS-DRM

4.4. Actionable Application: Precision through Differential Risk

Importantly, the **differential risk framework is not solely theoretical**; it offers a **practical roadmap** for enhancing DRR planning and investment. By Applying the principle of **precision through differential risk** allows disaster risk reduction (DRR) planning and investment to move beyond generalized, community-wide assessments toward disaggregated, data-driven strategies. By integrating both quantitative and qualitative indicators at multiple levels—individual, household, institutional, and environmental—decision-makers can:

- **Identify specific capacity gaps** across diverse element at risk, identifying where resilience deficits are most acute and what types of support (technical, financial, social, or ecological) are required.
- **Prioritize interventions** for populations or sectors exhibiting the widest capacity gaps, ensuring resources are directed where they generate the highest resilience returns rather than diffused through uniform, top-down approaches.
- **Inform development and investment plans** that strategically strengthen both individual and collective capacity (e.g., livelihood support, policy reforms, ecosystem protection) by aligning programs, policy reforms, and ecosystem management initiatives with the differentiated capacity profiles revealed through the framework.
- **Design anticipatory and contingency plans** that preposition resources and services according to high-risk profiles, enabling faster, targeted response and recovery.
- **Strengthen monitoring and evaluation (M&E)** systems by tracking how interventions reduce capacity gaps and how interventions reduce capacity gaps and alter differential risk profiles over time—offering measurable evidence of resilience gains and investment effectiveness.

This **precision-driven approach** supports more equitable and efficient use of resources, ensuring that assistance reaches those most in need while avoiding the pitfalls of one-size-fits-all strategies. It directly aligns with the **Sendai Framework for Disaster Risk Reduction (2015–2030)** and contributes to a people-centered, capacity-informed pathway to resilience.

Figure 2. Building Resilient Communities: Basic Minimum. Developed by Rustico "Rusty" Biñas; graphic improvement by Rhinadel M. Cañete.

Figure 2 *presents a* ***minimum standard framework*** *for operationalizing disaster risk reduction (DRR) and climate change adaptation (CCA) at the community level. It begins with* ***disaster risk analysis****, which integrates hazard characterization, vulnerability assessment, and the evaluation of both* ***hazard-focused capacities*** *(prevention and mitigation) and* ***vulnerability-focused capacities*** *(individual survivability and community readiness). The framework uses* ***differential risk baselines*** *to classify elements at risk—such as individuals, households, infrastructure, and livelihoods—into* ***high, medium, or low risk*** *categories by measuring the gap between the capacity needed and the capacity available. individuals, households, infrastructure) into high, medium, or low risk categories based on their capacity gaps.*

The risk analysis informs two planning streams: a **Development Plan**, which strengthens long-term prevention and mitigation measures (livelihoods, health systems, ecosystem protection, infrastructure), and a **Contingency Plan**, which outlines short-term actions during hazard events (early warning, evacuation, prepositioned supplies, shelter, communication, and search and rescue). Both plans are sustained through an **institutional mechanism**, ensuring an organizational structure capable of implementing and coordinating resilience actions.

Core **task functions** include identifying hazard prevention and mitigation measures, increasing the survivability and recovery capacity of highly exposed groups, and establishing robust community systems. The model also highlights the importance of **human relationship functions**, such as group development and collective action, to strengthen social cohesion. **Results and impacts** are tracked through a **risk monitoring and evaluation (M&E) system**, which establishes baseline data, provides real-time information during crises, and supports continuous improvement of DRR interventions.

By linking **capacity-based differential risk analysis** with practical planning, sustainable institutions, social systems, and robust M&E, the framework offers a **scalable, equitable, and adaptive pathway** for building resilient communities aligned with the **Sendai Framework for Disaster Risk Reduction (2015–2030).**

5. Conclusions and recommendations

5.1. Empower Local Governance as the Central Hub

Effective disaster risk reduction (DRR) hinges on local governance acting as the central conduit connecting communities to higher levels of government. This strategic role is fundamental to the Community-managed Disaster Risk Reduction (CBDRR) approach. It recognizes that communi-

ties, as the first responders, possess unique local knowledge that serves as the primary source of differential risk data. This granular data is vital for informed decision-making across all government tiers. For this data to be valuable at higher levels, a consolidation process must occur, transforming raw community-level information into a coherent, system-wide input.

As noted by Wisner, Blaikie, Cannon, and Davis (2004) in At Risk, disasters are not merely natural events but outcomes of social and political vulnerabilities. Therefore, a top-down approach is insufficient. True resilience can only be achieved by empowering local communities to address their specific disaster risk. This aligns with the work of Twigg (2004), who emphasizes that successful DRR is a partnership where local authorities facilitate an enabling environment for communities to build their own resilience, rather than imposing solutions. This makes community involvement in decision-making not just a best practice but a critical component of a functional disaster management system.

5.2. Adopt a Data-Driven, Differential Risk Assessment

To achieve truly effective planning, a shift from broad, generalized assessments to a differential risk assessment methodology is essential. This approach goes beyond a simple community-wide view to collect granular data, disaggregated by factors like age, sex, and specific assets such as crops and infrastructure. The result is a precise understanding of each element's degree of risk (high, medium, or low) and its specific capacity gaps. This blend of quantitative and qualitative data provides powerful information for decision-making across all levels of government.

This methodology is fully aligned with the Sendai Framework for Disaster Risk Reduction (2015-2030), which advocates for a people-centered and gender-sensitive approach. As consistently recommended by UNISDR (2015), this type of granular, disaggregated data is crucial for designing targeted interventions that address specific vulnerabilities and ensure a more equitable distribution of resources. This enables planners to allocate the right resources to the right people, maximizing both the efficiency of response and the fairness of resource allocation.

5.3. Promote Vertical and Horizontal Integration

To genuinely build resilience, governments must overcome the "silo effect" that isolates their departments. This requires a seamless vertical and horizontal flow of differential risk data. Data must move both upward—from local communities to national policymakers—and across different line agencies, such as agriculture, public works, and health. This integrated approach ensures that decisions are based on the same precise information, leading to more coordinated and effective disaster management.

This integrated approach is critical because, as Pelling (2003) argues in The Vulnerability of Cities, resilience isn't the sole responsibility of a single disaster management agency. It's a shared commitment that requires cross-sectoral collaboration. The disaggregated differential risk data serves as the crucial input that translates the specific, on-the-ground realities of a community into actionable national policies and targeted resource allocation decisions, as highlighted by Alexander (2014) in Disaster Resilience and its Discontents. By ensuring this consistent and coordinated flow of information, governments can align their risk-informed planning across all levels and departments, leading to more effective and efficient disaster management.

5.4. Foster a Culture of Risk Awareness and Empowerment

A truly resilient system depends on the collective action of every individual involved. By making differential risk assessment data transparent and accessible, governments can empower both communities and officials with a shared, precise understanding of their disaster risk. As Paton and

Johnston (2006) contend in Disaster Resilience: An Integrated Approach, public education and community engagement are fundamental for building resilience. This shared knowledge fosters a sense of responsibility, transforming a traditional top-down, command-and-control model into a collaborative partnership. This shift enables proactive behavior and collective action, ultimately reducing risk and enhancing overall resilience.

5.5. Recommendations on Differential Risk for DRR Stakeholders

5.5.1. Recommendations for Government (National and Local)

Figure 3. Differential Risk–Informed Disaster Risk Reduction and Resilience. Based on the report, "The Philippines' Enhancing Resilient Communities and Inter-agency Collaboration and Interoperability," a paradigm shift to differential risk is essential for all stakeholders to advance disaster risk reduction (DRR). The report's recommendations highlight that moving beyond generalized, "one-size-fits-all" approaches to a granular, capacity-centric framework is the key to creating more effective, equitable, and sustainable resilience.

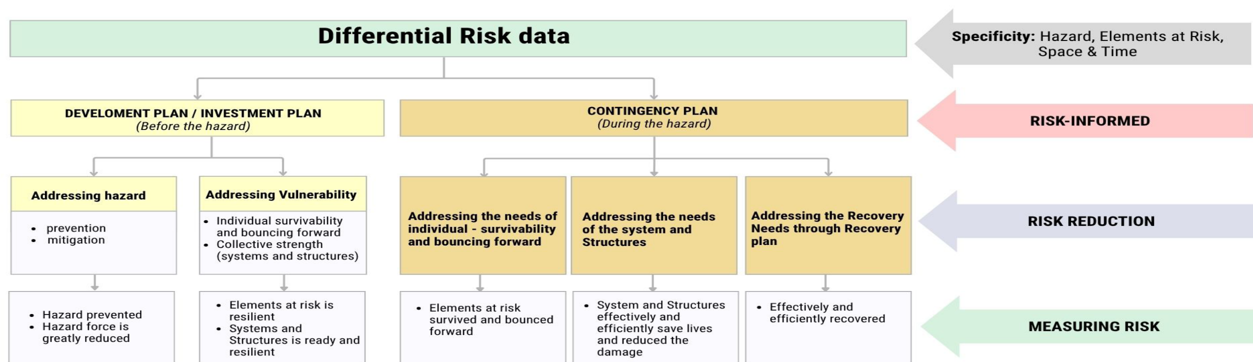

__Figure 3__ illustrates how __differential risk data__ informs risk-informed planning across the disaster management cycle. The framework begins by collecting __granular risk data__—classifying elements at risk (e.g., households, infrastructure, livelihoods) by __capacity gaps__ to determine high, medium, or low risk levels. Based on this analysis, two complementary planning tracks are developed: a __Development/Investment Plan__ implemented before a hazard (addressing hazard prevention and mitigation, strengthening individual survivability, and enhancing collective systems and structures), and a __Contingency Plan__ activated during a hazard (meeting immediate survival needs, ensuring system functionality, and supporting effective recovery).

The report emphasizes that the government's primary role is to embed the differential risk framework into existing systems and plans.

- **Mainstream Differential Risk Data:** The government should integrate differential risk data into its planning and governance systems. This includes using disaggregated data (by age, sex, etc.) as a baseline for risk-informed planning and programming across all levels and line agencies (e.g., Department of Social Welfare and Development, Office of Civil Defense). This will ensure that resource allocation and interventions are directly tied to the specific needs of the most at-risk populations.
- **Enhance Capacity Building:** The government offices should incorporate differential risk into their Community-Based Disaster Risk Reduction (CBDRM) modules. This will enhance the capacity of local government units (LGUs) to conduct precise risk assessments and design tailored, location-specific interventions.
- **Strengthen Inter-agency Collaboration:** The government must facilitate a seamless flow of differential risk data both vertically (from the village to national agencies) and horizontally (across different departments). This will dismantle the "silo effect" and ensure that all government bodies are working with a shared, precise understanding of risk, leading to more coherent and coordinated action.

5.5.2. Recommendations for the UN and Humanitarian Agencies

The report recommends that the UN and other humanitarian organizations lead by example by adopting a differential risk approach in their country strategies and operational frameworks.

- **Harmonize Conceptual Understanding:** UN agencies should work together to create a cohesive approach to resilience-building. This means harmonizing their conceptual frameworks, community engagement processes, and tools around the principle of differential risk. A unified approach will prevent confusion and ensure that all actors are speaking the same language.
- **Integrate into Sustainable Development Goals (SDGs):** The UN should integrate risk-informed planning, particularly using differential risk data, into its Sustainable Development Goals (SDGs) and country strategies. This will not only make development efforts more sustainable but also create a more robust framework for addressing the root causes of disaster risk.
- **Invest in Community Processes:** Humanitarian agencies should align their processes and timelines with those of the community. They should act as facilitators, assisting communities in understanding disaster risk and enhancing their capacities to cope and recover. The report recommends investing in risk-based community contingency and development planning to empower local communities and promote ownership.

*Figure 4. outlines a **participatory and systems-based approach** to resilience building. It starts with **risk monitoring and evaluation**, followed by **risk assessment and analysis** and **risk-informed planning** (development and contingency). The **community** acts as the acquisition group, supported by a **catalyst** that bridges local actors and government, while the **government** provides policy, planning, and budget support. Key **outputs** include community risk assessments, differential risk baselines, development and contingency plans, and monitoring systems. **Partners** champion facilitation, capacity building, and networking. **Government systems** enable responsive planning, resource allocation, and policy development. The process produces **outcomes** such as effective DRR measures, strengthened community capacity, and **impacts** including hazard prevention or mitigation, efficient response, and measurable transformation of resilience systems.*

Level of Inputs	Sequence of Community & Support System Engagement and Its Roles			Hazard-Specific	Element-at-Risk Specific / Thematic
Measurements	**The Role of a Catalyst: Bridging Community and the Government**			Externalities	Substance
	Acquisition Group: Community : mobilizes local groups, conducts risk assessment, organizes groups	**Catalyst:** bridges community and government; facilitates training, champions participation, links organized groups, documents progress, federates networks.	**Support System: Government:** provides enabling policy, planning, budget allocation, and technical support to ensure sustainability.		
	Risk Monitoring and Evaluation (Disaster Risk Reduction) → **Risk Assessent and Analysis** (design, method and tools) → **Risk-Informed Planning** (development and contigency plan → **Organization and** Implementation				
Output	**Community activities:** - Number of communities conducting risk assessments (women, men, children disaggregated by age/sex), including livelihood, ecosystem services, systems and structures, and enabling policy.Degree of risk of each specific element identified using **Differential Risk** - Number of communities with development plans. - Number of communities with contingency plans - Number of communities with organized groups and monitoring & evaluation systems.	**Partner activities:** - Championing facilitation -Conducting trainings - Linking organized communities - Documenting and federating networks.	**Government activities: Performance** - Local governance planning based on community risk assessments - Provision of budget and allocation. - Development of enabling policies and regulations. - Strengthening local governance responsiveness to needs. - Consolidating resilience baselines (segregated by age/sex, crops, livestock, etc.).	Structural / Infrastructure: built and maintained to support DRR and resilience	Basic services; Livelihood & health; Well-being; Ecosystem services; Community organization & local governance; Enabling policy environment
Outcome	**Implementation Role:** Based on actual risk assessment result Resilient objectives set and achieved; relevant DRR measures for each hazard and element at risk effectively and efficiently implemented.	**Facilitating Role:** Strengthened knowledge, skills, and facilitation capacity for every step of the process.	**Supporting Role and Resources Provider:** Responsive support systems, enabling policy, and significant budget allocation.	Built Significant Change	Delivered measurable transformation in resilience at community and system levels.
Impact	hazards prevented hazards mitigated; **Before hazard:** - elements at risk strengthened. - systems and structures ready and resilient; **During hazard:** - elements at risk survive and bounce forward; - systems and structures save lives and - reduce damage efficiently.	**Champion Facilitators**	**Protocols followed for disaster declaration** **Effective and Efficient response if needed.**	**Prevention:** hazard forces reduced or prevented through proactive capacity-building and systems in place. **Mitigation:** implemented where prevention is not possible; effective emergency response ensured.	Increased survivability and capacity to bounce forward; strengthened systems and structures ready before hazards strike.

Figure 4. Framework for Developing Participatory Resilient Programs and Projects. Developed by Rustico "Rusty" Biñas, Global Advisor for Disaster Risk Reduction and Resilience Building (2020).

5.5.3. Recommendations for Non-Government Organizations (NGOs).

NGOs are encouraged to act as catalysts for change, bridging the gap between communities and formal government systems by leveraging their on-the-ground experience.

- **Focus on Capacity-Building:** NGOs should help communities to understand and apply the differential risk framework. They should train community members and leaders to use this methodology to develop their own local resilience plans. This will empower communities to negotiate effectively with external agencies and donors.
- **Bridge Data Gaps:** NGOs should play a key role in collecting and validating differential risk data at the grassroots level. They can help translate this information into formats that are usable by both local government units and national agencies, ensuring that community realities inform higher-level policy and planning.
- **Advocate for Policy Change:** Based on their on-the-ground data and experiences, NGOs should advocate for more responsive resilience-building policies. By demonstrating how differential risk analysis leads to more effective interventions, they can influence government agencies to adopt the framework on a larger scale.

Author Contributions:

Rustico "Rusty" Biñas is an independent Global Advisor on Disaster Risk Reduction (DRR) and Resilience Building with over 25 years of international experience in technical cooperation and community-managed risk reduction initiatives across Asia, Latin America, and Africa. He has collaborated with governments, United Nations agencies, and international organizations to design and implement risk-informed development and crisis management programs.

Mr. Biñas earned his Master of Professional Studies from Cornell University, Ithaca, New York, USA, specializing in *International Agriculture and Rural Development*. He has held senior leadership roles, including Regional Coordinator for the Partnership for Disaster Reduction in Southeast Asia at the Asian Disaster Preparedness Center (Thailand) and Regional Director for Latin America of the International Institute of Rural Reconstruction (Ecuador).

He is a prolific author and thought leader in resilience-based DRR, having written or co-authored key works such as *Application of Resilience Framework to COVID-19: Reframing Our Work* (2021), *The Resilience Paradigm: Facts for Transformation* (2018), *Making CMDRR Operational at Community Level: A Guide*, *How to Navigate Through a Changing Climate*, and *Building Resilient Communities: A Training Manual on Community-Managed Disaster Risk Reduction*. He also co-authored the Greenpeace publication *Building Resilient Communities: Promoting People Participation to Address Disaster Risk* (2023).

His work strongly advocates for community-managed DRR and the Resilience Framework, which he defines as hazard-specific, element-at-risk-specific, space-specific, and time-specific. While based in Bacolod City, Negros Occidental, Philippines, Mr. Biñas continues to work internationally as a consultant, collaborating with diverse partners to advance innovative, capacity-driven approaches to resilience and disaster risk management.

Rhinadel M. Cañete focused on the structure of the manuscripts to emphasize central argument on differential risk. She led the literature synthesis and integration of emerging evidence, including the application of the various study to strengthen the theoretical grounding of the paper.

Drawing on her 15 years of professional experience humanitarian/development coordination and programming, she contributed deep practical insights on risk-informed data to link into financing, programming and local actor engagement. Her on-the-ground expertise support the manuscript's focus on capacity-based differential risk analysis and its role in equitable, evidence-driven planning and resource allocation.

Her academic background includes a Master of Business Administration (MBA) from National College of Business and Arts and an Executive Master's Diploma in Disaster Risk and Crisis Management (EMDRCM) from Asian Institute of Management (AIM) complementing her field expertise with strong analytical and strategic planning skills. She is also a disaster risk reduction and crisis management practitioner with strong financing and auditing background, bringing advanced

technical knowledge on feasibility and efficiency of the resilience frameworks. These qualifications guided the structuring of the including: (1) Refining the methodological narrative and linking it to practical DRR programming (2) Enhancing the discussion and application sections to ensure relevance for policymakers and practitioners (3) Designing tables, improved the frameworks, and figure explanations to meet academic publishing requirements. She was also responsible for the final editing, referencing, and alignment with IJDRM submission guidelines, ensuring the paper's theoretical rigor while maintaining its practical usability for diverse stakeholder and decision-makers.

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