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Strengthening Coastal Resilience: Reflections on Community-Led CCA-DRR for Coastal Community

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Abstract

Coastal communities and impoverished people are identified as more vulnerable to climate change and other natural hazards. Sustainable development enhancement through disaster risk reduction (DRR) and climate change adaptation (CCA) is necessary to reduce the risk of disaster occurrence and build coastal communities' resilience. However, despite the various efforts and progress taken on CCA and DRR, there is still a lack of focus, especially at the local level, where the disaster impacts are more pronounced, and policies should be translated into action. Prior research also identified that coastal communities should initiate decentralized actions on DRR and CCA to reduce vulnerabilities toward coastal hazard risk. Community-led initiatives are integral to CCA-DRR to strengthen resilience and contribute to better implementation in collaboration with local governments. Community-led CCA-DRR can be used to harness existing and build new community assets and capacity in order to address, manage, influence, and adapt to social, economic, and environmental change and disasters. Examples include appropriate recovery actions or mitigation for better coastal community resilience. This paper examines the implementation of community-led CCA-DRR in Indonesia as a case study through an extensive literature review of community-led approaches and CCA-DRR for coastal communities' resilience. This paper explores practical examples from the global context, draws lessons learned, and gives recommendations to enhance coastal community resilience in Indonesia. Existing experiences on integrated CCA-DRR in various countries demonstrate how a community-led approach can incorporate local community members, local government, external stakeholders, and appropriate support and funding mechanisms.

Keywords**:** *Community-led, coastal community resilience, CCA-DRR*

1. Introduction

Coastal areas are known to be hazard-prone and highly exposed to various coastal risks. Hydro-meteorological hazards, due to changes in temperature, precipitation, and sea level rise, have increased the occurrence of tsunamis, floods, earthquakes, shoreline erosion, sea-level rise, and coastal resource degradation (IOTWS, 2007; UNDRR, 2019). The increasing vulnerability of coastal communities is influenced by global climate change, an increase in coastal population, and human-induced activities such as shoreline development, runoff, wastewater discharge, overfishing, and other related activities (Oktari et al., 2020). By 2060, it is projected that the coastal population worldwide will increase by up to a billion people, leading to further coastal vulnerabilities (Neumann et al., 2015).

Coastal communities and impoverished people are more vulnerable to climate change and other natural hazards (Hilft et al., 2020). With the population density in urban coastal areas, the physical, social, and economic aspects of livelihoods are at stake (Levy & Patz, 2015; Neumann et al., 2015). The insufficiency of basic resources in rural areas reduces the capacity to respond to emergencies and hazards. It will eventually limit the capacity to prepare, respond, and recover from frequent disasters. As the community is regarded as an entity interrelated in the natural, social, and economic environment, the effort of risk reduction can operate in a multi-disciplinary way. Each step towards increased resilience should be considered an inseparable process.

As DRR relates to economic development, some planning and action efforts have been undertaken globally. In the aftermath of the 2004 Indian Ocean Tsunami, several international agreements were established already. The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 is one example that emphasizes four priorities: understanding disaster risk, strengthening disaster risk governance, investing in resilience, and enhancing disaster preparedness (UNISDR, 2015). This agreement, along with the 2015 Paris Agreement on climate change and the Sustainable Development Goals (SDGs), is supported by UNISDR to coordinate and ensure synergies across the multi-disciplinary aspects of DRR.

Practical solutions have been made related to post-disaster recovery in particular. The United Nations Environment Programme (UNEP) established a manual on tsunami post-disaster concentrating on sustainable physical reconstruction (UNEP, 2007). All these actions show the importance of DRR and disaster risk management (DRM) in avoiding and reducing disaster impacts on coastal communities and enhancing their resilience for future events.

Enhancing sustainable development and climate change adaptation (CCA) are necessary to reduce disaster risk and build coastal communities' resilience. Despite various efforts and progress taken on CCA and DRR, such as disaster management reform, the National Action Plan on Climate Change Adaptation, a legal framework to ensure DRR budgets, and training for local governments and community stakeholders – there is still lack of focus, especially at the local level where the disasters actually occur and policies should be translated into action (Anantasari et al., 2017).

Disaster risk, hazard, and local communities' responses should not be oversimplified to a model that considers risk, loss, and benefit of individuals and communities (Van Voorst, 2016). Related structural-technical and non-structural (social) problems can also contribute as risks within a local context and alter the response by government and other non-state actors. Each community is uniquely positioned regarding disaster risk, how they perceive their environment and their capacity to adapt. Structural positionality often limits the possible adaptive scheme. Therefore, government intervention can be targeted to expand these possibilities and enhance communities' capacity to strengthen their resilience while considering each member's position. For instance, the World Risk Report 2020 (Hilft, 2020)

highlighted Indonesia as one of the most vulnerable countries to natural hazards due to its location in the 'Pacific's Ring of Fire'. Approximately 90% of global earthquakes occur in this region, with an extremely high risk of associated tsunamis. Hence, Indonesian coastal communities face some of the highest tsunami exposure rates worldwide (Omira et al., 2019). As assessed by the World Risk Index 2020, Indonesia severely lacks adaptive capacities with regard to DRR and CCA and therefore combines high vulnerability with high exposure, especially in coastal regions (Hilft, 2020). This research shows the importance of DRR and DRM in avoiding and reducing such impacts on coastal communities in Indonesia and calls for more efforts to enhance resilience against future disasters.

Prior research also highlighted the weak capacities of local governments and institutions in implementing DRR measures (Anantasari et al., 2017). Local government personnel often lack the necessary skills and technical knowledge to develop DRR plans, and there is often confusion regarding the practical application of DRR strategies (UNDRR, 2019). In many cases, these governments are dependent on disaster funds from the national government and use provincial budgets for DRM implementation in a hesitant manner. Therefore, decentralizing DRR and CCA initiatives should be spearheaded by coastal communities to reduce vulnerabilities towards hazard risk. According to Oktari (2019), aside from insurance and access to financial funds, coastal communities can strengthen resilience through social networks, community engagement, and participation. These elements form the foundation of a community-led approach to DRM.

Community-led initiatives can enrich CCA-DRR, enhancing coastal communities' resilience while fostering more effective collaboration with local governments (Bijoux, 2015a; Satterthwaite, 2011). This approach empowers local communities to build upon and leverage their existing strengths and resources to address local issues and achieve collective visions and goals over the long term (Bijoux, 2015a; Torjman & Makhoul, 2012). Its strength lies in the active participation and engagement of different community stakeholders, allowing them to utilize various assets and creative ideas to foster resilience and meet specific needs, including those of the most vulnerable and marginalized groups. This generates ownership for local development and nurtures trust among community members and different stakeholders (Bijoux, 2015a; Corps, 2010; Satterthwaite, 2011). Moreover, a community-led approach can address challenges often faced by government-led CCA-DRR efforts, such as conflicting priorities, lack of interest, insufficient capacity and expertise to address community needs and root causes of vulnerability (Ingram et al., 2006; Kelman et al., 2012). Community-led CCA-DRR can be used to enhance existing and build new community assets and capacity, enabling communities to address, manage, influence, and adapt to social, economic, and environmental changes, as well as to recover from and mitigate the impacts of disasters and other threats, ultimately strengthening coastal community resilience (Catherine Courtney et al., 2007; Oktari et al., 2020).

This paper examines the implementation of community-led CCA-DRR in Indonesia through an extensive literature review of community-led approaches and their role in enhancing coastal community resilience. This paper explores practical examples from the global context, draws lessons learned, and provides recommendations to enhance coastal community resilience in Indonesia. Existing experiences on integrated CCA-DRR in various countries demonstrate how a community-led approach can integrate local community members, local government, external stakeholders, and appropriate support and funding mechanisms.

2. Coastal Communities and Coastal Hazards

Coastal areas face numerous challenges, and as coastal populations increase, their vulnerability becomes more significant (Mukhopadhyay et al., 2012). Human activities continually degrade the quality of the coastal environment and the integrity of coastal ecosystems on a daily basis. The coastline has become the epicenter of business, commerce, transportation, and industry. Approximately 40% of the global population resides within 100 kilometers of the coast (Arbon, 2014; Chelleri et al., 2015; Courtney et al., 2008; Ewing & Synolakis, 2011). Due to urbanization, the coastal population is expected to grow to encompass half of the global population in the future (Small & Nicholls, 2003). However, the safety and livelihoods of coastal communities are vulnerable and at-risk on account of natural and human-induced disasters driven by extreme weather events due to climate change and increased economic and development activities along coastlines (Almutairi et al., 2020). Furthermore, the dense concentration of the coastal population limits the community's capacity to plan for and respond to coastal hazards (Courtney et al., 2007).

2.1 Characteristics of Coastal Communities

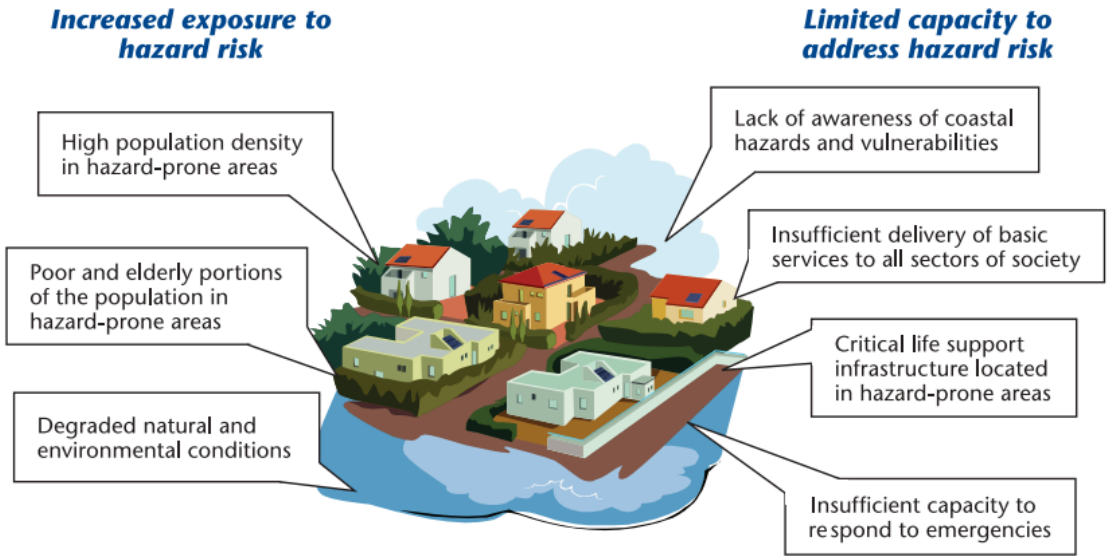

Figure 1. Factors that Contribute to Vulnerability in Coastal Populations

Source: Neumann et al., 2015

Millions of coastal inhabitants around the world already exist at the margins and face converging pressures that place them in vulnerable positions to make a living (Bennett et al., 2019). These pressures emanate from both land and sea, leading to a 'coastal squeeze' (Borchert et al., 2018; Bulleri & Chapman, 2010).

Many coastal communities live in relatively densely populated rural areas or small to medium-sized cities rather than in large cities. In such relatively rural communities, access to basic services and disaster warning and response mechanisms are limited. The limited capacity of a community to plan for and respond to coastal hazards makes coastal communities increasingly vulnerable and increases disaster risk. According to Neumann et al. (2015), more than 625 million

people live in coastal areas with less than 10 meters elevation. The population in such areas is expected to exceed one billion by 2060. The impacts of climate change, predicted to exacerbate coastal hazards, will have a significant impact on many lives and livelihoods of coastal communities (Umamaheswari et al., 2021)

Coastal communities are often associated with the fishing industry. These communities are strongly influenced by factors such as environment, seasonal changes, and market volatility, making them directly vulnerable to these variables (Wahyudin, 2013). This dependency has significant implications for the socio-economic living conditions of coastal communities, which are highly dependent on environmental conditions and vulnerable to environmental damage, particularly pollution, industrial waste, and oil spills. These can severely disrupt social and economic life and jeopardize livelihoods (Kusumastanto & Wahyudin, 2012)

According to Hanson (1984), the specific conditions of communities in coastal areas are:

Table 1. Coastal Communities' Specific Conditions

Aspects	Specific Conditions
Ecological and Geographic	a. Extensive ecological zone with a relatively narrow managed area. b. The physical aspect of the ocean causes high productivity in the activities of a day of shipping. c. There are limitations in sea transportation, ports, or alternatives to get land parts. d. Dealing directly with dangerous natural conditions such as wind, water currents, and various problems: malaria, water shortages, floods, droughts, and storms.
Economic	a. Revenues are generally below national standards. b. The income gap is caused by differences in resources, type of fleet, fishing gear, and market access. c. Fluctuating resources and market availability lead to income variation and uncertainty. d. Isolated community locations create high costs in building and maintaining infrastructure. e. Investment is rather difficult to do, and excess capital in some levels of society.
Social	a. Access to social services, such as health and education services, is limited. b. There is intervention from outsiders to form organizations for self-help that empower fishing communities, such as fishery cooperatives, fishing groups, and others. c. The closeness of relations in society is quite high. d. Independent of positive law, the community generally has local rules for utilizing local resources. e. The existence of crimes by certain people in the form of piracy, beatings, and other acts that are not considered by the government.

Source: Hanson, 1984

Hanson (1984) characterizes coastal communities as groups residing in disadvantaged areas, often facing socio-economic and infrastructural limitations. However, contemporary research suggests that these communities are increasingly becoming focal points of urbanization, introducing new layers of complexity to their socio-spatial dynamics. One prominent issue emerging from this transformation is coastal gentrification, driven by both economic development and climate change. Economic factors, such as investment in waterfront properties and tourism-driven urban renewal, often lead to the displacement of long-standing residents due to rising property values and shifting economic priorities (Freeman, 2008; Thompson, 2012; Willet, 2023). Simultaneously, climate change exacerbates these pressures, as adaptation measures—such as flood defenses and resilient infrastructure—frequently attract higher-income populations, reshaping the social fabric of these areas and further marginalizing vulnerable residents (Lees et al., 2008; Keenan et al., 2018; Best et al., 2023). This intersection of urbanization, economic restructuring, and climate adaptation underscores the urgency of examining coastal gentrification as a multidimensional challenge affecting social equity and environmental justice.

In Indonesia, based on Law No. 27 of 2007 concerning the Management of Coastal Areas and Small Islands and its amendment regulated in Law No. 1 of 2014, coastal communities can be divided into three groups: customary law communities, local communities, and traditional communities. The group divisions are described as follows:

Table 2. Coastal Communities' Characteristics in Indonesia

Groups	Definitions	Characteristics
Customary Law Community (MHA)	A group of people who have lived for generations in certain geographic areas in the Unitary State of the Republic of Indonesia because of ties to ancestral origins, strong relations with land, territory, and natural resources, have customary government institutions, and customary law order in its customary territory in accordance with the provisions of the legislation.	a. Ties to ancestral origins b. Strong relationship with land, territory, and natural resources c. Customary government institutions d. The customary law order in the customary area is in accordance with the provisions of the legislation
Local Communities	Groups of people who carry out their daily life based on habits that have been accepted as generally accepted values but are not completely dependent on certain Coastal Resources and Small Islands	a. The order of daily life based on generally accepted values b. Not completely dependent on coastal and small island resources
Traditional Communities	Traditional fishing communities have the right to carry out fishing activities or other legal activities in the waters of the islands in accordance with the rules of international sea law.	a. Traditional fishing communities b. Carry out fishery activities in certain areas in accordance with the rules of international law of the sea

2.2 The Most Common Coastal Hazards

Coastal hazards are those natural and human-induced hazards that occur chronically and episodically at the interface between the ocean and the shoreline. The risk from coastal hazards is characterized by the frequency of occurrence and the severity. Tsunamis are typically infrequent events with moderate to severe consequences. Mild flooding may occur frequently, while severe flooding may be infrequent. Coastal erosion may be a chronic event with mild consequences or, coupled with other hazards, may result in severe impacts on the shoreline. Saltwater flooding damages agriculture more than freshwater flooding, for example. Infrequent events with limited predictability pose the most significant disaster risk and the longest time needed for disaster recovery. Frequent or ongoing hazards, such as resource or environmental degradation processes, can be monitored to reduce risk.

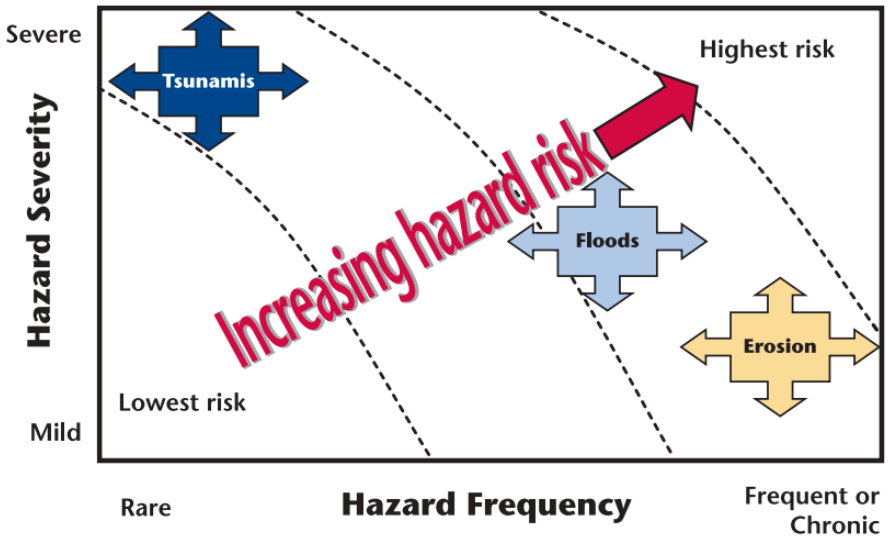

Figure 2. Risks from Coastal Hazards as Function of Hazard Frequency and Severity

Source: Courtney et al., 2007a

Tsunamis

A tsunami is a series of ocean waves typically generated by an underwater earthquake. Landslides, volcanic activity, and meteor strikes may also generate a tsunami. A tsunami wave may be very small in the deep ocean, but it increases in height as it approaches the shore, striking the coast as a fast-moving wall of turbulent water. Tsunamis can inundate low-lying coastal areas with multiple waves that can cause destruction far inland. Tsunamis can be labeled distant or local. A distant tsunami travels long distances from the trigger event to impact the coast hours later. A local tsunami can impact the coast within minutes after the trigger event, giving little or no time for warning and evacuation (Courtney et al., 2007a).

Earthquakes

Earthquakes are geological events that involve movement or shaking of the Earth's crust. Earthquakes are usually caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the earth's outer crust. Fault planes are typically found along the borders of the main tectonic plates; these plate borders generally follow the outlines of the continents. The areas of greatest tectonic instability occur at the perimeters of the slowly moving

plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent build-up of stored energy. When the built-up stress exceeds the rocks' strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, thereby producing an earthquake. Earthquakes can cause major damage due to intense ground shaking and liquefaction. In addition, the secondary impacts of earthquakes, such as tsunamis and fires, can also cause significant damage (Courtney et al., 2007a).

Storms

Numerous meteorological events can impact the coast, most commonly storms. These include severe thunderstorms, tropical cyclones, and extratropical cyclones (Courtney et al., 2007a). Coastal damage is caused by high winds and flooding.

Storm Surge

Storm surge occurs when water is pushed toward the shore by the force of the winds swirling around a storm. This advancing surge, combined with the normal tides, creates the storm tide. Tropical cyclone-induced storm tides can increase the mean water level by five meters or more. In addition, wind waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm surge coincides with the normal high tides. The greatest potential for loss of life-related to a tropical cyclone is from the storm surge, which historically has claimed nine out of ten victims of these events (Courtney et al., 2007a).

Flooding

Flooding is a localized hazard typically caused by excessive precipitation. The primary types of flooding are riverine flooding, coastal flooding, and urban flooding. Historically, flooding is the most common environmental hazard due to the widespread geographical distribution of river valleys and coastal areas and the attraction of human settlements to these areas. The severity of a flooding event is determined by a number of local factors, including river basin physiography, precipitation pattern ,and recent soil moisture conditions and vegetative state (Courtney et al., 2007a)

Landslides

Landslides occur when masses of rock, earth, or debris move down a slope, and can range in size from small to large and can move at slow to very high speeds. These events are typically triggered by storms, fires, and human modification to the land. Landslides pose serious threats to highways and structures that support fisheries, tourism, timber harvesting, mining, energy production, and general transportation. Landslides are particularly concerning because they often occur in conjunction with other natural hazards, such as earthquakes and floods. Landslides can also trigger other hazards, including tsunamis (Courtney et al., 2007a).

Spills and Chronic Pollution

Pollution can impact coastal areas in various ways, with spills occurring in the form of oil spills from ships, toxic materials released from storage tanks, and petroleum releases from severed pipelines, among others. These events can have devastating effects on coastal environments. In some cases, these episodic pollution events are caused by other coastal hazards such as tsunamis, tropical cyclones, and storm surges (Courtney et al., 2007a).

Shoreline Erosion

Shoreline erosion is the wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years through the action of wind, water, or other geologic processes. Wind, waves, and longshore currents are the driving forces behind coastal erosion. This removal and deposition of sand permanently changes the beach's shape and structure. Additional factors involved in coastal erosion include human activity, sea-level rise, seasonal fluctuations, and climate change. Shoreline erosion is typically a chronic hazard, but a single storm even may be induce severe shoreline erosion (Courtney et al., 2007a)

Sea Level Rise

Sea level rise is an increase in the mean sea level. Throughout history, the earth has gone through periods of sea level rise and decline, which are directly tied to climate change and global warming and cooling trends over geologic and recent times. Sea level fluctuations are a part of the natural processes on earth that are determined by many factors but largely are influenced by climate and global warming. In comparison to other disasters that affect the coastal zone, such as tropical cyclones, tsunamis, floods, and earthquakes, sea level rise is on a much more gradual time scale (Courtney et al., 2007a)

Climate Variability and Change

Short- and long-term climate variability can significantly impact coastal environments. Climate variability refers to temporal variations of the atmosphere and ocean system around a mean state. Climate variability can cause abrupt disruptions, such as floods, droughts, or tropical storms. Over the past decade, scientists have improved prediction capabilities for some climate variability events such as El Niño and La Niña. Climate variability can have huge impacts on coastal environments by causing an increase or decrease in storm activity, which in turn could lead to water supply issues, drought, or increased flooding and erosion (Courtney et al., 2007a)

Coastal Resources Degradation

Coastal zones are home to some of the Earth's most complex, diverse, and productive ecological systems. Coastal resources are very productive, both biologically and economically. Reefs, mangroves, wetlands, and tidelands provide nursery and feeding areas for many marine species. Additionally, these coastal resources function as important buffer areas, offering storm protection and helping to control erosion. However, human activities within coastal areas can contribute to the degradation of these crucial resources (Courtney et al., 2007a)

3. Community-led CCA-DRR Framework

3.1 Climate Change Adaptation and Disaster Risk Reduction (CCA-DRR)

Climate change refers to a wide range of extreme and intense natural events, also due to adverse changes in temperature, precipitation and weather conditions (Hilft, 2020, p. 7,9; UNDRR, 2020b, p. 16) leading to sea level rise and flooding, coastal inundation, landslides, or droughts, fires, and storms (UNDRR, 2020b), which in turn can result in coastal erosion, adverse changes of agriculture conditions and scarcity of drinking water (Hilft, 2020). Climate change can significantly increase the vulnerability of coastal communities also with regard to disasters. Therefore, to reduce vulnerability to the adverse impact of climate change, Climate Change Adaptation (CCA) is developed. It is defined as 'the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities' (IPCC, 2012). It includes adjustment of ecological as well as economic and social systems (Smit et al., 2001). In contrast to DRR, CCA only addresses climate-related hydro-meteorological hazards (Venton & Trobe, 2008, p. 7), which do not include geological hazards such as earthquakes,

volcanic eruptions, or tsunamis and some landslides, which are addressed by DRR (Solecki et al., 2011; Venton & Trobe, 2008, p. 7).

CCA has been integrated into DRR (Dias et al., 2018b, p. 978) according to the suggestion of researchers, practitioners, and policymakers in recent years (Forino et al., 2014). The SFDRR 2015-2030 specifies a clear linkage between sustainable development, CCA, and DRR. The increased incidence of multiple hydro-meteorological hazards (Hilft, 2020, p. 7; UNDRR, 2020b, p. 16) has led to shared targets across CCA and DRR. These are vulnerability reduction, enhancement of resilience, and adaptive capacity building to natural hazards (Dias et al., 2021b, p. 2; Venton & Trobe, 2008, p. 4). Coastal communities should be supported by this convergence of CCA and DRR, as they have been heavily impacted by both climate change and natural disasters (Shaw, 2010, p. 7). Measures for DRR can lessen the impact of climate change, and measures for CCA can lessen the risk of disasters (Dias et al., 2018b, p. 979). This paper views CCA-DRR as an integrated approach, although many challenges remain that hinder the actual combined implementation in practice (Dias et al., 2018b, p. 978).

Supplementary, CCA also addresses slower onset events such as ocean acidification, salinization, and desertification, as well as loss of biodiversity, changes in ecosystem services, and the spreading ‘of climate-sensitive diseases’ (IPCC, 2012; Venton & Trobe, 2008, p. 7), desertification or the degradation of land and forests, which can further threaten the economic and social factors of coastal communities and lead to higher vulnerability and lessened capacity to reduce disaster risks (Courtney et al., 2007b), which is therefore also relevant for DRR.

Disaster Risk Reduction (DRR)

DRR comprises ‘the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events’ (UNISDR, 2012, p. 91). DRR consists of goals that are part of DRM’s practical implementation of initiatives, despite both terms often being conflated (Twigg, 2015). In a traditional framework, the disaster management approach is based on the “disaster cycle”, a conceptual and linear operational model which divides cycles into phases consisting of before, during, and after disaster (Twigg, 2015).

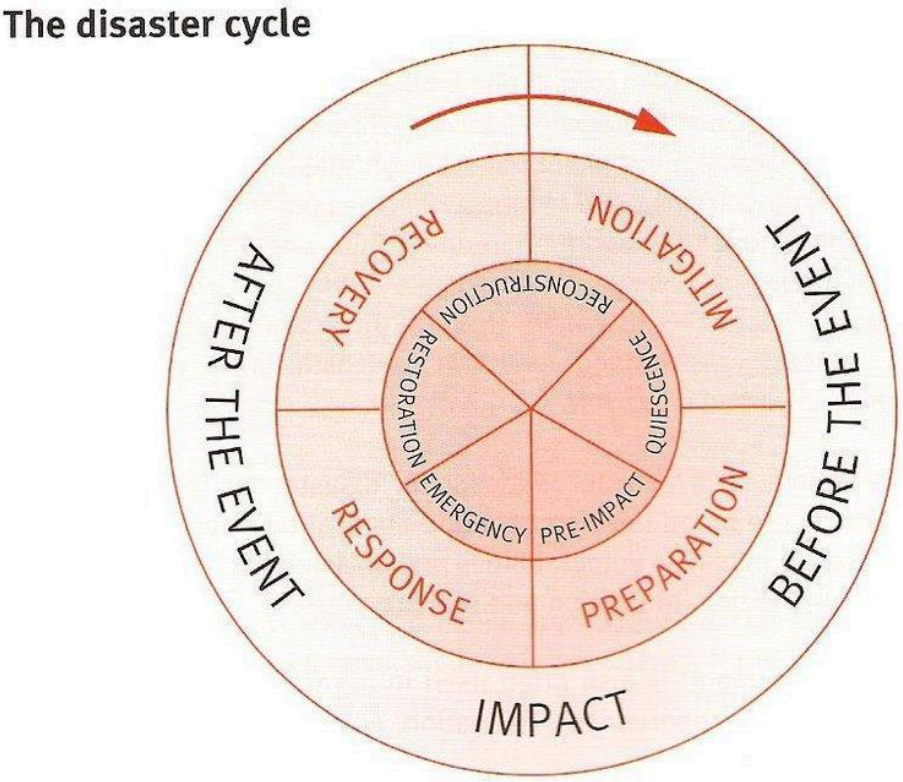

Figure 3. Disaster Management Cycle

Source: Adapted from Twigg & Humanitarian Practice Network (2004)

It is necessary to identify and subsequently combat the underlying drivers and root causes of disaster risk, which are often connected to inadequate economic and infrastructural development, environmental degradation, poverty, inequalities, and climate change. Even if the understanding of its interconnectedness exists, the traditional framework cannot accommodate this, leaving stakeholders with limited and fragmented operations in dealing with disaster (Alexander, 2013; Twigg, 2015; UNISDR, 2009). A holistic framework of disaster planning, implementation, and evaluation is needed to gain feedback within the process(Alexander, 2013; Twigg, 2015; UNISDR, 2009).

3.2 Benefits of Combined CCA-DRR

Combining CCA and DRR can mutually strengthen each other, as an integrated and holistic approach has multiple benefits for sustainability and effectiveness (Venton & Trobe, 2008). They share the main goals of resilience, vulnerability reduction, and building of adaptive capacity (Lei & Wang, 2014; Twigg, 2015; Venton & Trobe, 2008). Additionally, both approaches aspire to raise knowledge and awareness, as well as wider participation and the usage of policies (Venton & Trobe, 2008). DRR measures and policies can lessen climatic impacts and therefore reduce vulnerabilities to climate-related hazards and losses (Twigg, 2015; Venton & Trobe, 2008). Measures for CCA can equally lessen the risk for (especially climate-related) disasters through the reduction of vulnerability while learning from DRR implementations (Dias et al., 2018b, p. 979;

Lei & Wang, 2014, p. 1591;1595; Twigg, 2015). Several benefits of the combined CCA-DRR include:

Combination of Global Top-Down & Local Bottom-Up Approaches

CCA primarily adopts a top-down perspective, which includes analysis on a global scale mainly focused on local regions (Birkmann & Teichman, 2010). That can be explained through potential impacts related to climate change in contrast to local impact rather on the local communities (IPCC, 2012). In contrast, DRR considers more community-led approaches and participatory bottom-up approaches (Mercer, 2010). The top-down approach of CCA may lead to the exclusion of vulnerable communities at a regional level in terms of decision-making and eligibility (Pelling, 2003). Policies need to be translated into practical interventions (Lei & Wang, 2014), which can profit from local knowledge through community-based approaches rather than relying on the bottom-up perspective of DRR (Lei & Wang, 2014; Venton & Trobe, 2008).

Long-term Perspective

DRR benefits from the long-term global perspective and strategies of CCA (Lei & Wang, 2014; Venton & Trobe, 2008). Since DRR focuses more on the reduction of foreseeable risks by building on experiences from previous disasters, it is more likely that DRR will struggle with the integration of new risks (Venton & Trobe, 2008). Additionally, disasters are often classified as event-related and occur in a limited time period. Hence, interventions in DRR are often done with regard to a short-term perspective (Dias et al., 2021b; Lei & Wang, 2014). Meanwhile, CCA focuses on the prediction of climate change impacts, related shifts in environmental conditions (Few et al., 2006) and related hazards & disasters in specific regions over the long-term from the perspective of environmental sciences (Venton & Trobe, 2008). This long-term perspective is also sought by the DRR community (Sperling & Szekely, 2005).

Increased Efficiency & Effectiveness

Another benefit of considering DRR and CCA together is the increased cost-efficiency and effectiveness in terms of collaboration of human, financial, and natural resources (Venton & Trobe, 2008, p. 1). This enables resilience to be built more comprehensively (UNFCCC, 2017). CCA programming, for instance, tends to receive larger funding because it has received more attention at national levels than DRR and because donors support approaches which are based on scientific evidence (Dias et al., 2021b). DRR is often considered to be less scientific than CCA (Dias et al., 2021b); therefore, the combined CCA-DRR approach will benefit in terms of funding.

Knowledge Enrichment

CCA, in turn, benefits from the long experience and local view of DRR with regard to climate-related threats and hazards through learning from the extensive DRR history of managing hazards and past disasters (Lei & Wang, 2014; Venton & Trobe, 2008). DRR communities have effective tools to deal with climate-related disasters: vulnerability and risk assessment tools, early warning systems, land-use planning and building code regulation, and institutional and legal capacities (Venton & Trobe, 2008). The DRM community also has well-established, experienced, and strong institutions at more regional levels (Venton & Trobe, 2008) since DRR is often perceived as more important and responsive by municipal and local governments toward the local community's needs (Amaratunga et al., 2017)

Even though combined CCA-DRR approaches have several potential benefits, there has not yet been an explicit conceptual framework including operational instructions (Lei & Wang, 2014). For example, the 2012 IPCC report brings together several possible approaches, but it mainly stays on a macro level and strategic perspectives (IPCC, 2012; Lei & Wang, 2014). Hence, combined CCA-DRR effort can be improved through community-led Development that incorporates the insights from communities that actually experience the combined impacts of disasters and adverse effects of climate change.

3.3 Community-led Development

A community-led approach encompasses community-level initiatives implemented by various actors, including communities, NGOs, and governments (Loha, 2018), but there is no fixed definition for this approach. Most are similar and resolve in addressing the community-led approach as a bottom-up approach that implements community-need-specific development strategies from local partnerships (Inspiring Communities, 2018 ; Torjman et al., 2012). However, a community-led approach is an effective approach to building community strengths over the long term (Torjman et al., 2012) as an active and collective engagement of community members and stakeholders. It involves analyzing situations, discussing possible alternatives, and gathering different capabilities and resources to reach a locally owned vision and goals (Inspiring Communities, 2018; Reid, 2002). Participatory processes and the community leadership capacity are considered a significant part to contribute to the community-led approach (Reid, 2002). Community-led initiatives can enrich CCA-DRR to enhance coastal communities' resilience and may also contribute to better implementation in collaboration with local governments (Bijoux, 2015b; Satterthwaite, 2011). A community-led approach is an approach which can enable and empower local communities to build on and leverage their existing strength and resources to tackle local issues and reach collective visions and goals over the long-term (Bijoux, 2015a; Torjman et al., 2012). As stated by Oktari 2019, coastal communities can implement better resilience not only through insurance and access to funding but also through social networks, community engagement and participation, which is a main part of a community-led approach.

Community-led approach's strength point is the active participation and engagement of different stakeholders of a community which leads to the possibility of using all their different assets and creative ideas to foster resilience and meet the specific needs of all community members, including the most vulnerable and marginalized groups, who can therefore generate a feeling of 'ownership for development and build trusting relationships among the community and the stakeholders (Bijoux, 2015a; Mercy Corps, 2010; Satterthwaite, 2011). The community-led development allows people to participate in and feel ownership for their own development, gives an opportunity to the communities to prioritize urgent needs specific to their own community, and builds trusting relationships, positively impacting perceptions regarding the capability of actors and the impact of their efforts (Mercy Corps, 2010). Unchecked poverty for instance, is seen as a main driver and a root cause for disaster risks that can be faced through community-led development (UNDRR, 2021). Therefore, community-led CCA-DRR can be used as an approach to use existing and build new community assets and capacity, which include, as described by Courtney (Catherine Courtney et al., 2007), the ability to address, manage, influence and adapt to social, economic and environmental change and disturbances of threats and disasters for instance through appropriate recovery actions or mitigation for a better Coastal Community Resilience (Oktari et al., 2020).

Here, a community-led approach is seen as a general basis for community-led CCA-DRR efforts, since community-led CCA-DRR initiatives will strive to a specific development towards enhanced climate adaptation, disaster resilience, and risk reduction of a community. Several benefits of a community-led approach include:

Community Empowerment

Additionally, the community-led approach facilitates the empowerment of community members and (Forino et al., 2015) strengthens the ownership feeling of the community regarding their own particular development (Mercy Corps, 2010). The community empowerment takes place when the development involves all community members to actively participate in identifying problems, obtaining resources, and improving their skills and experience in the program (Ani et al., 2017). The sense of ownership can be enhanced by recognizing three characteristics such as ownership in process which identifies who has a voice and whose voice is heard, ownership in outcome which identifies who has influence over decisions and expected results from the effort, and ownership distribution, which identify who is affected by the process and outcome (Lachapelle, 2008). Moreover, it provides opportunities for community members and for communities as a whole to gain practical problem-solving skills, strengthen social capital, exploit local resources, and recognize context-specific factors that merit attention (Rojas Blanco, 2006) through bottom-up approaches of ideas (Aalst et al., 2008).

Enhance Capacity and Ability

Mercy Corps (2010) reached conclusion about the importance of community-led approach in enhancing capacity and ability, referring to their three main findings on the benefits of community-led programming in fragile environments from Iraq and Afghanistan: Mercy Corps (Mercy Corps, 2010) reached conclusion about the importance of community-led approach in enhancing capacity and ability, referring to their three main findings on the benefits of community-led programming in fragile environments from Iraq and Afghanistan:

Community-led approach results in capacity-building by engaging with local officials and population in close working relations to run initiatives while ensuring responsibility and openness.
Community-led approach helps achieve community-building with the involvement of all concerned parties to determine and tackle the local problems, promoting inclusion and collaboration, and ensuring proper use of resources.
The approach helps to ensure ownership-building by enhancing individuals' ability and readiness to play a role and contribute in initiatives to create better local settings.

Overcoming Government-Led Effort Issues

In addition, a community-led approach has the potential to overcome further issues, such as those related to government-led development regarding the CCA-DRR effort. Efforts by the government can fail due to lacking know-how, capacity, interest of priorities, and resources of responsible governmental actors (Ingram et al., 2006; Kelman et al., 2012), thus failing to address root causes of the community's vulnerability. Unchecked poverty for instance, is seen as a main driver and a root cause for disaster risk (UNDRR, 2021), which can be faced through a community-led approach since it involves residents in identifying priorities and needs (Mercy Corps, 2010, p. 4). It can also lead to changes in broader systems through civil society pressure,

local analyses, knowledge, and proof of community's capacities and community-led Initiatives to the government and other institutions (Satterthwaite, 2011, pp. 341–342).

As an example, a successful community-led approach can influence a beneficial revision of policies and institutions to enhance community resilience regarding DRR (Satterthwaite, 2011). It can also lead to changes of funding arrangements for the benefit of the community initiatives (Bijoux, 2015b). As stated by Bijoux (2015), one of the examples on how community-led approach activities were funded by many local authorities and gained attention is the central New Zealand government, which has become more active in exploring such initiatives (Bijoux, 2015b).

3.4 Community-led CCA-DRR Principles

The following aspects are compiled from several writings about community-led approach, which identified these aspects with regard to previous research, projects and practice as crucial for success. The principles are combined and complemented with the CCA-DRR principles. These principles will be a guide for applying community-led CCA-DRR in designated areas. Each principle will be elaborated below as follows:

1. The long-term nature of Community-led approach

The process of community-led development is a continuous process of learning, reflection, and revision of progress toward objectives (Bijoux, 2015b; Thornley et al., 2015; Torjman & Makhoul, 2012). The community-led approach recognizes the importance of both outcomes and processes and the need for a longer time to tackle complex problems and find solutions (Torjman & Makhoul, 2012). Additionally, a long-term arrangement for funding with capacity and flexibility for adaptation is necessary to enable sustainable change and improvement (Thornley et al., 2015). The availability of suitable and specific funding arrangements, including long-term investment, is also seen as a necessary component for effective CCA-DRR (Dias et al., 2021b). However, funding arrangements for CCA-DRR are often challenging due to the segmented funding mechanisms and lack of cooperation between CCA and DRR (IPCC, 2012; Venton & Trobe, 2008). Hence, those factors reinforce the long-term nature of the community-led approach.

2. Community self-determination and focus on their voice and views

The community-led approach process is driven by active, collective, and participative engagement of the residents. The residents will need to work together to develop and achieve their own shared local visions that drive their planning as well as the related action (Bijoux, 2015b; Inspiring Communities, 2018). This leads to an increase in the 'feeling of local ownership', which further enables more sustainable and valued impacts (Mercy Corps, 2010). Furthermore, it is reported that community connectedness increased in post-disaster. Especially in the immediate aftermath when people acted, which helped them to adapt afterward as well as focus more on themselves (Thornley et al., 2015).

3. Community leadership capacity and empowerment

Community-led development, particularly in rural areas, is a matter of hope and participatory processes toward collective goals and toward increased community leadership capacity over time, not as simple as money (Reid, 2002). There is a process of building the capability of community members to assume leadership roles in community-led development that does not just happen on its own (Thornley et al., 2015). The building and fostering of diverse, skilled, and collaborative local leadership are considered as another main point fora successful community-led approach (Bijoux,

2015b; Inspiring Communities, 2018). Capable leaders are essential to create enthusiasm and motivation for the whole community-led approach movement (Bijoux, 2015b). Furthermore, engagement with such leaders can develop more leadership capacity through creating and demonstrating how flourishing collaborative work can look (Bijoux, 2015b). According to the literature, the experience of collaborative and collective problem-solving not only empowers community members but leads to more successful disaster recovery (Chandra et al., 2010; Mooney et al., 2011; Paton et al., 2008)

4. Capable and fair perceived multi-stakeholder collaboration as effective convener

As CCA-DRR is interdisciplinary that depends on various parties, including governmental bodies, private sectors, academia, and communities to work together, a multi-stakeholder participatory system is needed (Phanumat, 2015; Torjman & Makhoul, 2012). In Scotland, stakeholders in disaster resilience could be divided into two responsibilities, managing disaster risks and improving community resilience. These include government authorities, private and third sector organizations, as well as communities at risk (Adekola et al., 2020). Hence, it is recognized that no single agency has all the necessary power, expertise, resources, and structure to address the challenge of reducing new or existing disaster risks (Hickman, 2018; Magis, 2010).

It is usually a local group, organization, or individual with competence that unites many various parties with different interests to create local governance bodies (Bijoux, 2015b; Torjman & Makhoul, 2012). For instance, it is stated that the community-led approach programs were united by the NGOs to promote the inclusion and participation of community groups (also marginalized groups) and were 'serving as a catalyst for improving local institutions' (Bijoux, 2015b). Thus, it is necessary to build strong, trusting, supportive, and empowering collaboration, including networks, such as academia, residents, NGOs as well voluntary organizations, the private sector, and the government (Thornley et al., 2015; Torjman & Makhoul, 2012). The active engagement of stakeholders will help to utilize different assets, resources, and creative ideas to foster resilience and meet the specific needs of all community members, including the most vulnerable and marginalized groups (Bijoux, 2015b; Mercy Corps, 2010; Satterthwaite, 2011).

5. The use of existing strengths, knowledge, and assets of the local community

The transfer and common use of information, know-how, and experience between the different stakeholders are seen as crucial to ensuring suitable CCA-DRR strategies (Birkmann & Pardoe, 2014; Dias et al., 2017). Several literature acknowledge the importance of determining strengths, assets, and resources to build upon solutions that are prioritized, implemented, and led by the communities (Bijoux, 2015a; Inspiring Communities, 2018; Torjman & Makhoul, 2012). Furthermore, in the decision-making process, individuals and communities at least need to have the potential to acquire knowledge and skills necessary to participate (Torjman & Makhoul, 2012). This principle for CCA-DRR should address the appropriate data on vulnerability, capacity, risks as well as understanding impacts of disasters and climate change-related events and development (Dias et al., 2021b). Relying on existing resources and skills while letting the community members utilizing the existing capacity can lead to effective progress toward the vision (Bijoux, 2015b). The transfer and common use of information, know-how, and experience between the different stakeholders are seen as crucial to ensuring suitable CCA-DRR strategies (Birkmann & Pardoe, 2014; Dias et al., 2017). Furthermore, in the decision-making process, individuals and communities at least need to have the potential to acquire knowledge and skills necessary to participate (Torjman & Makhoul, 2012). This principle for CCA-DRR should address the appropriate data on vulnerability, capacity,

risks as well as understanding the impacts of disasters and climate change-related events and development (Dias et al., 2021b).

4. Results and Discussion

4.1 Community-led-CCA-DRR Initiatives in Indonesia

As mentioned by Bijoux (Bijoux, 2015b), successful community-led approach examples are often related to specific projects derived from prevailing issues in the community:

4.1.1 Community-led Action in Palu City, Indonesia

On September 28, 2018, Palu City was shocked by multiple hazards such as tsunami, earthquake, and liquefaction. During the emergency, government reinforcements did not come readily, which resulted in the communities directly distributing assistance, bringing basic needs such as food, clothing, and aid logistics (Yulianto et al., 2021, p. 6). To gather and share information during the disaster, the communities also used social media, where they could share what they needed and support each other (Yulianto et al., 2021, p. 7). Social media information by communities was crucial to access infrastructure and transportation facilities. In contrast, transportation was mostly needed due to the large number of people who wanted to leave Palu City during this phase because of the chaos in the form of looting markets, fuel stations, and shops (Yulianto et al., 2021, p. 9).

The case above highlights the vital Palu community-led actions during the emergency situation, particularly for quick response and self-evacuation. This action was also rooted in their local knowledge and wisdom of earthquakes that have been passed down through generations (Yulianto et al., 2021, p. 7).

4.1.2 Community-based Responses of Flood in Cilacap Regency, Indonesia

Based on the data of the Regional Disaster Management Agency (*Badan Penanggulangan Bencana Daerah*/BPBD), Cilacap Regency was damaged by tidal floods, flash floods, and land subsidence throughout 2016, which caused loss of Rp. 71.5 billion in total (Subiyakto et al., 2019, p. 51). To reduce the risk level of floods, the Cilacap Regency Government involved the local community organizations in risk mitigation to reduce disaster risk, from preparedness, emergency response, and post-disaster situations. Such community organizations include Muhammadiyah Disaster Management Center (MDMC), Youth Disaster Response (*Taruna Tanggap Bencana*/TAGANA), and Police Partner Communication Center (*Sentra Komunikasi Mitra* POLRI) (Subiyakto et al., 2019, p. 53).

In practice, MDMC focuses on DRR by raising awareness and educating communities. During a disaster, their primary role shifts to assisting victims, while after the disaster, they provide guidance in trauma rehabilitation. (Subiyakto et al., 2019, p. 53). As a youth organization, TAGANA specifically focuses on training young people in disaster mitigation. Similar to MDMC, their role during a disaster is to assist the disaster survivors, while after the disaster they primarily concentrate on rebuilding infrastructure. (Subiyakto et al., 2019, p. 53). Meanwhile, *Sentra Komunikasi Mitra POLRI* is mainly responsible for communicating any disaster information and early warning to the community (Subiyakto et al., 2019, p. 53). When a disaster occurs, they function as a communication center for victims and infrastructure recovery after disaster.

This case highlights the crucial role of collaboration between local community groups and local governments in enhancing community preparedness, such as through flood disaster education,

awareness programs, and training (Subiyakto et al., 2019, p. 53). During disasters, similar to the Palu's case, information shared by the local community is key during an emergency phase where they could connect real information from local authorities and act as a safeguard for the victims. Moreover, the community could also speed up the recovery process at the post-disaster situation by rebuilding damaged infrastructure and facilities.

This case signifies the importance of Because the community's role to respond to the floods is critical, therefore the community still continues to communicate and cooperate between communities and the government. Important lessons to be learned is that the local community groups in flood disaster education, socialization, and training for the general community can act as an educators to people within socialization or training in the flood disaster area (Subiyakto et al., 2019, p. 53). Similar to the Palu's case, information shared by the local community is key during an emergency phase. Information is the key to help victims during a disaster, the community they could act as a media to connect real information from local authorities and act as a safeguard for the victims. After that, the community could also speed up the recovery process by focusing on rebuilding damaged infrastructure and facilities.

4.2 Countries Reflections on Community-led-CCA-DRR Initiatives

4.2.1 Enhancing Community Resilience to Disasters (ENCORE), the Philippines

The Enhancing Community Resilience to Disasters (ENCORE) project in the Philippines was implemented by Save the Children, an NGO that targeted children from high and primary schools (Hore et al., 2018). This project provided training programs for the youths through knowledge transfer and capacities by the local youth champion before they graduate (Hore et al., 2018). The project involved youths to actively contribute to the analysis of hazards, vulnerability, and adaptive capacity. The youths also conducted awareness campaigns for DRR in schools which included disaster preparedness and waste management to prevent flooding and environmental degradation (Hore et al., 2018). Furthermore, they also established early warning systems and organized drills for disaster response for the whole neighborhood community (Hore et al., 2018).

Overall, this ENCORE project has increased the awareness and understanding of disaster management among the communities, including their capacity in a decision-making process (Gaillard et al., 2014; Hore et al., 2018). With regard to the community-led CCA-DRR principles, this project optimized the unique capacity of the children and youth community to enhance resilience. Moreover, it also contributes to increasing the involvement of the whole community in awareness dialogue. Unfortunately, there was no information about the further sustainability and the funding of this project since ongoing support from Save the Children would be important for long-term success.

4.2.2 CUPA in Te Awa Kairangi – Lower Hutt, New Zealand

One example of a community-led initiative for CCA, mitigation, and general fostering of collective well-being is the Common Unity Project Aotearoa (CUPA) community initiative, which was established in 2012 in Te Awa Kairangi – Lower Hutt in New Zealand (Simon et al., 2020). The initiative started with a project where an unused school soccer field has been converted into a micro-farm (Simon et al., 2020, p. 96) and café to provide inclusive and affordable meals for everyone. Several activities to retain sustainability were also done, such as affordable reuse actions of repairing and reselling bikes; and using reusable and zero-waste materials for collective sewing and mending clothes (Simon et al., 2020, p. 97). All these enterprises teach people through using and learning from

each other's diverse skills and knowledge and learning together through hands-on activities (Simon et al., 2020). This leads to a feeling of being able to contribute something valuable whilst gaining something in return (Simon et al., 2020, p. 99). Other than that, CUPA had a strong base of financial support through funding from different community grants, government funding, and corporate and individual donations (Simon et al., 2020).

Regarding the principles of community-led CCA-DRR, the CUPA initiative fulfilled the main success driving aspects, such as supportive stakeholder engagement, partnership and appropriate funding from stakeholders. Other than that, it also contributed to creative ways of vulnerability reduction through securing food supply and skill transfer about sustainable living while building collective resilience. Although these activities are not directly related to CCA, increasing food security and increasing ability to learn are vital parts of fostering urban resilience to cope and adapt with climate change (Pelling, 2011; Simon et al., 2020; IPCC, 2014).

4.2.3 Indigenous Flood Disaster Risk Reduction in Nigeria Coastal Communities

Nigeria's coastal communities have been affected by flood disasters over decades which results in human, property, and livelihood resources loss (Cirella & Iyalomhe, 2018, pp. 2, 8). Hence, Nigeria's coastal communities have a unique way to reduce the flood risks and adapt to climate change through indigenous flood control and management systems (Obi et al., 2021, p. 1). Nigeria's local wisdom on flood risk management is passed down through generations and has been proven successful in upgrading knowledge in disaster reduction planning strategies and its climate adaptation at grass-roots level (Danladi et al., 2021, pp. 49–50). Indigenous flood control and management practices, knowledge systems, and prediction methods have effectively reduced flood risks by enhancing forecasting, magnitude detection, emergency preparedness, coping strategies, food security, and safety procedures (Obi et al., 2021, p. 8). The flood control and management practice of coastal communities mainly rely on the indigenous flood defense techniques (e.g. dykes, reservoirs, weirs) while also supported by modern technologies (e.g. canals, embankments, dykes) (Obi et al., 2021, p. 8). In addition, other indigenous knowledge is also employed for flood control, forecasting, magnitude detection, emergency preparatory, coping, food security, and safety (Obi et al., 2021, p. 8).

In this Nigerian case, indigenous knowledge acts as a united system in resolving flood disasters in coastal communities. The results also show that community-based disaster management is important in developing sustainable approaches to flood risk reduction worldwide (Obi et al., 2021, p. 9). It can also be further improved by combining local wisdom with modern flood management. For example, in Nigeria, indigenous knowledge could be integrated with modern architectural design to create sustainable houses and infrastructure that are resistant to flooding.

There are almost no precise community-led CCA-DRR for coastal communities' resilience examples found where most initiatives are more related to DRR. One reason can be that there are still barriers of the convergence of CCA and DRR which hinders combined funding – also for CLIs. The case of the Maori community has provided an example of how existing CLIs still demand governmental recognition and support, as the lack of formal integration into national policy has hampered implementation. Another reason for a lack of examples for community-led CCA-DRR especially in developed countries can be the fact that citizens of high-income countries often don't need to address CCA-DRR issues through community-led approach, since services and infrastructure regarding disaster risk reduction are adequately addressed by the related government institutions (Satterthwaite, 2011, p. 340). Additionally, as mentioned before, CCA is not that familiar with bottom-up approaches since it has been more focused on the broader political policy base so far (Mercer, 2010)

There are some essential lessons-learned derived from CLIs which are not directly related to CCA-DRR to build coastal communities' resilience, but can still serve as orientations and positive examples. However, many of these initiatives are concerning socio-economic issues, which can be addressed regarding some of the root causes of vulnerability and disaster risk. For instance, Bijoux (2015) mentions several aspects derived from nine long-term operating community-led approaches in Aotearoa New Zealand, which highlights the contextual differences of communities that induces the need of different approaches for successful operations in participative ways. Also, as ascertained by Bijoux (2015), to start CLIs and achieve progress regarding a shared community vision, project approaches were commonly favoured (Bijoux, 2015b, p. 759) as one of the successful community-led approach approaches, moreover that most local-led change are often driven by previous experience (Bijoux, 2015a, p. 764). Hence, it shall also be implemented in the context of community-led CCA-DRR for coastal communities' resilience by starting projects with fast visible outcomes built on existing strengths, skills and resources to increase impact and motivation (Bijoux, 2015a, p. 766). All this together was seen as a cause for the overcoming of distrust and a development of respect as well as gratefulness (Torjman & Makhoul, 2012, p. 37). In addition, the aforementioned case of the ENCORE project in the Philippines has highlighted the importance of a long-term plan and a sustainable approach, which is also a necessity to consider when conducting community-led initiatives.

4.3 Reflection on Global and Indonesia National Framework of Community-led CCA-DRR

There are three crucial frameworks for implementing CCA-DRR: Sendai Framework for Disaster Risk Reduction (SFDRR), Paris Agreement, and Sustainable Development Goals (SGDs). These frameworks deliver climate change and disaster resilience and further sustainability for the world. Moreover, community-based and community context in general has been addressed to stimulate the process of achieving resilience and further sustainability.

The Sendai Framework for Disaster Risk Reduction (SFDRR) prioritizes reducing disaster risks by enhancing public understanding, strengthening governance, and investing in resilience. It emphasizes community involvement and collaboration among authorities, indigenous groups, and civil society. Similarly, the Paris Agreement integrates climate adaptation, disaster risk reduction, and financial support for climate resilience while aiming to limit global warming below 2°C. Community-led initiatives play a key role in strengthening resilience and protecting vulnerable populations. Complementing these efforts, the Sustainable Development Goals (SDGs) promote resilience through targets such as Clean Water (6), Reduced Inequalities (10), Sustainable Cities (11), Climate Action (13), and Life on Land (15). Lastly, as the UNFCCC TP/2017/3 acknowledge, the three agendas can be intertwined.

The three global agendas highlighted above-become a reference for the implementation in the Indonesian framework on CCA-DRR. However, in the national framework, the three agendas are still implemented separately, although both *Rencana Nasional Penanggulangan Bencana* (RENAS PB) and *Rencana Aksi Nasional Adaptasi Perubahan Iklim* (RAN API) already mention and aim to achieve similar sustainable development goals in their documents. At the national level, necessary regulatory changes can be made possible to integrate CCA, DRR, and sustainable development goals as mutually supporting frameworks. At the moment, both revisions for law no. 24 the year 2007 and Reformation (strengthening) of the Disaster Resiliency System were still ongoing. However, challenges remain in integrating the community-led initiatives into existing agendas. The progress of RENAS PB has barely mentioned the

importance of community-led initiatives in disaster management, however, they have centered on improving communities' resilience and participation in general. Regardless, the document has not acknowledged the role of local knowledge and grassroots leadership explicitly. Conversely, the RAN-API has included community-based initiatives in the document despite suboptimal implementation that still lacks an ideal amount of localized projects. For Indonesia, future efforts must focus on expanding community-based projects, securing long-term funding, and implementing local capacity-building. A more inclusive approach where communities are not only beneficiaries but active decision-makers will be essential in strengthening disaster preparedness and climate adaptation.

4.4 Prospect and Challenge on Implementing Community-led CCA-DRR in Indonesia

Even though community-led CCA-DRR are beneficial, there are various challenges that could be faced due to the unfulfilled aforementioned principles, implementation-aspects, and remaining difficulties regarding the cooperation, integration, and government roles in CCA and DRR. The main challenges and their prevalence in Indonesia's context are mentioned in the following paragraphs:

Challenges in Separate Operations of CCA and DRR

The integration of CCA and DRR is challenging, due to the many aspects that need to be aligned for it to effectively integrate. Institutional frameworks, political processes, financing mechanisms, information sharing, and expert practitioners have mostly remained separate (IPCC, 2012; Venton & Trobe, 2008). In many countries, CCA and DRR are led by different government institutions at the national level. This then causes policies and programs to be developed parallel with each other, with minimal collaboration (Dias et al., 2021a). Efforts in integrating the two have begun, but challenges were found in creating adaptation strategies due to competing interests of different stakeholders (Lei & Wang, 2014), this is increasingly difficult when the scope of interest increases from local to regional to national. Meanwhile, translating from global and national policies to local development plans has its own difficulties. Local CCA-DRR is often related to weak linkages, limited budget, poor knowledge transfer, and poor participation approaches that cause CCA-DRR plans to not reflect local and community needs (Dias et al., 2021a).

Indonesia has developed plans for CCA-DDR (Bappenas, 2019; BNPB, 2020). Both regulations provide a guide for national and local governments to create adaptation plans of their own, while emphasising community participation and empowerment. An integration of CCA-DRR is seen in the National Medium-term Plan (RPJMN 2020-2024), in section seven outlining plans to (1) increase the quality of the environment, and (2) improve disaster and climate change resilience, and (3) implement low carbon development. However, all three national level plans did not provide a good description on what community participation in CCA-DRR might look like. (Bappenas, 2019). Detailed CCA-DRR plans are expected to be further defined by local governments in regional and local development plans. However, a study in the Bandung metropolitan area showed the difficulties in integrating CCA-DRR in local development and spatial plans, as the plan only focused CCA in environmental aspects, and only focused on disaster rather than climate-related disasters (Wijaya, 2018). Another study also found difficulties in local government actors (BPBD) to create community focused programs and DRR investments due to a lack of budget and capacity (Srikandini et al., 2018). In summary, practical integration efforts currently may not be sufficient if it is government focused.

However, CCA-DRR integration makes sense at the community level, because CLIs do not separate between these two efforts, rather combine them and focus on addressing risks in their livelihoods and environment (Gero et al., 2011). Through collaboration from capable local conveners, local stakeholders,

and several experts and from both fields (CCA-DRR), CLIs can contribute to a better integration of tangible CCA-DRR efforts (Torjman et al., 2012). In practice, the previously mentioned success stories of CLI in CCA-DRR have found that with assistance from NGOs and other organizations, communities are able to assess their risks, create community action plans that are suited to their capacity, implement them, and become more resilient from climate-hazards or disasters. This also benefits government led programs by reducing duplication of efforts, and ensuring aids are accurate and effective (Gero et al., 2011). Lessons learned by all organizations involved or separate DRR and CCA actors can foster better understanding of DRR-CCA integration measures. Reflecting from previously mentioned successful practices, the CBDM mechanism in Bangladesh may provide a good starting model on integrating CCA and DRR.

Insufficient Funding, and Complex or Untransparent Funding Requirements

The implementation of community-led approach approaches, including CCA-DRR effort, takes around 5 years and needs consequent long-term funding with capacity & flexibility for adaptation (Thornley & Ball, 2015) to ensure a successful and robust social transformation (Loha, 2018). However, several challenges can be faced, especially due to inappropriate funding. In this regard, (Thornley & Ball, 2015) refer to short-term and unsecured funding (France, 1999 and Greenaway & Witten, 2006 as cited in (Sankar & Wong, 2003; Thornley & Ball, 2015), underfunding (Hinkle 2010 as cited in (The New Zealand Productivity Commission, 2015; Thornley & Ball, 2015), unrealistic time frames (France, 1999 and Signal et al. 2009), and inflexible funding (Thornley & Ball, 2015).

Community-led approach needs a certain freedom in the usage of the financial resources since it involves learning by doing which induces the necessity of flexibility, from needed changes in their procedure based on community needs and possibilities (Thornley & Ball, 2015). In fact, donors often provide funding only for specific purposes with the requirement of measurable outcomes, which isn't always possible especially at the beginning of community led initiative processes (Sankar & Wong, 2003). Moreover, 'piecemeal funding' all from different agencies and institutions with different requirements adds as a barrier and difficulty (Department of Internal Affairs 2011 and Te Puni Kōkiri 2013 as cited in (Sankar & Wong, 2013; Thornley & Ball, 2015).

Grants are an important and often a crucial source of funding for CLIs. However, strict administrative requirements make it difficult to access, apply, and obtain the funding (Celata & Coletti, 2019; Torjman et al., 2012). Additionally, complex funding schemes, poor information and poor transparency make it difficult for initiatives to obtain funding (Celata & Coletti, 2019), especially smaller initiatives that are action focused and less policy focused. Hence, governments and other donors could facilitate this through lowering complicated administrative barriers and providing appropriate support and information.

In Indonesia, most of the funding in CCA and DRR efforts comes from the public sector, official development assistance (ODA) and international donors. In the public sector, disaster-related funding has disproportionately been focused on post-disaster aid, while CCA funding is expected to come from provisions in local or national plans and their respective budgets (as stated in the RAN PBI). However, DRR funding is said to be insufficient in local governments (BPBD in particular) as the amount is not enough to fund community related activities or other DRR investments (Srikandini et al., 2018). Meanwhile, the annual cycle of budgeting requires long term plans to be strict and less flexible, thus potentially insufficient in community-led CCA-DRR plans that are usually dynamic. The limited state budget also poses a problem in prioritising funds. On the other hand, the recent "Green Sukuk" or green bond and future funding schemes from Indonesia's SDGs Special Mission Vehicle (SMV) brings prospective new funding solutions, but they need to consider potential community-led CCA-DRR funding

problems. On the other hand, donors are usually more flexible than government funding, but not all are exempt from common funding problems stated above. However, reflecting on previously mentioned successful practices, the ENCORE and CUPA program may provide a baseline on what sufficient funding and NGO facilitation can do to create a more resilient community.

Challenges in Policy, Bureaucratic (Multilevel Governance) and Legal Barriers

Another challenge faced not only with regard to the convergence of CCA and DRR but also for community-led approach and therefore for combined community-led CCA-DRR action is the overarching system of public and private institutions, principles, norms, regulations, decision-making procedures and organizations that are valid or active in a given issue of world politics' (Biermann et al., 2009; Gero et al., 2011). Government agencies and their operations often undermine the self-determination of a community and operate more hierarchically with mostly top-down approaches (Thornley & Ball, 2015). The lack of appropriate and enabling legislation, which recognise the juridical and legal status of the CLIs and 'too strict requirements' regarding volunteering and organizational structures are often widespread concerns (Becker et al., 2018; Celata & Coletti, 2019). Also, discrepancies and inconsistencies of regulations and policy on different government levels and partly between different local government agencies can further complicate the CLIs operation (Celata & Coletti, 2019,). Furthermore, poor governance may cause governments to break promises, which will lower trust in governments and hinder collaborations (Ministry of Health, 2008; Thornley & Ball, 2015).

Indonesia's CCA and DRR national plans expect local governments to define, plan and implement CCA-DRR efforts that are aligned with key national issues and specific to local or regional needs. Planning and implementing plans are expected to be supported by DDR-CCA leading sectors such as BNPB or KLHK via co-governance. However, a recent study in Indonesia's DRR governance found a heavy and confusing organisational set up, in which local state actors face a lack of budget, lack of human resources, and poor capacity (Srikandini et al., 2018). When DRR efforts are done, they are predominantly limited in regional, local, district or village governments due to poor coordination and lack of synergized legislation (UNDRR, 2020a). Meanwhile governance issues in CCA come from the inability to find well defined consensus in adaptation metrics used by multiple stakeholders, thus adaptation needs are difficult to map, and programs are dispersed or even overlapped (Suroso et al., 2021). A recent study also noted potential problems in the local CCA collaboration process, in which issues of distrust, conflicts of interest, un-integrated capacities, and political dominance could derail efforts in CCA collaborations (Mukhlis & Perdana, 2022). A recent study focusing on health aspects of CCA-DRR regulatory framework, also found poorly interlinked policies, stakeholder engagement, institutional coordination, information and resource sharing, as well as sectoral egos, and difficulties in translating into actionable policies (Oktari et al., 2022). Therefore, solely relying on government actors to implement CCA-DRR operations could lead to unsatisfying outcomes.

In addressing this, good governance and capacity building in DRR and CCA will be needed, practically guides for CCA-DRR local implementation are useful, coupled with building the will for cross-sectoral cooperation, participatory approaches, democratic access to knowledge, and institutional accountability (Setiadi et al., 2010). Facilitation of CLIs, its implementation and function will also be possible through specific enabling laws or policies for community organisation (Celata & Coletti, 2019). The reduction of bureaucratic barriers in government can lead to a more enabling and empowering situation for community-led CCA-DRR initiatives and allow participating citizens to communicate their needs, visions, and challenges (Celata & Coletti, 2019; Loha, 2018; Thornley & Ball, 2015).

Challenges in Ensuring Effective Community Participation

Participation is considered as crucial for the achievement of positive impacts (Brooks et al., 2012; Pagdee et al., 2006 as cited in Gurney et al., 2016). Participation is a predominant factor in the effectiveness and sustainability of projects. Through participation local communities are able to identify risks endangering their livelihoods, develop plans based on local knowledge, and implement them (Gero et al., 2011). However, there are still challenges in implementing effective participation. From studying CLIs in CCA-DRR in three countries (Maldives, Indonesia, India), there were complex power relations that hinder participation from the most vulnerable groups, communities may lack awareness about their susceptibility, have little knowledge of available adaptation solutions, facilitators or government may not use the right participatory mechanism, and particularly for CCA governments may default to use top-down approaches (Setiadi et al., 2010). During project implementation, participants may lose motivation or energy to continue the initiative further (especially if it relies on volunteering) (Sankar & Wong, 2003; Thornley & Ball, 2015).

Indonesia is no stranger to CLIs in CCA-DRR, particularly in community-based upgrading with noted successes in community-based settlement rehabilitation or post-disaster reconstruction (World Bank, 2019). Those practices have outlined key conditions for success, which are; (1) sufficient prior experience along with institutional and cultural norms that favour CLIs, (2) development and understanding of a suitable approach, (3) detailed attention on who and how they will be assisted, and (4) possible future developments after community-led CCA-DRR. Indonesia's slum upgrading program (essential to CCA-DRR efforts) has also focused more on community led approaches and experienced some successful outcomes (ADB, 2012, p. 46). However, it was noted that these efforts cannot simply rely on the community to participate, rather government and non-government parties must understand slums complexities, support the program, and ensure local engagement (Hasanawi et al., 2019).

The local context needs to be considered for the implementation of a successful community-led CCA-DRR initiative (2011). Governments or non-government facilitators should also be able understand effective participation mechanism or methods, and provide awareness and capacity building to communities (Setiadi et al., 2010). By identifying and listening to each vulnerable sub-groups in the community, more participation will be generated. From success stories mentioned in previous sections, the community has a strong self determination to not only survive but contribute in any way they can in rehabilitation or resilience-building efforts. Such strong initial participation should be leveraged to achieve successful CLIs in CCA-DRR.

However, the community-led approach has its limitations. Community-led initiatives cannot completely take over some main responsibilities of the governments such as the construction of citywide large-scale infrastructure for risk reduction and resilience, even though they can contribute to and influence it (Satterthwaite, 2011). Regarding such infrastructure, the building of bridges and road networks as well as appropriate drainages are assigned to resolve heavy rainfalls and storms (Satterthwaite, 2011). Therefore, there is a difficulty from the government to provide for such large-scale infrastructure without the support from a community-led approach (Satterthwaite, 2011), although such infrastructure can significantly contribute a possible action for coastal communities to build resilience, such as large-scale dam, sea wall, retention zone, or robust evacuation buildings.

5. Conclusion and Recommendation

There is potential to integrate DRR with the CCA approach where the two approaches can mutually reshape and fill the gap in their respective approach, as evidenced by several examples from Indonesia, the Philippines, New Zealand, Bangladesh, and Nigeria. One way to strengthen the development of the integrated CCA-DRR is the community-led approach, which focuses on bottom-up initiatives to build

community engagement through discussions toward a collective vision and goals. By learning through the existing experiences on integrated CCA-DRR in various countries, a successful community-led development, CCA-DRR can initiate strong initiatives among local community members built through involvement between local government and external stakeholders and appropriate support and funding.
There are great possibilities for applying the community-led CCA-DRR approach in coastal communities with strong cultures rooted in community-led initiatives to increase their resilience. However, this approach still has its limitations especially in the systemically separated operations of CCA and DRR, funding challenges, bureaucratic barriers, as well as several unfulfilled principles due to various factors among the community. There are also problems in integrating the CCA-DRR practices, such as arranging funding schemes that can adapt to the community's flexible and ever-changing conditions and motivations. Furthermore, a complex dynamic between local communities and the government is emerging from the systemic and regulatory issues, as well as a lack of trust among locals, resulting in barriers to sustained long-term collaboration and support.

Diverse literature and policy documents highlight the need for a better link and “joint forces” between CCA and DRR in community-led development. The efforts are strongly related to strengthening the coordination and capacity of multi-institutional, strengthening society and resilience. Critical thing in that process is the need for the availability of and access to resources such as: financial resources, cooperation within and across institutions, stakeholder’s coordination, network capability, availability and quality of information to actions, and level of understanding within institutions. The government becomes a key player as they not only serve their communities, but also meaningful change from different stakeholders, such as the private sector or the academias. Hence, this multi-level cooperation and governance needs good management and organizations. Stakeholders should improve their common understanding and increase more efficient implementation of legislation and policy, as well as improve their knowledge management by sharing and transferring knowledge and good practice. They can conduct joint problem-solving exercises for that. Furthermore, networking capabilities are also important, considering the value of informal institutional relationships. Hence, there is a need to improve the opportunities for cooperation to reduce weaknesses in the network, for example, through accountability measures. The establishment of proactive disaster and climate risk management is essential to confronting the challenges effectively.

Governments should establish a policy to encourage key infrastructure institutions to consider the impacts of CCA-DRR on their business and push forward action. Furthermore, disaster and climate risk assessments need to be done and updated regularly. It can provide an advantage in CCA-DRR as it allows plans to be updated to maintain awareness of risk over time while dealing with uncertainties in future risks. Required risk assessment and adaptation planning through legislation can work relatively well at ensuring these actions are taken, demonstrating the effectiveness of driving positive action. A better influencing synergy between CCA and DRR in a community-led approach could improve the effective use of any available and additional financial, human, and natural resources, which will lead to increased effectiveness and sustainability for community-led CCA-DRR.

Community-led development is a continuous process that includes learning, reflection, and revisions. It is reasonable, considering the aim of intertwining community-led CCA and DRR is to reduce people’s exposure and vulnerability to climate and disaster risks through the community as a leading actor. Hence, a long-term nature impacts the need for suitable and specific funding arrangements, such as long-term investment. Governments must build a financial case for community-led CCA-DRR adaptation in national budgets and ensure the involvement of Ministries with broad responsibilities in the process. Multiple stakeholders should collaborate and coordinate to promote access to external funding sources for CCA-DRR, promote private sector adaptation mechanisms, and promote financial mechanisms such as insurance, investment, and credit schemes. The process of investments, particularly in climate- and

disaster-related areas, should encompass benefits in multiple dimensions. Thus, this requires improvement in both cost-benefit analysis methodologies and the stakeholder's capacity. Furthermore, it should be highlighted that integrating DRR and CCA through a community-led approach could bring more favorable returns on investment, improving efficiency and funding mechanisms.

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Annex I. Global Framework for CCA-DRR and Its Relation for Community

Framework	SFDRR	Paris Agreement	Sustainable Development Goals
Outcome related to Community-led/Community-based	The **substantial reduction of disaster risk** and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.	Limit the global average temperature increase to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C (mitigation) with the aims to reduce the risks as well as the possible negative consequences of climate change, increase the ability to climate change adaptation and direct financial flows to low-carbon and climate-resilient development.	17 goals of the SDGs that engage development (economic development) with social progress and environmental protection to limit destruction from development that didn't consider its future impacts; from large scale financial crises to climate change.
Priorities of Action to Community-led/Community-based	1. **Understanding disaster risk**: develop disaster risk information for general public and build capacity of government, non-governmental organization, and society through collaboration on disaster risk reduction 2. **Strengthening disaster risk governance to manage disaster risk:** empower authorities, community representative, indigenous people and civil society into disaster risk and management through implementation of laws and regulations 3. **Investing in disaster risk reduction for resilience:** strengthen the design and implementation of policies and develop social mechanism to ensure resilience and find durable solutions in the post-disaster phase 4. **Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction:** establish community centres to increase public awareness	Cooperate, facilitate and consider respective obligations on human rights, local communities, as well as people in vulnerable situations to action and support the resilience of communities, livelihoods, and ecosystems related to climate change	Points of SGDs in general, aimed through resiliency. Directly related to CCA-DRR: Clean Water and Sanitation (6), Reduced Inequalities (10), Sustainable Cities and Communities (11), Climate Action (13), and Life on Land (15)
Implementation in Indonesia	● Formulation and validation of RENAS-PB (National Disaster Management Plan) ● Destana (disaster resilient village program) briefly mentioned in RPJMN ● Operationalization of BNPB (*National Disaster Management Office*), BPBD (Local Disaster Management Office) and inaRISK website and application ● Formed laws and policies about disaster risk and management	● Formulation and validation of RAN-API (National adaptation planning for Climate Change Adaptation) ● Voluntary to implement policies about development that consider climate change, such as Bali Action Plan, IFCA, LCDI, and Paris Agreement ● Kampung Iklim (climate resilient village program) briefly mentioned in RPJMN	● Formulation and validation of RAN-SDGs (Indonesia National Action Plan SDGs), SDGs Dashboard and SDGs Investment Platform ● Integrating 17 goals of SDGs in RPJMN 2020-2024 ● Formed laws and policies about sustainable development goals in the form of presidential regulation

Framework	SFDRR	Paris Agreement	Sustainable Development Goals
		● Formed laws and policies about climate change in the form of Law and regulation	

Annex 2. Indonesia National Framework for CCA-DRR and Its Relation for Community

Framework	RENAS PB 2020-2024	RAN API
Outcome	Reduced economic losses on gross domestic products (GDP) due to the impact of the disaster.	Climate-resilient development within the sustainable development framework
Gaps Identified	● Limitation in monitoring instruments. ● Development in high-risk areas. ● Increase in hydrometeorological risks due to climate change. ● Insufficient budget, planning, and local governance capacity for disaster management	● Appropriate and measurable policymaking is critically needed by considering various climate change scenarios and climate risks which might establish a resilience community and development to climate change. ● Indonesia is a vulnerable country that has an extensive coastline, high population density in coastal areas, high dependence on agricultural production and natural resources, relatively low adaptive capacity, and tropical climate.
Priorities of Action	1. Strengthen and harmonize regulations 2. Strengthen disaster governance and response system 3. Applying disaster research and innovation through multi-party collaboration 4. Increase mitigation infrastructure 5. Collaborative social engineering 6. Protection for environment vulnerability 7. Build back better and rehabilitation	Infrastructure, technology, capacity building, and governance on: 1. Water Sector: 2. Agriculture Sector 3. Marine and Coastal Sector 4. Health Sector
Reflection on Current Practice	Mainly enacted by BNPB. The framework itself mentioned several intersecting projects with other government institutions and also community-improving projects, but still limited in mentioning community based and lacking firmer and clearer framework to actually put community in charge and growing local community knowledge.	Integrated with several initiatives initiated through collaboration between government institutions and communities, and also by independent institutions (NGOs and Academics). However, it is still limited in scope and localized in hundreds of projects currently running. Need more widespread funding and support to also address the root causes.

Resilience
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