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Build Resilience Community Through Mapping Participatory: Implementation Community-Based Disaster Risk Reduction

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A B S T R A C T

Indonesia is a country with level vulnerability tall to disaster natural consequence position geographically located at the meeting point three plate big world. Regency Probolinggo, especially Krejengan Village, has potential threat disaster like floods and rain extremes that result in damage infrastructure and environment. Activities devotion public This aim increase capacity public in face disaster through approach Community-Based Disaster Risk Reduction (CBDRR). Implementation method done in a way participatory through a number of stages, including preparation, implementation, analysis and validation of data, as well as compilation plan action mitigation. Collection information done through interviews, Focus Group Discussions (FGD), and mapping map risk disaster. Results of activities show that Krejengan Village has five forms vulnerability main, namely physical, economic, environmental, social, and political local. Based on results analysis, society together team devotion succeeds compile Risk Map Krejengan Village Disaster which includes location vulnerable, route evacuation, and points gather emergency. Next, it is arranged Reduction Action Plan Risk Disaster Management (PRB) which includes formation Village PRB Forum, Disaster Safe School program, and activities improvement awareness environment. Activities This prove that participation public in every stage's mitigation disaster effective increase preparedness, strengthening institutional local, and encourage creation Adaptive and sustainable disaster resilient villages.

INTRODUCTION

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Indonesia is one of the countries with level risk disaster natural the highest in the world, because location geographically located at the meeting point three plate the world's largest regions, namely Indo-Australia, Eurasia, and the Pacific (Alqulby et al., 2025; Zulkifli et al., 2022). Condition This placing the Indonesian region in a vulnerable situation to various disaster like flood, land landslide, earthquake earth, and eruptions mountain fiery. Regency Probolinggo, in particular Subdistrict Krejengan, is one of the areas experiencing potential risk Based on field data, this area experienced several times Rain torrential rain that triggered floods and damage infrastructure with loss reach dozens million rupiah (BNPB, 2024). Phenomenon This confirm importance effort mitigation disaster-based public for build toughness local.

In a way conceptual, mitigation disaster is part from cycle management risk disaster that emphasizes action prevention before disaster happen (Nurfadillah et al., 2025). Community-Based Disaster Risk Reduction (CBDRR) Theory explain that effort subtraction risk disaster will effective if public play a role active in the identification process threats, analysis risks, as well as compilation plan action-based source Power local (Amin et al., 2023; Selvia & Angela, 2024). Participatory approach This No only increase capacity society, but also strengthens cohesion social as factor important in success mitigation (Nurcahyo et al., 2022)

In frame build nation Which tough to disaster and take lesson in overcome disaster, government with agreement DPR has issued Law Number 24 of 2007 concerning Disaster Management. Constitution This arranged with use paradigm that countermeasures disaster management must be carried out in a planned, integrated and coordinated manner by involving the stakeholders. This law has given the government a mandate to give protection to public from threat disaster and as form from embodiment Opening Constitution Base Year 1945. Based on results observation in Krejengan Village, still there is a number of threat disaster that needs to be addressed overcome, including:

Table 1. Identification/recognition of disaster threats (hazards) in Krejengan Village

No	Hazards/ Threat	Year of Event	Amount Victim	Loss Treasure Object (Rp)	Environment Affected	Area Size Affected (Km)	Amount Resident Exposed	Loss Exposed infrastructure (Rp)	Probability 5 years forward
1	Heavy Rain and Strong Winds	2022	-	-	Fallen trees, damaged roads and damaged houses	±50 m	-	-	-
2	Earthquake	-	-	-	-	-	-	-	-
3	Heavy rain and flooding	2025	-	Rp. 20,000,000	Drifting goods	±1 km	30 Houses	Rp. 10,000,000	
4	Earthquake	-	-	-	-	-	-	-	-
5	Tsunami	-	-	-	-	-	-	-	-
6	Volcanic Eruption	-	-	-	-	-	-	-	-
7	Landslide	-	-	-	-	-	-	-	-

Source : processed data team devotion (2025)

Disaster Resilient Villages/Sub-districts (Destana/Katana) are villages/sub-districts that have the independent ability to adapt to potential disaster threats. (Pribudi & Sugiarto, 2025). This village/sub-district is also able to recover quickly from the impacts of disasters. A village is said to be resilient to disasters when it has the ability to recognize threats in its area and is able to organize community resources to reduce vulnerability while increasing capacity to reduce disaster risks. This resilience in facing disasters is manifested in development planning that contains prevention efforts, preparedness, disaster risk reduction (DRR), and capacity building for post-emergency recovery. The development of Destana/Katana is one of the community-based disaster risk reduction efforts by increasing preparedness capacity, which is planned and implemented by the community as the main actor (Sulistyowati et al., 2023). Communities in disaster-resilient villages are actively involved in assessing, analyzing, handling, monitoring, evaluating, and reducing disaster risks in their area by utilizing local resources.

Destana/Katana is one of the manifestations of the government's responsibility to provide protection to the community from the threat of disaster (Sulfikar et al., 2025). The purpose of its development is to protect communities living in hazard-prone areas from the detrimental impacts of disasters, increase community participation in resource management in order to reduce disaster risks, increase community institutional capacity in resource management, and maintain local wisdom for disaster risk reduction, increase government capacity in providing resource and technical support for disaster risk reduction, increase

cooperation between stakeholders in DRR, local governments, the private sector, universities, NGOs, community organizations, and other concerned groups.

The problems faced by Krejengan Village, in effort realize village tough disaster covers various related aspects with condition social, economic, and preparedness society. Problems the can formulated as following:

1) Protect community in the area vulnerable danger from impacts harm disaster.
2) Increase role as well as society, especially group vulnerable, in management source Power For reduce risk disaster.
3) Increase capacity institutional public in management source power and maintenance wisdom local for PRB.
4) Increase capacity government in give support source power and technical for PRB.
5) Increase cooperation between stakeholders' interest in PRB, the party's government region, institution business, college high, institution self-reliance community (NGO), organization communities and groups others who care.
6) Develop and follow up on safe school and madrasa programs from disaster

In context said, the activities devotion public This focused on improving ability public in face disaster through education, training, and strengthening capacity institutional local. The goal is for build Disaster Resilient Village (Destana) which is capable adapt and recover in a way independent after happen disaster. This approach in harmony with principle resilience building, namely ability public for survive and rise from disturbance social and ecological (Suprianto et al., 2025)

Devotion public This aim in a way explicit for increase awareness, knowledge, and skills Krejengan Village community about mitigation disaster. Through activity socialization and simulation responsive emergency, community expected capable recognize potential dangers in the environment, compiling plan evacuation, and developing system warning early based community. In addition, strengthening institutional like establishment of the PRB (Damage Reduction) forum Risk Disaster level village become step important in ensure sustainability activity mitigation.

LITERATURE REVIEW

In a way theoretical, activities This support implementation Social Capital Theory which emphasizes importance network social, trust, and collaboration between residents in build resilience public to disaster (Aldrich & Meyer, 2015; Bakarbessy, 2024). The power of social capital can speed up the handling process emergency and recovery post-disaster Because public have a sense of responsibility answer together and good coordination (Takwa et al., 2024). Therefore that, strengthening network social at the level local become foundation main in activity devotion This.

From the side practical, activities devotion community in Krejengan Village expected capable become a model of empowerment public based mitigation disasters in other areas. Merger between wisdom local, regional vulnerability data, and approaches scientific will create a management model risk adaptive and contextual disaster management. Multi - stakeholder

involvement like government region, institution education, NGOs, and communities local will strengthen synergy cross sectors that become characteristics main management risk modern disasters (UNNDR, 2022).

In a way overall, devotion public This expected give contribution real to improvement welfare society. Society that has preparedness tall to disaster will capable protect asset economic, social and environmental issues that become source livelihood they. With Thus, the activities This No only focus on prevention risk disaster, but also on creation public powerful and resilient in a way social and economic going to development sustainable community resilience.

METHODOLOGY

Collection information disaster can obtain from notes incident or history disasters that ever happened occurs in certain areas. One of them method effective in obtaining disaster data is through interview with society that ever affected directly by a disaster (Nguyen et al., 2011; Shah et al., 2023; Tierney, 2025). This approach allows obtaining more empirical data contextual about form threat, perception risks, and adaptation strategies local that has done public (Lechowska, 2022).

Collection techniques information in a way direct from public done through participation inhabitant or involvement group in the inventory and mapping process disaster (Ayuningtyas, 2022; Rezvani et al., 2023). Activities This become important Because public local own knowledge contextual which is often not recorded in document official government. Through approach participatory, community not only become object research, but also plays a role as subject active in the process of reduction risk disaster (Bonfanti et al., 2023).

Participation public in mapping potential and mitigation disaster in Krejengan Village done for produce more information detailed and customized with condition social, environmental, and power support source Power local. Through this process, we obtain description comprehensive regarding vulnerable areas, potential danger, and capacity local that can used in effort mitigation disaster (Rachmawati et al., 2018). Community-Based Disaster Risk Reduction (CBDRR) Approach used as runway theoretical in activity this, where the community become actor main in collection, analysis, and compilation plan mitigation.

In activities devotion this, the collection information disaster in frame improvement preparedness Krejengan Village community done through mapping participatory three dimensions (3D participatory mapping). This method involving representative society, devices village, figures society and elements government area in activity mapping location vulnerable disaster, source Power nature, as well as infrastructure important village. The resulting map become base compilation plan action mitigation and improvement preparedness public to disaster flood, rain extreme, and land landslide.

Activity implemented in a number of stages main, namely:

1) Stage Preparation, including coordination with government village, socialization activities, as well as secondary data collection about condition geography and socio-economics of Krejengan Village.

2) Stage Implementation, including activity interview in- depth discussion group Focus Group Discussion, and mapping participatory with involving public local.
3) Stage Data Analysis and Validation, namely processing results mapping and interviews for produce map risk disaster validated by the community.
4) Stage Compilation Action Plan, namely formulation of mitigation and improvement strategies preparedness-based results mapping participatory.
5) Stage Evaluation and Mentoring, including activity reflection together for evaluate effectiveness activities and formulate action carry on strengthening capacity public

Every stage implemented in a way participatory to create a sense of ownership and sustainability of the mitigation program disaster in Krejengan Village. Through approach this, it is hoped formed a resilient and prepared society face disaster in a way independent.

RESEARCH RESULT & DISCUSSION

Implementation activity devotion community in Krejengan Village, Regency Probolinggo is a form implementation real from draft Community-Based Disaster Risk Reduction (CBDRR) which places public as actor main in subtraction risk disaster. Discussion This to describe results and process of activities in a way comprehensive, starting from stage planning until mentoring sustainable. Every stage implemented with principle participatory, collaborative, and based on local data so that activities devotion No only nature ceremonial, but also produces impact real to improvement capacity society. With thus, the part discussion This explain in a way five- stage systematic main implementation dedication: (1) Preparation, (2) Implementation, (3) Data Analysis and Validation, and (4) Compilation Action Plan.

Preparation

Stage preparation is foundation from all over series activity devotion community activities carried out in Krejengan Village. Activities started with coordination between team devotion, government village, and Disaster Management Agency Regional Disaster Management Agency (BPBD) of the Regency Probolinggo. This step important for ensure that activity in line with policy areas and needs public local community service team do identification beginning to potential dangers in the area, including flood, rain heavy, and windy tight as recorded in historical data disaster 2022–2025 (Table 2).

Figure 1
Coordination between team devotion, government village, and BPBD of Probolinggo Regency
Source: Documentation personal (2025)

Table 2. Identification of Vulnerability Types

No.	Type Vulnerability	Identification Type/Form Vulnerability School
1	**Vulnerability Physique** *Form vulnerability Which owned by the school in the form of inability to face certain dangers in a timely manner physique, for example: fragility school buildings*	Schools located in the Krejengan Village area are categorized as physically safe and safe from disasters.
2	**Vulnerability Economy** *Financial capability prevention efforts or mitigation disaster in renovating and strengthening buildings*	The financial capacity of the Krejengan Village community is considered good because it is an area that is safe from potential disasters.
3	**Vulnerability Environment** *Environment Around the school, there are rivers of both medium and small sizes. The school area is near rice fields.*	The environment around the school up to Krjengan Village is generally located in a strategic area and is safe from potential disasters because there is good river flow and the school environment is far from rice fields.
4	**Vulnerability Social** *Social conditions of the community also influence the level vulnerability to threat danger. From aspect education, lack knowledge about risk danger And disaster will heighten level vulnerability, thus also level health public Which low Also result in vulnerable to face danger.*	The educational attainment of the people of Krejengan Village in Motten 1 Hamlet is relatively low, resulting in a lack of preparedness for potential natural disasters. However, this is supported by the minimal potential for disasters in Krejengan Village, as seen in the Disaster Risk Map.
5	**Vulnerability Political Local** *Aspects of local political support and commitment in activity countermeasures disaster, for example related support program, activity And budget until on level village And subdistrict For countermeasures disaster, including Also lack of commitment of local elites and/or community leaders to follow contribute And participate in mitigation activities disaster.*	The supporting capacity for disaster management for Krejengan Village is considered good, as evidenced by the village apparatus contributing and participating in disaster management.

Source: processed data team devotion (2025)

Based on results identification early, obtained description that Krejengan Village own level vulnerability relative social high, especially in the community educated low and group prone to like women and the elderly. In addition to identifying type threat disaster (hazards), stage this also includes analysis to various form vulnerability (vulnerability) public. Based on field data, there are five categories vulnerability main:

1) Vulnerability physical, in the form of condition building house and facilities the public who still not enough stand to intensity rain and puddles.
2) Vulnerability economy, namely ability financial public in do effort repair and mitigation Still limited to groups certain.
3) Vulnerability environment, which is related with location settlement near flow river as well as land potential rice fields affected rainwater runoff.
4) Vulnerability social, marked with low level education and lack of knowledge public to danger disaster, especially in Motten I Hamlet.
5) Vulnerability political local, related with to what extent is the commitment officials and figures public in support activity countermeasures disaster

Identification This done with method observation field and discussion group directed for dig view public about factors reason vulnerability. Analysis results show that even though Krejengan Village classified as relatively safe in a way geographical, level preparedness social Still need improved. Therefore that, stage preparation focused on the preparation plan activity-based need local and preparation device education easy disaster understood public (BNPB, 2024).

Implementation

Stage implementation done through approach Community-Based Disaster Risk Reduction (CBDRR), namely involvement active public in every mitigation process disaster (Shaw, 2012). At this stage this, team carry out a number of activity main:

1) Socialization and education public about importance mitigation disaster and preparedness family.
2) Interview in-depth and discussion group focused group discussions (FGD) For dig experience public in face disaster as well as recognize potential local that can utilize.
3) Mapping participatory three dimensions (3D mapping), where the residents involved direct in mark locations important like river, land agriculture, settlements solid, and point vulnerable flood.

This process No only collect spatial data, but also strengthen capacity social public in understand existing risks. This approach confirm that participation direct public strengthen data accuracy and improve awareness collective to threat disaster.

Data Analysis and Validation

After the data is collected through mapping and interviews, team carry out data analysis and validation processes in a way collaborative together community and authority's village. Analysis focused on three components main, namely: level hazard, level vulnerability and capacity community (capacity). Based on results analysis, it is known that Krejengan Village own threat main in

the form of flood consequence intensity Rain high trigger flooding in low-lying areas. However, the level of capacity social public Enough tall Because there is mutual cooperation and support apparatus village in guard environment.

Data validation is performed through a joint forum (village workshop), where the map results mapping reviewed repeated by the community for ensure suitability with condition real. Validation approach participatory This ensure the resulting data accurate, contextual, and can accepted by all stakeholders' interests. Every problem that have been identified start from vulnerability floods, lack of knowledge about mitigation disaster, until Not yet optimally utilization technology mitigation needs integrated approach. Therefore that, the solution offered arranged in a way systematic in accordance priority, with measurable output targets.

Subtraction risk disaster (disaster risk reduction) is design new in development framework Work For reduce risk with drip focus on effort empowerment individuals and society in face disaster. Reduction risk disaster is approach proactive with purpose for increase capacity individuals and society in mitigation and preparedness for minimize impact incident disaster so that public own capacity for endure as well as return rise from disaster in effort livelihood sustainable livelihood.

1) There have been initial efforts to formulate PRB policies at the village or sub-district level;
2) There are efforts beginning for compile document PB planning;
3) There are efforts beginning for form a PRB forum consisting of representatives from public;
4) There are efforts beginning for stage assessment risk management risk and reduction vulnerability;
5) There are efforts beginning for increase capacity preparedness as well as responsive disaster.

Preparation of Action Plan

The action plan development stage is a crucial part of the overall community service process because it serves as a concrete implementation of the results of previous data analysis and validation. Disaster risk management is in the pre-disaster phase, which emphasizes the importance of prevention, mitigation, and preparedness before a disaster occurs, using the INARISK application.

Figure 2. INARISK application
Source: Documentation personal (2025)

This approach aims to reduce the impact of disasters through planned, participatory, and sustainable strategies (BNPB, 2024). In the context of Krejengan Village, this stage is aimed at formulating strategic community-based mitigation measures that are appropriate to local potential and conditions. The method used is what must be done is as follows:

1) Recognize the dangers around you our residence
2) Identify risks based on probability/likelihood occurrence disaster along with intensity/impact
3) Analyze/assess type high-risk threats from several types of existing threats
4) Manage risk with do prevention (risk avoidance), mitigation (risk reduction), And transfer part of the burden/risk (risk transfer)
5) Total acceptance or surrender accept existence danger (risk acceptance) will but public must on alert

After all these steps are taken, at all times and continuously continuously monitoring of threat developments and vulnerability developments is carried out public for anticipate improvement efforts ability Which required. Community together team devotion Then compile Reduction Action Plan Risk Disaster (PRB) which includes a number of aspect main:

1) Formation Reduction Forum Risk Village Disaster which consists of members representative community, religious figures, apparatus village, and youth elements
2) Compilation track evacuation and points gather agreed emergency together.
3) Development of Disaster Safe School program in institutions education around Krejengan Village
4) Improvement awareness environment through activity Work devotion routine in river and land areas agriculture.

Plan action This No only strengthen institutional local, but also strengthens capacity adaptive public to potential threat disaster. This kind of approach This proven effective Because capable build awareness collective and strengthening synergy between government village and community in create resilient environment disaster.

ACTIVITY OUTPUT AND IMPACT

Activity devotion community in Krejengan Village produce a number of external real (tangible outcomes) and impact social (social impacts) who contributed to improvement capacity local in subtraction risk disaster. External the includes:

Risk Map Krejengan Village Disaster

Result of activity mapping participatory three dimensions (3D participatory mapping) in the form of map risk disaster that displays location vulnerable flood, route evacuation point gather emergency, and infrastructure important village. This map has validated through community forums and used by the government village as base in planning development as well as policy mitigation local. Document maps were also submitted in a way official to device village and BPBD Regency Probolinggo for entered in database disaster area.

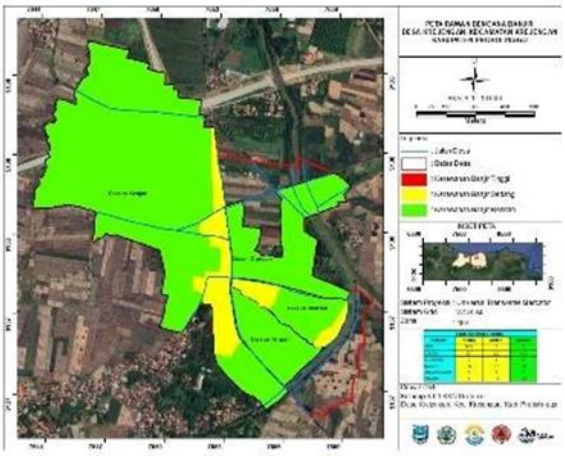

Figure 3. Disaster Risk Map
Source: Documentation personal (2025)

Formation of the Reduction Forum Risk Village Disaster (PRB Forum)

As a local institution, this forum consists of representatives from residents, community leaders, youth, teachers, and village officials. The DRR Forum plays a key role in disaster education, emergency response coordination, and the formulation of DRR policies at the village level. The forum has an organizational structure, an annual work plan, and a schedule of routine activities, such as evacuation simulations and preparedness training.

Figure 4. Village PRB Forum
Source: Documentation personal (2025)

Disaster Safe School Program

As a follow-up to the activity, the community service team, along with elementary school principals in Krejengan Village, developed a Disaster Safe Schools program. This program includes training teachers and students on evacuation procedures, installing evacuation signs in the school area, and developing a disaster contingency plan within the school environment using the INARISK application. This program is expected to serve as a pilot project for other schools in Krejengan District.

Figure 5. INARISK Socialization
Source: Documentation personal (2025)

Improvement Awareness Environment and Community Mutual Cooperation

The social impact of this activity is evident in the increased community participation in routine community service activities such as cleaning water channels, protecting river areas, and strengthening emergency embankments. These collective activities reflect the growth of social capital and a spirit of mutual cooperation in maintaining village resilience to disaster risks.

Figure 6. Handover of Tree Seedlings
Source: Documentation personal (2025)

Improvement Capacity Village Government in Management Risk Disaster

Village governments now have initial guidance for developing Disaster Risk Reduction (DRR) Action Plans integrated with the Village Medium-Term Development Plan (RPJMDes). This demonstrates the strengthening of local governance that is adaptive to disaster threats.

Figure 7. Collaboration with Probolinggo Regency
Source: Documentation personal (2025)

In a way overall, activities This No only produce product physique in the form of map risk disaster, but also strengthening dimensions social, institutional, and educational at the level village. The sustainability of the program is maintained through collaboration between the PRB forum and the government villages and institutions education. With Thus, the external activity This give impact positive to improvement preparedness public at a time support achievement Sustainable Development Goals (SDGs) point 11 (Sustainable Cities and Communities) and point 13 (Climate Action).

CONCLUSIONS AND RECOMMENDATIONS

Activity devotion community held in Krejengan Village, Regency Probolinggo, shows that improvement preparedness and resilience public to disaster can realized through approach participatory and based community. Based on analysis from stage introduction until compilation plan action, found that the Krejengan Village area own potential threat a relative disaster low in a way geographically, but still face risk social and environmental needs attention special. Therefore that, strengthening strategy capacity public become key main in build toughness local to threat disaster.

From the side conceptual, activities This in line with principle Community-Based Disaster Risk Reduction (CBDRR) which places public as actor main in the mitigation process disaster. This approach proven effective in build awareness risk, strengthening network social, as well as increase ability adaptation public to threat environment. The participatory process implemented also shows integration between theory social capital and resilience building, where social capital become base formation behavior collective for preparedness disaster.

Stage preparation produce identification beginning to type threats and vulnerabilities Krejengan Village community, including vulnerability physical, economic, environmental, social, and political local. Analysis results This give strong foundation for compilation relevant interventions with condition public local. On the other hand, local activities socialization and mapping participatory carried out at the stage implementation succeed push involvement active inhabitant in identify potential risks in the environment they itself. This process No only increase knowledge community, but also strengthens the sense of ownership of the reduction program. risk disaster.

Next, the results data analysis and validation show that preparedness public can improved through mechanism learning together and discussion forum local. The validation process carried out in a way collaborative between society and devices village produce map accurate and predictable risks made into base planning policy village. Stage This show that data accuracy and legitimacy social is aspect important in management risk disaster based public.

Stage compilation plan action become peak from overall activities, with output main in the form of Risk map disaster. In the stage this, applied principle that management risk disaster is in phase pre-disaster, which focuses on effort prevention, mitigation, and preparedness before disaster happened. Through plan action said, the community together government village succeed formulate steps concrete like formation Village PRB Forum, preparation track evacuation, as well as implementation of the Disaster Safe School program. Initiative This form system institutional resilient and sustainable local communities.

In a way overall, activities devotion public This prove that approach participatory local data based capable produce change real in behavior and capacity public face risk disaster. Synergy between society, government villages and institutions education become factor key in creating a Disaster Resilient Village model that is not only reactive, but also proactive in face future

challenges. With Thus, the results activity This contribute to achievement objective development sustainable development (SDGs), especially point 11 (Sustainable Cities and Communities) and point 13 (Climate Action).

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