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Formulating Public Policy for Earthquake Disaster Risk Reduction

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Abstract

When extraordinary events (hazards) occur in communities that are already at risk, people are unable to handle the consequences, which leads to disasters. The acknowledgement that a disaster poses a threat to the public is known as policy. Policymakers must establish a priority scale that takes resource scarcity into thought when designating a disaster as a public hazard. The presence of management and public policy can offer remedies and approaches to coping with calamities. his research aims to explore the strategic policies and management practices for earthquake disaster risk reduction in Indonesia. The study employs a descriptive research method with a qualitative approach, focusing on literature review and analysis of existing disaster management policies. The findings reveal that disaster management in Indonesia has evolved, with increasing emphasis on community resilience and legal responsibilities. The government has developed several disaster management models, including the Disaster Management Continuum Model and the Pre-During-Post Disaster Model, to address various stages of disaster response. Moreover, earthquake mitigation strategies such as earthquake-resistant building standards and community-based organizations are critical for reducing the impact of earthquakes. The study concludes that strategic policies and efficient public management, including resource allocation and clear institutional frameworks, are vital for addressing earthquake risks. Future policies should focus on improving the preparedness and response capabilities of both central and regional governments, ensuring a coordinated effort to mitigate the devastating effects of earthquakes.

Keywords: policy, management, public, earthquake disas

INTRODUCTION

Law No. 24 of 2007 defines extraordinary events as "events or series of events that threaten and disrupt the life and livelihood of the community caused, either by natural and/or non-natural factors or human factors resulting in human casualties, environmental damage, property loss, and psychological impacts" (Chaudhary & Piracha, 2021; Lassa et al., 2022; Nane et al., 2018; Nefianto, 2023; Sarmiasih & Pratama, 2019). The definition of extraordinary events as described above contains three basic aspects, namely the occurrence of an event or disruption that poses a threat and causes damage (hazard), the event or disruption threatens the lives, livelihoods, and functioning of society, the threat results in casualties and exceeds the community's capacity to cope using their own resources and disasters can occur due to two conditions: the presence of a threatening and damaging event or disruption (hazard), and the vulnerability of the community (Huggel et al., 2022). If a hazard occurs but the community is not vulnerable, it means the community can handle the disruptive event on its own (Smith et al., 2023). On the other hand, if the community is vulnerable but no threatening event occurs, then no extraordinary incident will take place.

Indonesia’s position within a disaster-prone region has led to the loss of hundreds of thousands of lives over the past decade due to various natural disasters such as tropical

storms, floods, tsunamis, earthquakes, volcanic eruptions, landslides, and droughts (Ash-Shidiqqi et al., 2023). Although rapid and effective responses have been made to the best extent possible, the long-term psychological and socio-economic impacts of these extraordinary events continue to affect disaster victims for an extended period. Therefore, strategic policy and management must be swift and responsive in addressing such extraordinary occurrences. To according Li & Paudel, (2024) the study revealed that an individual's earthquake risk perception significantly impacts policy efficacy but is unlikely to directly influence policy support. The findings also suggest that individuals who have experienced seismic shockwaves are more likely to perceive earthquake risk and understand earthquake risk mitigation policies. However, an individual's earthquake experience does not significantly impact the relationship between risk perception and policy support.

In this research, the focus is on evaluating earthquake disaster management policies, particularly how public policies have evolved in response to these natural hazards. The study highlights the necessity of proactive disaster preparedness, early warning systems, and the strategic role of governmental institutions in mitigating the effects of earthquakes. By exploring the strategies that have been implemented, this study aims to contribute to understanding the effectiveness of these measures and their role in reducing vulnerability.

This research is novel in its approach to analyzing the intersection of public policy and disaster risk reduction in earthquake-prone areas, specifically in Indonesia. While much research has been conducted on disaster management, there is limited focus on the nuances of policy formulation and the integration of local-level response strategies with national frameworks. The urgency of this research is underscored by the increasing frequency of seismic events in the region and the continued vulnerability of populations.

The objectives of this study are twofold: to assess the effectiveness of current disaster management policies in reducing earthquake risks and to identify gaps that need to be addressed to enhance the resilience of affected communities. The findings will offer valuable insights into policy formulation and implementation, providing actionable recommendations for improving disaster management frameworks and ensuring more sustainable, effective responses to future earthquakes.

RESEARCH METHODS

This research is prepared using a descriptive method with a qualitative approach (Colorafi & Evans, 2016; Stanley, 2023). Data collection is conducted through literature study by reviewing relevant references related to strategic policies and public management in response to extraordinary events such as earthquakes.

Conceptual Framework

Disaster Management Model

Disasters are the result of extraordinary events (hazards) occurring within vulnerable communities, rendering them unable to cope with the various implications of such events. Disaster management essentially aims to protect communities from these extraordinary occurrences, either by reducing the likelihood of hazards or by addressing vulnerabilities. There are five models of disaster management, namely:

1. Disaster Management Continuum Model

Because it is easier to implement and has distinct stages, this model is arguably the most often used. Emergency, relief, rehabilitation, reconstruction, mitigation, preparedness, and early warning are the phases of disaster management in this concept.

2. Pre-During-Post Disaster Model

Activities related to a disaster are separated into phases under this disaster management approach. It covers the necessary steps to be followed before to, during, and following the catastrophic event. The continuum model of disaster management is frequently combined with this concept.

3. Contract-Expand Model

According to this approach, disaster-prone places should regularly apply all phases of disaster management, including emergency, relief, rehabilitation, rebuilding, mitigation, readiness, and early warning. The emphasis on particular stages distinguishes disaster settings from non-disaster conditions. During a disaster, specific stages such as emergency response and relief are prioritized, while others like rehabilitation, reconstruction, and mitigation tend to receive less attention.

4. The Crunch And Release Model

This disaster management model emphasizes efforts to reduce vulnerability in order to address extraordinary events. If the community is not vulnerable, the likelihood of a disaster occurring remains low even if a hazard still takes place.

5. Disaster Risk Reduction Framework

This emphasizes disaster management efforts on identifying the risks of extraordinary events, both in the form of vulnerabilities and hazards, and on developing the capacity to reduce those risks.

RESULTS AND DISCUSSION

Natural Disaster Management Policies

As the table shows, there have been a number of trend changes in strategic disaster management policies in recent years (Djalante & Garschagen, 2017). Among the noteworthy patterns that demand notice are:

a. A political context that increasingly drives strategic disaster management policies to become a legal responsibility.
b. A growing emphasis on enhancing community resilience or reducing vulnerability.
c. Disaster management solutions are increasingly focused on community organization and development processes.

Agenda-setting, decision-making, policy formulation, policy execution, and policy evaluation are the typical steps in the creation of a strategic disaster management policy (Wu et al., 2017). The Indonesian central government is presently engaged in the process of formulating policies. (several government regulations are in the process of being drafted) and the policy implementation stage (the National Disaster Management Agency BNPB has been established and is actively encouraging the formation of Regional Disaster Management Agencies BPBD at the local level). Local governments

are still developing their agendas and making decisions in the interim. Some areas that have gone through significant disasters have progressed to the stages of developing and implementing policies.

The ideal extraordinary event management policy, in addition to being developed through a proper process, must also clearly establish the following aspects:

a. The division of responsibilities between the Central Government and Regional Governments.
b. The appropriate allocation of resources between the Central and Regional Governments, as well as among the various related functions.
c. Clear and firm changes in regulations and institutional structures.
d. Working mechanisms and arrangements among various institutional portfolios related to extraordinary events.

One of the main topics of this study is the contextual institutional framework for handling extraordinary events that was created in Indonesia. There are established institutions and systems that have been in operation in different areas. These current institutions and procedures, especially those who have long been experienced in managing extraordinary events, will interact with the institutional policies created by the Central Government.

The strategic policy process is a multi-step, dynamic process. Most significantly, it entails identifying the issue, putting it on the political agenda, speaking for different groups, creating alternatives or answers, establishing goals for implementation, carrying out the plan, assessing the results, and updating or finalising the policy. In the case of extraordinary circumstances, the first three steps are really simple. Depending on geophysical factors, different options may be available. In order to carry out implementation, government laws, directives, and financial support are issued. once the extraordinary event, an evaluation is carried out, and the results are released once the unforeseen losses have been determined. Governments at the local, national, or worldwide levels may be involved in the creation and execution of strategic public policies.

Although it is not the only factor influencing public attention, the size of losses is frequently used to define the scope of an issue when developing strategic policy. Recognising that an extraordinary event poses a hazard to the public is the first step in creating a strategic policy. Because of the limited resources, policymakers are forced to prioritise responses when an extraordinary event is classified as a social hazard. A straightforward criterion is the event's magnitude and response ease. Prioritising critical issues should come before those that need for significant initiatives.

Setting priorities involves specific considerations, such as universal health and safety standards. For instance, a public strategic policy may intervene when casualties and property loss are not caused by individual error but rather by a lack of protection for volunteers working in high-risk environments. Additionally, public policy cannot be implemented without spatial considerations. Since extraordinary events are typically identified at the local level, public responsibility initially lies with local governments.

However, when such events have national implications, a national strategic policy is more appropriate due to the broader spatial scale of the impact. Therefore, strategic public policy must reflect an adequate and proportionate response.

Policies should be based on the scale of the issue or the potential magnitude of future threats.

Policy Implementation

Government level, goals, and event timing are some factors that can be used to classify extraordinary event regulations. National, provincial, and local governments are the three tiers of government. Some provinces actively participate in the creation and execution of strategic policies, and both the federal and local governments enforce laws for handling extraordinary situations. The federal government and local governments may work together to design disaster response legislation (e.g., creating national standards for public service facilities).

Each level of government employs different approaches to achieve policy objectives. Regulations clarify what must be done within a "command and control" framework that demands resolution according to specific standards. The same applies to mandates, orders, or responsibilities that may or may not be tied to particular regulations. Program activities can be viewed as tactics for implementing a strategy. In some cases, strategies may be mandated.

Earthquake Disaster Mitigation

Mitigation of extraordinary events refers to a series of efforts aimed at reducing the risks associated with such events, either through physical development or by raising awareness and enhancing the capacity to face potential threats. Disaster mitigation serves as a proactive measure to minimize the impact of extraordinary events, including efforts to reduce casualties and property losses when such events occur.

The following are several earthquake disaster mitigation efforts based on sources from Kochi International Association (2008) and BMKG (n.d.):

1. Identifying the location of residential or workplace buildings, specifically the likelihood of being situated on an earthquake fault line, as well as the potential strength of earthquakes in the area, based on seismic hazard mapping.
2. Constructing houses using earthquake-resistant building standards, like those described in Indonesia's Guidelines for Earthquake Resistance Planning for Buildings, SNI 03-1726-2002. For instance, buildings should generally be built on compacted, dry soil rather than on filled land; reinforced concrete foundations should be used; walls should be positioned evenly; and building materials should be in good condition not too old or termite-damaged. The Ministry of Public Works' 2006 publication, the Technical Manual for Earthquake-Resistant Houses and Buildings, has comprehensive guidelines.
3. Renovating buildings that are not earthquake-resistant or are already old or in poor condition. This is especially important for public facilities used by large groups of

people, such as educational institutions, healthcare centers, and government buildings.

4. Reducing the risk of furniture shifting or toppling during an earthquake.
   Furniture that moves, collapses, or falls can block exit routes and cause injury. To minimize these risks, several measures can be taken, such as: Avoid placing tall furniture like cabinets on carpets; instead, place them on hard, flat flooring, Store heavier items on lower shelves and lighter ones on top, Do not place hazardous items, such as scissors, in high or unstable locations, Install earthquake-resistant brackets or anchors, Use adhesive rubber pads for electronic devices like computers, Rearrange furniture layout to ensure clear evacuation paths and reduce potential hazards.
5. Renovating buildings that are not earthquake-resistant or are in old or poor condition. This is essential, especially for public buildings used by large numbers of people, such as educational facilities, healthcare centers, and government offices.
6. Reducing the risk of furniture shifting or collapsing during an earthquake.
   Furniture that moves, tips over, or falls can block evacuation routes and injure occupants. Measures to reduce this risk include: Avoid placing tall furniture like wardrobes on carpets; instead, place them on hard, flat surfaces, Store heavier items on lower shelves and lighter ones above, Refrain from placing dangerous items such as scissors in high locations, Install earthquake-resistant fasteners or brackets, Use adhesive rubber pads on electronic devices such as computers, Rearrange furniture layout to improve safety and ensure unobstructed evacuation routes.
7. Establishing community-based independent organizations for earthquake disaster management.
   These organizations aim to enhance public knowledge about earthquake disasters, create localized disaster maps for neighborhoods and residential areas to identify the safest places to take shelter during an earthquake—whether indoors, at work, or outdoors—and determine the nearest safe evacuation sites. They also encourage residents to record important phone numbers, such as fire and ambulance services, to prepare for the possible impacts of an earthquake. Furthermore, they promote earthquake preparedness by organizing simulation drills to train appropriate responses and self-rescue actions, including how to reach the nearest of 37 designated safe evacuation points during an earthquake, and how to act in the aftermath of the disaster.

Management of Earthquake Disasters and Public Policy

Extreme occurrences, whether caused by natural or man-made factors, are common in Indonesia. Earthquakes are among the most common natural disasters in Indonesia. This has a lot to do with the nation's location at the meeting point of the Pacific, Eurasian, and Indo-Australian plates (BMKG, 2014), which is made more difficult by the existence of many microplates in between these major tectonic plates.

Furthermore, from Aceh to North Sulawesi, Indonesia is home to 129 active volcanoes. The high frequency and severity of seismic activity in the nation are a result of these two geographic factors. Nearly constant earthquakes occur in Indonesia; some

are detected by sensors, while others are experienced directly by people (Crisis Management Centre, Ministry of Health, Republic of Indonesia, 2007) (Miah et al., 2023).

According to Aryanto et al., (2023) an earthquake is the abrupt release of energy that causes particle vibrations to spread in all directions, usually as a result of a subduction process. An earthquake is a seismic vibration brought on by the rupture or shifting of rocks at a specific site within the Earth's crust, according to Prager (Yue, 1970). Seismic waves from these vibrations travel through the earth and are perceived by people on the surface, where they are recognised as earthquakes.

According to Dewangana et al., (2025) there are two primary hypotheses concerning the creation of earthquakes: the elastic rebound theory and the fault displacement hypothesis. About 225 million years ago, when the continents were still part of a single landmass called Pangaea, the fault displacement idea was developed. This continent gradually separated to produce the tectonic plates of Earth, which still move and collide and cause earthquakes.

According to the elastic rebound theory, earthquakes happen when the lithosphere's rocks suddenly release elastic strain energy that has been trapped there. Ground vibrations are caused by the sudden release of energy when the tension surpasses the elastic limit of the rock. The magnitude of the ensuing earthquake increases with the amount of energy released (Bychkov, 2023; Moczo et al., 2024).

CONCLUSION

The mapping of earthquake-prone areas by research organisations is one of several urgent measures that must be implemented. Raising public knowledge of the dangers posed by extreme events like earthquakes must also be a priority of national and local government initiatives. Zoning laws and building construction standards are urgently needed to make sure that residential, commercial and public structures are earthquake-resistant and reduce the possibility of fatalities. Inspections must be carried out both before and during the construction process in order to comply with these rules. Volunteers can be used to help low-income communities develop earthquake-resistant structures by offering advice and assistance. Because it places a strong emphasis on the safety and reinforcement of all physical infrastructure, this second strategy is frequently referred to as structural mitigation. By imparting first aid knowledge and skills, preparing medical supplies, and providing basic necessities like clean drinking water, non-perishable food, underwear, and securing personal savings, communities can become more prepared to face dangers. Traditional money-storage techniques, like putting cash in bamboo, wooden posts, or beneath mattresses, are still widely used in many Indonesian rural regions. Since they emphasise logistical, behavioural, and educational readiness above physical infrastructure, these strategies which span from the third to the fifth are frequently referred to as non-structural mitigation. In order to handle extreme events like earthquakes, it is anticipated that the presence of strategic policies and efficient public management will offer answers, response plans, and doable actions.

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