

Enhancing Disaster Response Effectiveness: A Case Study of the 2006 Bantul Earthquake in Yogyakarta

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Abstract. This article delves into enhancing disaster response efficacy by analyzing the 2006 Bantul earthquake in Yogyakarta, Indonesia. The study investigates challenges, strategies, and lessons from the seismic event. Employing a qualitative descriptive approach, it examines impact, information gathering, resource allocation, and inter-organizational collaboration. Findings reveal substantial infrastructure and community impact. Information gathering was hindered, necessitating real-time data collection and advanced technology. Swift humanitarian aid allocation by the Indonesian government faced data accuracy challenges, impacting recovery efforts. Inter-organizational collaboration showed both successes and barriers due to protocol disparities, communication issues, and sectoral competition. In conclusion, this study emphasizes improving disaster response efficacy. The 2006 Bantul earthquake offers insights for advancing information gathering, resource allocation, and collaboration. Acknowledging local government limitations, the study underscores learning from these setbacks to build stronger disaster management systems. Integration of these insights can bolster future responses, enhancing coordination and effectiveness in mitigating community impact.

Keywords: Disaster Response; Effectiveness; 2006 Bantul Earthquake; Yogyakarta

1 Introduction

An earthquake struck the island of Java on May 27, 2006, at 05:53 local time, with a magnitude of 6.3 on the Richter scale. The epicenter of the earthquake was located in the Indian Ocean, approximately 33 kilometers south of Bantul regency, Yogyakarta Province. The tremors lasted for 52 seconds. More than 750 aftershocks were reported, with the strongest intensity reaching 5.2 on the Richter scale [1] [12]. The earthquake occurred at a shallow depth in the Sunda Plate above the Australian Plate subduction zone. The tectonic movement in Java is dominated by the Australian Plate moving northeastward beneath the Sunda Plate at a relative speed of around 6 cm/year [2].

The earthquake had a direct impact on Yogyakarta Province and Central Java Province. In Yogyakarta, the event affected all five of its regencies: Bantul, Gunung Kidul, Kulon Progo, Sleman, and Yogyakarta City. To the west and north of Yogyakarta, six regencies in Central

Java were affected – Boyolali, Klaten, Magelang, Purworejo, Sukoharjo, and Wonogiri. The two most severely affected districts were Bantul in Yogyakarta Province and Klaten in Central Java Province.

Table 1. Casualties and Number of Injuries from the Yogyakarta-Central Java Earthquake [3]

Provinces and Cities/Regencies	Fatalities	Victims of injuries
Yogyakarta	4,681	19,401
Bantul	4,143	12,026
Sleman	240	3,792
Yogyakarta City	195	318
Kulon Progo	22	2,179
Gunung Kidul	81	1,086
East Java	1,057	18,526
Klaten	1,041	18,127
Magelang	10	24
Boyolali	4	300
Sukoharjo	1	67
Wonogiri	-	4
Purworejo	1	4
Total	5,716	37,927

The disaster's impact was heavily concentrated in Bantul regency in Yogyakarta Province and Klaten in Central Java. Bantul and Klaten together accounted for over 70% of all damages and

losses. Among other major areas that suffered damages were Yogyakarta City and three other rural regencies in Yogyakarta Province (see Figure 1). Klaten experienced the most severe overall damage, particularly in the housing sector; Bantul endured significant damages and losses in both the productive sector and housing.

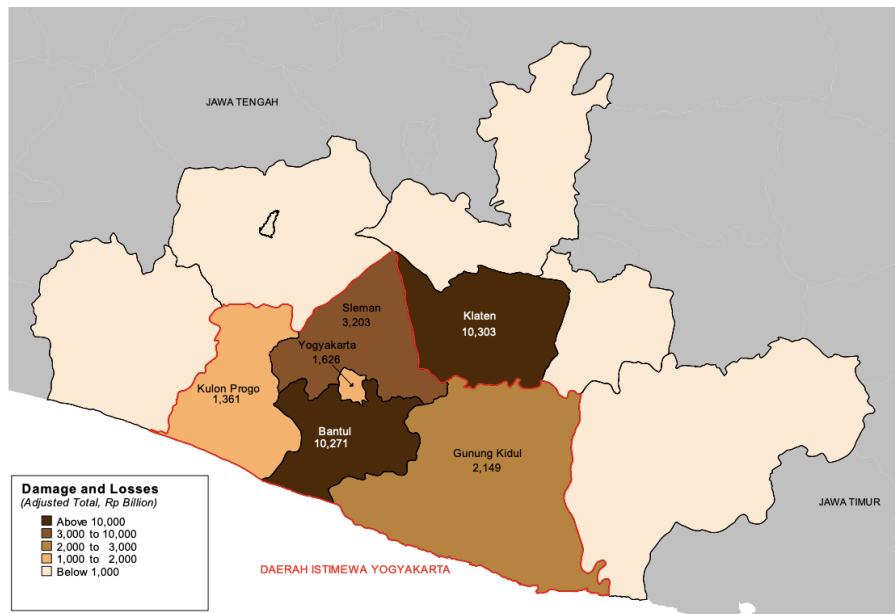


Fig. 1. Map of Post-Earthquake House Damage and Losses in Yogyakarta [3]

Figure 1 depicts the distribution of post-earthquake house/building damage in DIY and Central Java, indicating a total of 29,115 structures that were damaged. This number is believed to encompass buildings that suffered mild, moderate, and severe damages. From the data, it is recorded that the damage to houses/buildings is nearly evenly split between Bantul Regency (DI Yogyakarta) with 10,271 structures and Klaten Regency (Central Java) with 10,303 structures. This illustrates that the earthquake's impact zone lies along a fault line.

The total value of losses (both factual and indirect spread effects) incurred in the disaster event in Yogyakarta Province shows that the earthquake, occurring suddenly and unpredictably, resulted in a substantial figure of Rp 29.1 trillion. These losses encompass damages to buildings/houses, infrastructure, social impacts, economic/productive damages, and cross-sectoral losses [4].

The conditions during the tectonic earthquake disaster on May 27, 2006, give the impression of a lack of preparedness in facing such an event. This was due to the earthquake coinciding with an extended holiday period, which hindered effective coordination. Additionally, Yogyakarta's attention at that time was primarily focused on the volcanic threat from Mount Merapi, diverting preparations towards that impending disaster. Consequently, the impact of the tectonic earthquake on Yogyakarta Province was significant, with the worst-hit being Bantul Regency due to its location along the fault line [5] [18].

Among the areas affected by the earthquake in the DIY region, Bantul Regency experienced the greatest impact due to its proximity to the epicenter. Even today, the population in Bantul Regency remains traumatized and panicked when aftershocks occur. Such social realities can contribute to the emergence of social changes. The aftermath of the May 27 earthquake, as felt by the community of Janganan Panggungharjo, Sewon, and Bantul, particularly in RT 03, RT 04, and RT 05, is similar. In these areas, nearly 95% (RT 03) and 65% (RT 04 and RT 05) of buildings were either leveled to the ground or severely damaged [6].

2 Research Method

This research employs a qualitative descriptive approach using a literature review as the method. The literature review is utilized to examine and provide a foundation for the research. The compilation of the literature review aims to gather scientific data and information in the form of theories, methods, or approaches that have evolved and been documented in books, journals, manuscripts, notes, records, history, documents, and other sources. The rationale for conducting a literature review in this study is based on the fact that the 2006 Bantul earthquake, the subject of this research, is a natural disaster that occurred in the past, allowing for multiple and diverse analyses, both by the same individuals and different ones [7]. The literature review data in this study focuses on research related to the 2006 Bantul Earthquake and strategies implemented by the local government to mitigate its effects.

This research adopts the framework proposed by Yang (2010) on the effectiveness of the disaster management system in Taiwan [8]. There are three independent variables in this research: information gathering, resource mobilization, and inter-organizational collaboration. Meanwhile, the dependent variable in this study is the effectiveness of addressing the 2006 Bantul Earthquake in Yogyakarta (see Figure 2).

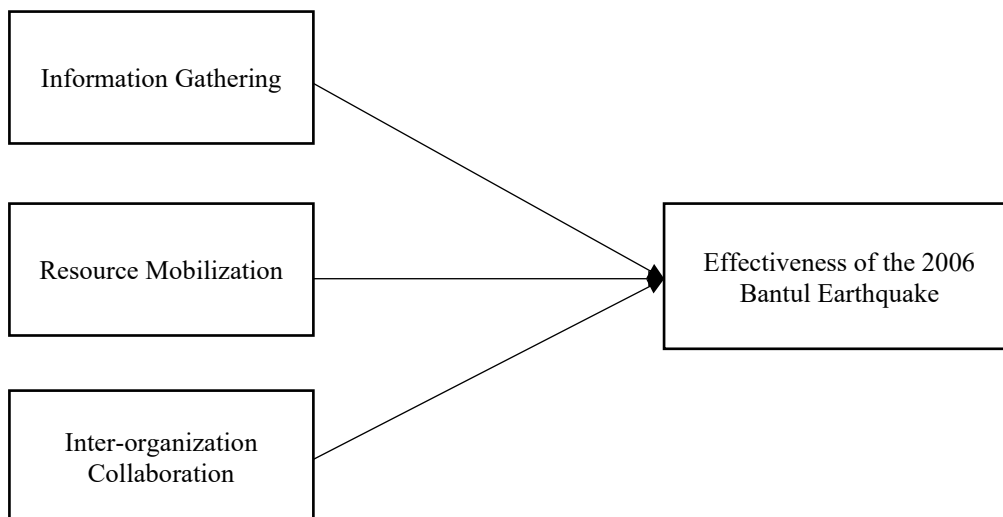


Fig. 2. Research Framework

3 Result and Discussion

3.1 Information Gathering

On May 27, 2006, the Bantul region in the Special Region of Yogyakarta, Indonesia, was struck by a 6.3 Richter scale earthquake. This event resulted in significant infrastructure damage and impacted the local population, posing substantial challenges in gathering information for disaster response. The process of information collection during the 2006 Bantul earthquake unfolded through several stages and encountered a number of obstacles.

Firstly, during the initial phase, the relevant agencies, using seismic sensor networks and GPS, detected the earthquake's location and magnitude. This data provided an initial overview of the potential impact. However, challenges arose as some detection equipment might have been damaged by the earthquake itself, impeding the collection of early data [9].

The subsequent phase involved efforts to gather field information regarding damages and emergency needs. Disaster assessment teams were deployed to evaluate the damages in the affected areas. However, access to heavily damaged regions became a serious constraint due to road and major infrastructure destruction. Geospatial data and satellite imagery were employed to aid mapping and damage identification, but the information obtained might not have been real-time and lacked detailed accuracy. Another challenge was disrupted communication due to power outages and telecommunications infrastructure damage. This hindered information transmission between assessment teams, command centers, and relevant government agencies. Consequently, disaster response was hindered in coordinating effective assistance and evacuation efforts [10].

The hindered information collection and technological limitations at the time affected the effectiveness of the disaster response. The lack of real-time data on damages and emergency needs impeded the government's and humanitarian institutions' ability to accurately allocate resources. Coordination of aid and evacuations became more difficult due to communication disruptions, potentially resulting in delayed assistance to some affected areas [11]. In this context, the importance of more advanced early warning systems, resilient communication infrastructure, and more accurate mapping capabilities becomes evident. Effective responses to disasters like the 2006 Bantul earthquake require accurate and real-time data to inform sound decisions in resource allocation, evacuation, and recovery efforts in the affected areas. With improved technology and robust information systems, the information collection process can serve as a stronger foundation in building effective disaster responses.

3.2 Resource Mobilization

The Indonesian government responded to the disaster within a few hours and allocated Rp 5 trillion in humanitarian aid. President Susilo Bambang Yudhoyono arrived in Yogyakarta a few hours after the disaster and relocated his office there from May 27 to May 31 to personally monitor humanitarian aid efforts. The National Disaster Coordination Agency (BAKORNAS), led by Vice President Jusuf Kalla, coordinated the initial aid delivery and rescue efforts. This response was carried out in close cooperation with the Coordinating Ministry for People's Welfare, the Department of Social Affairs, the military, local governments, and various UN agencies. The Indonesian government initially allocated Rp 1 trillion from the state budget

(APBN) for aid delivery and reconstruction activities. Out of this amount, Rp 75 trillion was directed to BAKORNAS for humanitarian aid. Relief delivery teams, medical teams, and military units from all over the country were mobilized to the disaster-stricken areas. The allocated budget increased to Rp 5 trillion.

The local governments distributed disaster compensation funds and essential supplies provided by the central government. Among the distributed items were 10 kilograms of rice per person per month, Rp 3,000 per person per day, a one-time grant of Rp 100,000 per person for clothing, and Rp 100,000 per household for kitchen utensils. Additionally, it was announced that over 820,000 individuals whose homes suffered severe damage would receive full living expenses for three months. Families also received Rp 2.0 million per deceased family member. Vice President Kalla announced that Rp 30.0 million would be given for each completely destroyed house and Rp 10.0 million for houses with damage. Hospital costs for earthquake-related injuries were covered by the government in public facilities [14].

The effectiveness of governance in Bantul Regency was evident despite the fact that the May 27, 2006 disaster occurred during a long holiday period (since May 25). Despite the circumstances, the command of Sri Sultan HB X (Governor of DIY) and the Regent of Bantul ensured that government functions continued. In Bantul Regency, even employees whose homes were damaged were called upon to swiftly engage in disaster response efforts, particularly in distributing logistic aid such as food and medicine received from various sources [13].

In addition to the governor's and regent's directives, governance effectiveness was reinforced by the instructions of the President of Indonesia regarding disaster management, which included: (1) save victims, attend to the injured before property, (2) repair infrastructure, electricity, and roads to facilitate logistics distribution and life-saving operations, (3) ensure sufficient food, and (4) identify the extent of damage to plan for rehabilitation and reconstruction. Governance effectiveness was also reflected in the victim data collection process. Following the guidance of the Coordinating Minister for People's Welfare on May 31, 2006, the Bantul local government held a coordination meeting involving all levels of local administration, including village heads, to initiate data collection. This process was carried out by RT (neighborhood unit) leaders and witnessed by the victims.

Subsequently, the Bantul local government conducted data collection using predefined forms based on a letter from Bakornas PB dated June 2, 2006, regarding General Guidelines for Emergency Response Assistance. This form was to be completed by June 4, 2006. Bantul local government operationalized this by issuing a decree on June 2, 2006, classifying districts for the basis of providing monetary assistance and rice to affected earthquake victims. The classification included districts severely affected, districts with critical/socially vulnerable status, and districts with moderate damage. Within one week after the earthquake, the victim data collection process faced issues of data accuracy due to negative perceptions, aftershock concerns, and security disruptions. Nevertheless, the Bantul local government decided on this policy as the data would be crucial for future decision-making. The local government maintained a positive approach, putting trust in lower-level officials, particularly RT leaders and community leaders.

Despite the data collection challenges, some residents were not included due to a lack of administrative records (not registered in the local ID system). This included students, students

in Bantul boarding schools, traders, and migrant workers. Nevertheless, the Bantul local government decided to provide assistance to all earthquake victims to avoid unequal distribution, which could lead to jealousy and negatively impact social cohesion and the quality of social capital (mutual cooperation, tolerance, community spirit, etc.) in the society. The preservation of social capital was a priority for the Bantul local government, as they believed it was a primary strength for the people of Bantul to rebuild their community. The Governor of DIY declared a one-month state of emergency, which was consistently followed by all regents. The rationale behind this decision was that extending the emergency period could lead to dependency on aid, hindering self-reliance. Motivation to regain self-sufficiency was encouraged by the regents and governor. Bantul Regency's Regent even called for families to regain their economic activities within two weeks after the earthquake (in the third week) by returning to farming, teaching, and trading.

In the context of providing Rehabilitation and Reconstruction Assistance Funds after the 2006 Bantul earthquake, a case emerged that marred the efforts of post-disaster recovery. This assistance fund was allocated based on the level of damage suffered by affected communities' houses. Houses with severe damage were entitled to receive assistance amounting to fifteen million Indonesian rupiahs, while those with moderate damage were eligible for four million rupiahs, and houses with light damage qualified for one million rupiahs [15].

As a specific case illustration, in the village of Temuwuh, located in the Dlingo sub-district of Bantul Regency, a reconstruction fund of five billion eight hundred fifty million rupiahs was allocated to 37 community groups. However, the disbursement of this assistance was tainted by widespread corrupt practices. The corruption involved officials who were tasked with distributing the assistance funds to eligible community members [15].

In this case, the funds that were intended to aid the needy community were misappropriated for personal gain. The officials who were supposed to be the pillars of post-disaster recovery instead engaged in significant fund embezzlement. The embezzlement ranged from three to seven million rupiahs per beneficiary, resulting in substantial financial losses. The total amount of funds unlawfully siphoned reached a staggering one billion six hundred twenty-four million five hundred thousand rupiahs.

3.3 Inter-organization Cooperation

In 2006, the earthquake that struck Bantul resulted in a complex inter-organizational collaboration to address its impact. This analysis will discuss the collaboration process, challenges, shortcomings, its relation to disaster response effectiveness, barriers in inter-organizational collaboration, and the roles of the Bantul District Local Government and the DIY Regional Government. The process of inter-organizational collaboration during the 2006 Bantul earthquake can be seen from various aspects. Based on data, various institutions such as non-governmental organizations (NGOs), local governments, the military (TNI), police (Polri), volunteers, and other agencies collaborated in rescue, evacuation, medical treatment, and post-earthquake recovery efforts. Coordination was achieved through meetings, communication, and information sharing to maximize the resources and competencies of each organization.

The effectiveness of disaster response is also heavily influenced by inter-organizational collaboration. When collaboration is successful, responses can be better coordinated and more

responsive to emergency needs. However, when collaboration is hindered, responses can be less efficient, and coordination disruptions can lead to suboptimal aid quality and recovery outcomes. Research findings reveal several key barriers to inter-organizational collaboration during the 2006 Bantul earthquake [16].

Firstly, differences in protocols and operational standards among involved organizations were observed. This lack of alignment resulted in confusion in taking effective coordinated actions, as each organization followed its own internal guidelines and procedures. The implication is the inability to take swift and coordinated steps in responding to emergencies, which can hinder victim rescue and assistance efforts.

Secondly, communication and coordination issues posed serious challenges to inter-organizational collaboration. Research data indicates difficulties in delivering accurate and timely information to all involved parties. Delays in sharing information led to confusion in emergency planning and execution. The consequence was a lack of alignment in responses provided by different organizations, potentially reducing the overall effectiveness of disaster mitigation efforts.

Thirdly, in some cases, sectoral ego and competition among organizations posed serious obstacles to collaboration. Research findings indicate instances where organizations tended to prioritize maintaining their image or sectoral dominance over effective collaboration. The implication is the potential wastage of resources and unfocused efforts, as the energy that should be allocated to collaboration is diverted to less productive goals.

The roles of the Bantul District Local Government and the DIY Regional Government were significant in this situation. Local governments possess a deep understanding of the local conditions and community needs, enabling them to provide more accurate guidance in disaster response. Furthermore, the Bantul District Local Government was responsible for coordinating efforts and connecting various stakeholders [17]. Inter-organizational collaboration during the 2006 Bantul earthquake had positive impacts in disaster management, albeit with challenges and shortcomings. The effectiveness of disaster response is highly influenced by the quality of collaboration. Overcoming collaboration barriers can be achieved through improved planning, more effective communication, and a deeper understanding of each organization's role. Local governments play a key role in facilitating coordination and connecting various stakeholders in disaster mitigation efforts.

4 Conclusion

The 2006 Bantul earthquake in Yogyakarta, Indonesia, serves as a compelling case study highlighting the multifaceted challenges and responses associated with natural disasters. This conclusion synthesizes the key findings and insights from the different sections of the research, encompassing the earthquake's impact, information gathering, resource mobilization, and inter-organizational collaboration.

The information-gathering process during the disaster faced several stages and obstacles. Initial data collection, relying on seismic sensors and GPS, provided an overview of the earthquake's magnitude and location. However, the destruction of some equipment impeded early data acquisition. Subsequent efforts to assess damages encountered challenges in accessing heavily

affected regions, prompting the use of geospatial data and satellite imagery for mapping. Communication disruptions hindered timely information sharing among response teams and coordination centers. Improved technology and real-time data collection emerged as prerequisites for accurate resource allocation, evacuation planning, and recovery efforts.

The response to the disaster showcased the Indonesian government's swift and coordinated efforts. President Yudhoyono's personal involvement and relocation to Yogyakarta demonstrated the government's commitment. Allocation of humanitarian aid, distribution of compensation funds, and essential supplies by local governments illustrated effective governance at various levels. Despite challenges in data accuracy and negative perceptions, the Bantul local government prioritized social cohesion, acknowledging the value of maintaining social capital in community rebuilding efforts.

Inter-organizational collaboration played a pivotal role in addressing the disaster's impact. Collaboration among NGOs, local governments, military, police, volunteers, and other agencies facilitated coordinated responses. However, challenges emerged, including protocol differences, communication issues, and sectoral competition. Overcoming these barriers required improved planning, effective communication, and a deeper understanding of each organization's role. The roles of the Bantul District Local Government and the DIY Regional Government were instrumental in facilitating coordination, understanding local conditions, and ensuring effective disaster mitigation.

In concluding, the 2006 Bantul earthquake serves as an illuminating case study underscoring the intricate challenges and responses that accompany natural disasters. Regrettably, an evaluation of the local government's response during this crisis indicates a lack of overall effectiveness due to various issues. While the earthquake's impact was profound, the local government's ability to gather accurate and timely information, allocate resources effectively, and coordinate inter-organizational efforts fell short in crucial ways.

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