

## Evaluation of flood disaster management planning: a comparative method for Botswana and Indonesia

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Received Date: June 8, 2023

Revised Date: July 30, 2023

Accepted Date: July 30, 2023

Cite This Article:

Gunanda, A., & Koestoer, R. H. S. (2023). Evaluation of flood disaster management planning: a comparative method for Botswana and Indonesia. *ASEAN Natural Disaster Mitigation and Education Journal*, 1(1), 12-19. <https://doi.org/10.61511/andmej.v1i1.2023.134>



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### Abstract

Disaster management planning is an activity that is translated into documents to be used as a reference in carrying out disaster risk reduction. Furthermore, based on data from UN-ESCAP for 2022, disaster events in Indonesia and Botswana are dominated by extreme weather, especially storms, floods, and droughts. So, disaster management planning, especially for flood disasters, is considered important as one of the efforts to reduce disaster risk. This study aims to compare the evaluation results of the disaster management planning documents owned by Botswana and Indonesia. This study uses a systematic literature review method and a comparative study with a qualitative descriptive approach to the evaluation of disaster management planning between Gaborone, Botswana, and Yogyakarta, Indonesia. The results of the research show that the evaluation of disaster management planning in Gaborone City, Botswana still requires updating and involving the public more in the preparation of this document. In addition, the results of the evaluation of disaster management planning documents in the City of Yogyakarta, Indonesia still require efforts to integrate disaster documents with other planning documents so that they can become a reference for the implementation of disaster risk reduction activities by various stakeholders involved in the disaster sector. The problem with disaster management planning documents in the two countries is the lack of public involvement and the lack of integration of this disaster management planning document with other development planning documents, including issues regarding validity periods. The offered solution is to update the disaster management planning document by involving more public arguments.

**Keywords:** flood; disaster; gaborone; planning; Yogyakarta

### 1. Introduction

Globally, the impact of natural disasters on incidence, deaths, casualties, and the estimated total cost of economic loss is increasing. This is further exacerbated by the rate of global warming which exacerbates the frequency, level of damage, and impact of disasters caused by climate change (Ntim-Amo et al., 2022). Every year, extreme climate change events cause significant losses in Asian countries. Damage and losses due to floods are increasing, affecting the economic development of several countries in Asia as a whole (Patri et al., 2022).

Based on statistical data, in the period 1970 to 2021, Indonesia reported the most deaths in Southeast Asia caused by disasters with an average of around 4,100 deaths each year. Disaster events are dominated by extreme weather, especially storms, floods, and droughts (UN-ESCAP, 2022). Several previous studies have shown that flood disasters can be caused by human activities (Otsuka et al., 2022; Zhang et al., 2023). In addition, flood

disasters can also be caused by the influence of natural activities (Bouchard et al., 2022; Marengo et al., 2023)

Indonesia's Disaster Information Data (BNPD & UNDP Indonesia, 2022) shows that throughout 2022, Indonesia experienced 3,522 natural disaster events, with 1,524 flood events or 43.1% of the total natural disaster events. The central part of Java Island is an area that often experiences flood disasters from 1900-2022 which makes the area vulnerable to flood disasters (Langlois et al., 2023).

The Special Province of Yogyakarta (D.I) is located in the central part of Java Island. Disaster risk assessment data compiled by (BPBD, 2022) shows that frequent disaster events in D. I. Yogyakarta Province consist of floods, extreme weather, and landslides. Administratively, D. I. Yogyakarta Province consists of 4 Regencies and 1 City, with the Provincial Capital City located in the City of Yogyakarta. Based on the 2017-2022 Disaster Management Plan documents, floods are one of the worst disasters that have occurred in the City of Yogyakarta (BPBD, 2017).

Apart from the continent of Asia, floods and droughts are the most common natural disasters that have and continue to cause enormous economic losses and loss of life throughout southern Africa (Samuel et al., 2022). In Botswana, disasters resulted in droughts and floods that affected 1.5 million people and economic losses of more than US\$3 million between 1965 and 2006 (EM-DAT, 2007).

Flood damage and economic losses were felt around the capital city of Gaborone, Botswana due to high infrastructure investment and high population density in the region. The increasing intensity of damage caused by flooding and recurring every year in the capital city of Gaborone indicates that there is no adequate plan to manage floods properly (Parida et al., 2003)

One of the efforts that can be made to be able to mitigate the impact of flood disasters is through disaster management which is compiled in a disaster management plan from the national level to the local level (Sajjad, 2021). Efforts to integrate disaster resilience at the local government level into the central government are a challenge. Especially in areas that are experiencing high urbanization, there are still some serious challenges in local planning due to some integration constraints (Ner et al., 2022).

## 2. Methods

This study uses a systematic literature review method and a comparative study with a qualitative descriptive approach to evaluating disaster management planning between Gaborone, Botswana, and Yogyakarta, Indonesia. As a comparison from the aspect of disaster management planning, this article uses two types of parameters, namely the period of implementation of the disaster management plan and the suitability of the disaster management plan with the priority needs of disaster risk reduction.

The time frame for disaster management planning can be said to vary. Plans can be divided into short, medium, and long-term plans. Variations in the planning period apply equally to planning at the central, regional, and local levels and can be evaluated to determine the effectiveness of the implementation of the plan. In addition to the time period, planning evaluation can also be carried out on the suitability between priority activities in planning and the suitability of needs in the field. Field needs can be viewed from the dominant type of disaster in an area with mitigation efforts that are in accordance with the dominant type of disaster.

The main sources of this research are journals obtained from international journal publication databases. These sources are complemented by other relevant literature to provide a comparative analysis of the strategies used by each local government in implementing disaster management.

## 3. Results and Discussion

### 3.1. Disaster Management Planning in Gaborone, Botswana

Gaborone is in southeastern Botswana, 15 km from the South African border to the east at coordinates 24°39'16.11"S and 25°54'24.71"E (Fig. 1). Gaborone's topography is

undulating to flat (Kent & Ikgopoleng, 2011), situated in a flat valley between the Kgale and Oodi hills (Sebege & Gwebu, 2013) with the Notwane River flowing from south to north, with a total catchment area of 18,053 km<sup>2</sup> (Mladenov et al., 2005), including the Gaborone dam with a capacity of 141,100,000 m<sup>3</sup>. Gaborone, like the rest of Botswana, has a semi-arid climate with hot, dry summers from October to March. Rainfall is erratic and unpredictable. Based on the results of climate data, this rainfall pattern is influenced by the movement of the Inter-Tropical Convergence Zone (ITCZ) and tropical climate troughs and their associated knots. Due to the high amount of rainfall recorded from November to March, the long dry season hardens the soil surface, encouraging rapid runoff and causing flash floods.

A country needs a comprehensive disaster management strategy. The disaster management cycle is not carried out systematically in Botswana because it only emphasizes emergency assistance provided and is reactive rather than proactive (NDMO, 2009), resulting in disaster management efforts not running optimally. Botswana tends to use general disaster management strategies and does not go into detail about the specific types of disasters that may occur in Botswana and uses different management for each type of disaster, as urban and rural settings require different approaches to disaster management.

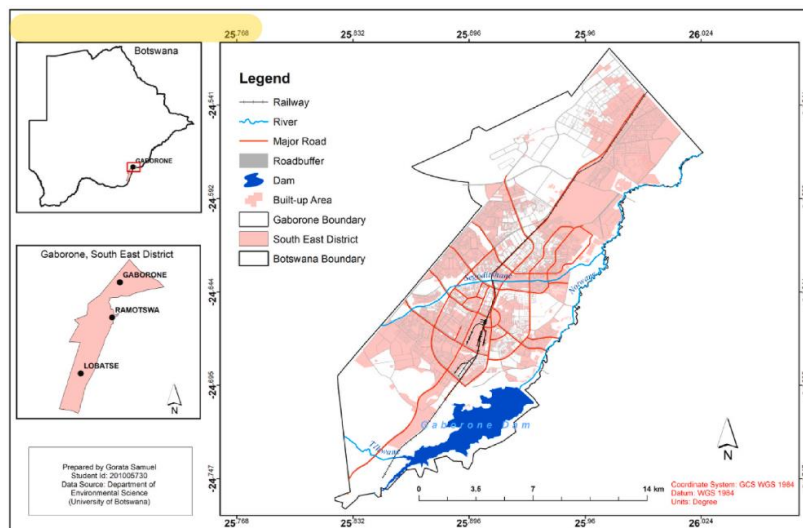


Figure 1. Administration map of Gaborone, Botswana (Ntim-Amo et al., 2022)

As background, the disaster management strategy in Botswana is structured in such a way as to reflect the conclusions resulting from consultations and input by different stakeholders such as police, military, health workers, agricultural workers, red cross, and other private stakeholders. The National Agency for Disaster Management in Botswana (NDMO) advocated that the strategy should be developed concurrently with existing plans and policies (NDMO, 2009). Botswana's 1996 national policy on current disaster management is used to reduce the impact and vulnerability of future disasters. This policy also ensures that disaster preparedness measures are taken to deal with disasters when they occur (NPDM, 1996). The policy includes the country's institutional and legal framework for disaster risk reduction and outlines key definitions, measures, and responsibilities for disaster preparedness at all levels of the coordination line sector (NPDM, 1996). It should also be noted that Botswana does not have a law for disaster management but instead uses emergency measures to support the declaration and status of a disaster event (NDMO, 2009). The 2009 National Disaster Risk Management Plan, on the other hand, lays out a national framework for disaster risk reduction and emergency management in Botswana by involving all stakeholders in disaster management (NDMO, 2009).

The aim of all existing strategies, plans, and policies in Botswana is to reduce disaster risk. The main finding from the evaluation results of Botswana's strategic planning

is that the objectives of the disaster risk reduction strategy are not actually achieved in the field because there are no identified development policies and programs that are directly related to disaster risk reduction efforts at the national, district, community, down to the household level ladder.

The important thing is the evaluation findings from the three disaster management documents; National Strategy for Disaster Risk Reduction (NDRRS 2013–2018); National Disaster Risk Management Plan (NDRP 2009); and the National Disaster Management Policy (NDPM 1996) have all expired documents. Flood hazard patterns have changed with respect to climate change and this has rendered strategies, plans, and policies irrelevant to current conditions. The 2009 NDRP partially accommodates the current trend of flood disasters in Botswana which clearly states what is being done appropriately in each phase of the disaster management cycle. The plan is effective compared to other policies and strategies. Another explanation that can be added is that strategies, plans, and policy formulation are usually a top-down approach developed in consultation with the sector with very minimal public involvement and this raises the question of whether the documents prepared represent the community well or not.

According to the strategy, disaster planning involves reducing the level of harm, severity, and likelihood of harm (NDMO, 2013), but it is not clear how this will be done and the relevant stakeholders for each of these activities are not specified. In addition, planning is only done at the national and district level which basically excludes the people who are the main victims of the disaster. It is also affected by the lack of disaster risk reduction legislation which undermines strategies, plans, and policies due to the difficulty in determining the rights and responsibilities of individuals (communities) and authorities (stakeholders) affected by the legislation. This could be due to the limited human resources sufficient to carry out this task alone as a coordinating agency.

### *3.2. Disaster Management Planning in Yogyakarta, Indonesia*

The city of Yogyakarta is located between 110°24'19'-110°28'53' East Longitude and between 07°15'24'-07°49'26' South Latitude, with an area of approximately 32.5 Km<sup>2</sup> or 1.02% of the area of the Province of the Special Region of Yogyakarta. Administratively, the City of Yogyakarta consists of 14 sub-districts and 45 sub-districts as shown in Figure 2 (BPBD, 2017). The population of the City of Yogyakarta in 2014 was 417,656 people, with details of 204,242 male residents and 213,414 female residents. The sex ratio or the ratio between the male and female population is 94.74%. The city of Yogyakarta, which is located on the slopes of Mount Merapi, has a relatively flat slope of between 0-2% and is located at an average elevation of 114 meters above sea level (dpa). Part of the area with an area of 1,657 hectares is located at an altitude of less than 100 meters and the rest (1,593 hectares) is located at an altitude of 100-199 meters dpa. In general, the highest average rainfall in the City of Yogyakarta during 2014 occurred in February, which was 311 mm. The average air humidity is quite high, the highest occurs in December at 88% and the lowest is in October at 76%. The average air pressure is 997.21 mb and the average temperature is 26.30 C.



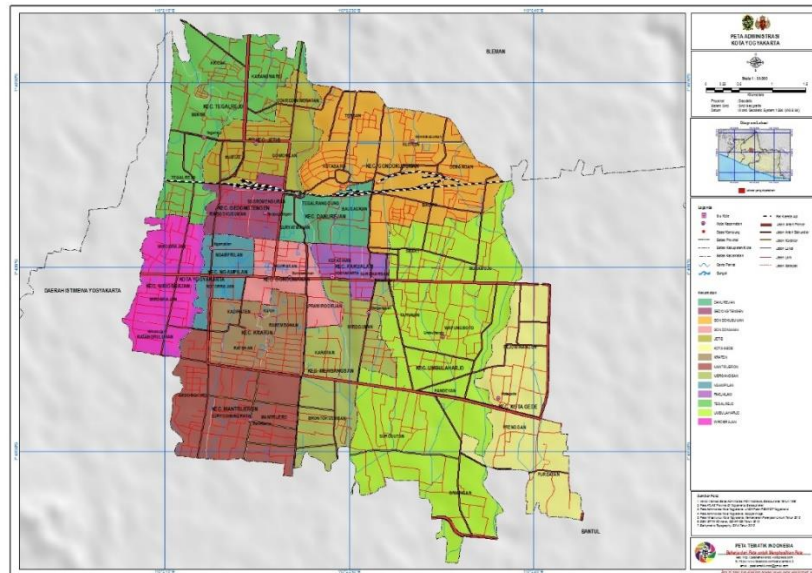


Figure 2. Administration map of Yogyakarta, Indonesia  
(Yogyakarta city regional development planning agency, 2022)

The city of Yogyakarta has ecoregional characteristics which are classified into 4 (four) classes, namely structural hills, structural mountains, volcanic plains, and fluvial plains. Based on this, it can be seen that the City of Yogyakarta has the potential for earthquakes, extreme weather, and flooding due to the potential for river overflow. The implementation of Yogyakarta City disaster management needs to pay attention to cooperation between neighboring districts/cities and neighboring provinces. This partnership can cover the area of the Progo-Opak-Serang River Basin (WS). Based on the scope of WS Progo-Opak-Serang, the Yogyakarta City disaster management partnership was implemented with Central Java Province (BPBD, 2017).

In general, disaster management plans for both the City of Yogyakarta and Indonesia have been prepared sequentially. Indonesia already has a long-term management plan prepared through the 2020-2045 Disaster Management Master Plan (Regulation of the President of the Republic of Indonesia Number 87 of 2020 concerning the 2020-2044 Disaster Management Master Plan, 2020). Then the Long-term disaster management plan has been lowered into the national disaster management plan document (Renas-PB) prepared by the National Disaster Management Agency (BNPB, 2019). In more detail, at the provincial level, the Regional Disaster Management Agency (BPBD) for the Special Region of Yogyakarta, has prepared a 2022-2027 Disaster Management Plan which has been stipulated through a Governor's regulation (Regulation of the Governor of the Special Region of Yogyakarta Number 39 of 2020 concerning Regional Disaster Management Plans for 2018- 2022, 2020). This was followed up by compiling a disaster management plan document, for the city of Yogyakarta with a validity period of 2017-2022 (BPBD, 2017).

In terms of the completeness of disaster management documents, the City of Yogyakarta can be said to have a complete disaster management document. This is indicated by the formulation of the RPB for the City of Yogyakarta which refers to the RPB for the Province of the Special Region of Yogyakarta. The RPB document compiled by BPBD Kota Yogyakarta contains various matters related to disaster management, including statistics on disaster events in the past few years, potential future disaster risks in terms of the Yogyakarta City disaster risk index, as well as the activities undertaken. can be carried out for the purpose of reducing the impact of disaster risk, which has been translated into aspects of policies, strategies, programs, and priority focus. These activity efforts have further been compiled into an action plan that has mapped out cross-stakeholder programs and activities in relation to disaster risk reduction. Administratively, this Yogyakarta

Disaster Management Plan document has also divided activity interventions down to the sub-district level.

However, if reviewed in terms of the implementation period, the RPB document owned by the City of Yogyakarta has just passed its validity period, where the validity period of this RPB document is from 2017-2022, so it is felt necessary to update this RPB document by reviewing it. the dominant types of disasters that are changing. Even though it has been prepared with reference to disaster management documents at the national and provincial levels, this RPB document still needs to be harmonized with planning documents at the regional level such as the Yogyakarta City Regional Medium Term Development Plan (RPJMD) and the City Regional Government Work Plan (RKPD). Yogyakarta. This is intended so that the RPB documents that have been prepared can be integrated more thoroughly and become a reference for all stakeholders in the City of Yogyakarta. Administratively, although this document already involves sub-districts as areas of intervention, it is still necessary to detail the areas of intervention down to village units so that residents and communities can also refer to intervention activities in terms of disaster risk reduction.

#### **4. Conclusions**

Based on a comparative study on the evaluation of disaster management planning, firstly, the city of Gaborone in Botswana already has a national planning document that accommodates disaster management efforts. The problem with the disaster management planning documents in Gaborone City, Botswana is that the currently available documents have expired and there is minimal public involvement, so they have not been felt and touched by the surrounding community. The solution that can be applied is to update the disaster management planning document by involving the public more so that the disaster management planning document in the future can be more useful and the general public can benefit from it.

Furthermore, problems with existing disaster management planning documents in the City of Yogyakarta, Indonesia are due to the fact that this disaster management planning document has not been integrated with other existing development planning documents and the document's current period has also expired. As a solution, updating related documents is carried out by involving more planning agencies in the regions so that the disaster management planning documents that will be produced can be better integrated and can become a reference for activities for other sectors involved in the field of disaster management.

#### **Acknowledgment**

This journal article was written by Arkha Dhemas Gunanda from the Department of Disaster Management Masters, School of Environmental Sciences, University of Indonesia based on guidance from Prof. Dr. Ir. Raldi Hendro Koestoer. The contents are fully the responsibility of the author.

#### **Author Contribution**

Arkha Dhemas Gunanda: Conceptualization, Methodology, Software, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original Draft Preparation, Writing – Review & Editing, Visualization. Arkha Dhemas Gunanda and Raldi Hendrotoro Seputro Koestoer: Validation and Writing – Review & Editing.

#### **Conflicts of Interest**

The authors declare no conflict of interest.

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