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HEXAHELIX COLLABORATION IN FLASH FLOOD DISASTER MANAGEMENT IN THE LAKE TOBA AREA

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ABSTRACT

This study aims to analyze the governance of Hexahelix collaboration in the implementation of flash flood disaster management in the Lake Toba Area and to identify the constraints and obstacles encountered in its implementation. The research method used is descriptive qualitative, with data collection techniques through interviews, observations, and documentation. The research informants consisted of the Head of the Regional Disaster Management Agency (BPBD) of North Sumatra Province, the Head of the Cooperation, Control and Evaluation Division of BPBD North Sumatra Province, Staff of the Community and Environmental Empowerment Department of PT Inalum Hydropower, the Chair of the Pandawa Kayak Organization of North Sumatra, the Director of the Center for Climate Change and Disaster Mitigation Studies of the Faculty of Forestry, University of North Sumatra, and a journalist from Tribun Medan. The results of the study indicate that the role of the Regional Disaster Management Agency has been carried out in accordance with the concept of governance, where disaster management is no longer centered solely on the government but involves various actors within a collaborative framework. However, the implementation of Hexahelix collaboration has not been fully optimal, particularly in the pre-disaster phase, which still requires strengthened coordination, increased human resource capacity, and cross-sectoral program integration. Internal constraints include the limited number of disaster-certified personnel, while external constraints are related to the persistence of communities residing in flash flood–prone areas due to livelihood factors. This study recommends enhancing the capacity of disaster management personnel, strengthening scientific studies as a basis for policy, developing more integrated multisectoral collaboration, promoting development oriented toward disaster risk reduction, and increasing the transparency of information that is easily accessible to the public.

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1. INTRODUCTION

Natural disasters are events that cannot be separated from Indonesia's geographical condition as an archipelagic country located in a disaster-prone region. One of the hydrometeorological disasters that frequently occurs and causes significant impacts is flash flooding. The Lake Toba area, as one of Indonesia's super-priority national tourism strategic areas, is also not free from such threats. The topographical characteristics dominated by hilly areas, high rainfall, and land-use changes are factors that increase the region's vulnerability to flash floods.

This condition requires disaster management governance that does not rely solely on the government but involves various actors collaboratively.

The development of the public administration paradigm shows a shift from government to governance, emphasizing the importance of multi-stakeholder collaboration in public affairs. The concept of governance according to Rhodes (1996) views that the management of public affairs is no longer dominated by the state but involves networks of interdependent actors [6]. In line with this, Osborne (2010), through the concept of New Public Governance, emphasizes that public sector performance is largely determined by the ability to build cross-sector collaboration [5]. In the context of disaster management, the collaborative approach becomes increasingly relevant because the complexity of disaster risks cannot be handled by a single institution alone.

One of the collaboration models that has developed is the Hexahelix model, which is an extension of the Triple Helix model by Etzkowitz and Leydesdorff (2000) [2]. This model was later expanded into the Pentahelix by Calzada (2016) by adding elements of society and media, and subsequently evolved into the Hexahelix by incorporating additional actors that strengthen the collaboration ecosystem [1]. The Hexahelix approach emphasizes synergy among government, business sector, academia, community/society, media, and other supporting actors in achieving development goals, including disaster management.

From a disaster management perspective, the theory proposed by Waugh and Streib (2006) asserts that collaborative emergency management is an effective approach to enhancing disaster response capacity [7]. Furthermore, Kapucu (2006) also highlights the importance of inter-organizational coordination in modern disaster management [3]. Both perspectives reinforce that cross-sector collaboration is a fundamental necessity in complex disaster management systems.

Normatively, disaster management implementation in Indonesia already has a strong legal foundation. Law Number 24 of 2007 concerning Disaster Management emphasizes that disaster management is a shared responsibility between the central government, local governments, and the community [8]. Furthermore, Government Regulation Number 21 of 2008 concerning the Implementation of Disaster Management regulates the disaster management stages, which include pre-disaster, emergency response, and post-disaster phases [9]. At the regional level, the Regional Disaster Management Agency (BPBD) plays a highly strategic role as the coordinator of disaster management implementation.

Although the regulatory framework is in place, the implementation of multi-stakeholder collaboration in disaster management, particularly flash floods in the Lake Toba area, still faces various challenges. Empirically, coordination among actors has not been fully integrated, disaster human resource capacity remains limited, and community involvement in mitigation efforts is not yet optimal. This condition indicates a gap between the collaborative policy design and its practical implementation in the field.

Several previous studies have examined collaboration in disaster management. Research by Kapucu (2006) shows that the success of disaster management is largely determined by the effectiveness of inter-organizational collaborative networks [3]. Furthermore, Waugh and Streib (2006) emphasize the importance of cross-sector partnerships in improving disaster preparedness [7]. In Indonesia, studies on the Pentahelix model in disaster management indicate that multi-stakeholder synergy can enhance mitigation effectiveness, although coordination and program integration challenges remain.

However, studies that specifically analyze Hexahelix collaboration in the context of flash flood disaster management in the Lake Toba area are still relatively limited. In fact, this area has high-risk characteristics and involves many strategic stakeholders. Therefore, this research is important to fill the research gap while providing empirical insight into how Hexahelix collaboration governance is implemented and what factors influence its effectiveness.

2. RESEARCH METHODS

This study employed a descriptive qualitative approach to analyze the governance of Hexahelix collaboration in flash flood disaster management in the Lake Toba area. This approach was chosen because it is capable of providing an in-depth understanding of the collaboration process, the roles of actors, and the constraints encountered in the field.

The research location was in North Sumatra Province, focusing on institutions and stakeholders directly involved in flash flood disaster management in the Lake Toba area. Research informants were selected using purposive sampling based on the relevance of their roles and involvement in Hexahelix collaboration. The informants consisted of the Head of the North Sumatra Provincial BPBD, the Head of the Cooperation, Control and Evaluation Division of the North Sumatra Provincial BPBD, Staff of the Community and Environmental Empowerment Department of PT Inalum Hydropower, the Chairperson of the Pandawa Kayak Organization of North Sumatra, the Director of the Center for Climate Change and Disaster Mitigation Studies of the Faculty of Forestry, University of North Sumatra, and a journalist from Tribun Medan.

Data collection techniques were carried out through in-depth interviews, field observations, and documentation. Interviews were used to explore information regarding the roles and coordination among actors, observations were used to examine factual conditions in the field, while documentation was used to complement relevant secondary data. Data analysis used the interactive model of Miles, Huberman, and Saldaña (2014), which includes the stages of data condensation, data display, and conclusion drawing/verification [4]. Data validity was tested through source and technique triangulation to ensure the validity and reliability of the research findings.

3. RESULT AND ANALYSIS

The Hexahelix collaboration in flash flood disaster management in the Lake Toba area indicates efforts to create synergy among the government, private sector, academia, community, media, and other supporting actors. This approach aligns with the governance paradigm that emphasizes multi-stakeholder involvement in addressing complex public issues, including hydrometeorological disasters.

Based on interviews and observations, the Regional Disaster Management Agency (BPBD) of North Sumatra Province plays the main coordinating role in disaster management implementation. This role includes planning, coordination, command during emergency response, and facilitation of cross-sector cooperation. Within the Hexahelix framework, BPBD has established communication with various actors, such as PT Inalum through corporate social responsibility support, academics through disaster risk studies, volunteer communities such as Pandawa Kayak in field operations, and mass media in disseminating disaster information.

From the government perspective, formal coordination mechanisms have been implemented through inter-agency forums, contingency planning, and integrated emergency response activities. However, in the pre-disaster phase, the integration of mitigation programs is still not fully optimal. Synchronization of risk data, area-based planning, and strengthening of preventive efforts still require more systematic consolidation so that the approach used is not merely reactive.

The involvement of the private sector, particularly PT Inalum Hydropower, is reflected through support for facilities and infrastructure, logistical assistance, and community empowerment programs in vulnerable areas. This contribution demonstrates the private sector's commitment to supporting disaster management efforts. However, the collaboration pattern that has been developed remains largely program-based and has not yet been fully institutionalized within a long-term partnership scheme integrated with regional disaster planning.

The role of academia is evident through the provision of scientific studies, risk mapping, and policy recommendations that support disaster risk reduction. Nevertheless, the utilization of these study results in operational decision-making has not been fully maximized. This indicates that the bridge between knowledge production and policy implementation still needs to be strengthened so that evidence-based policy can function more effectively.

From the community perspective, the involvement of volunteer groups such as Pandawa Kayak shows a significant contribution, especially during the emergency response and evacuation phases. This community participation reflects strong social capital in the Lake Toba area. However, overall community disaster capacity is still uneven, particularly in terms of mitigation training and community-based preparedness. Meanwhile, the role of mass media has helped increase public awareness through the dissemination of disaster information. Publications regarding potential risks and disaster events are relatively quickly conveyed to the public. Nevertheless, risk communication that is educational and continuous still needs strengthening, especially in the pre-disaster phase, so that the media does not only play a role during disasters but also in building a culture of risk awareness. Overall, the implementation of Hexahelix collaboration in the Lake Toba area has shown a fairly solid foundation. However, the collaboration remains stronger during the emergency response phase compared to the mitigation and preparedness stages. This indicates the need to strengthen coordination, cross-sector program integration, and institutionalization of cooperation so that collaboration can run more effectively and sustainably.

Research findings indicate that the implementation of Hexahelix collaboration still faces various constraints originating from both internal and external factors. Internally, the limited number of personnel with certified disaster management competencies remains a major obstacle. This condition affects the uneven technical capacity and the high workload of personnel both during emergencies and in preparedness phases.

In addition, cross-sector coordination has not yet been fully integrated into a unified disaster information system. Although coordination forums are available, data exchange, program synchronization, and planning alignment still show sectoral tendencies. As a result, the collaborative potential that should be mutually reinforcing has not been fully optimized.

From the planning aspect, disaster management still tends to be oriented toward response when disasters occur. Structural and non-structural mitigation efforts in the pre-disaster phase have not yet become a strong priority. This condition indicates the need for a shift toward a more preventive and disaster risk reduction-based approach. Externally, many communities continue to reside in flash flood-prone areas due to livelihood factors and limited relocation alternatives. This situation increases community vulnerability when disasters occur. In addition, the level of disaster literacy among communities is still uneven, resulting in fluctuating participation in mitigation and preparedness activities, which tends to increase only during disaster events.

Another influencing factor is the lack of sustained risk communication among the government, media, and the community. Disaster information is still often incidental and has not been fully integrated into a community-based early warning system. This condition impacts the incomplete development of a strong risk-aware culture at the community level. Thus, although Hexahelix collaboration in flash flood disaster management in the Lake Toba area has been implemented, strengthening institutional capacity, system integration, human resource quality, and community empowerment are key factors that need attention to improve the effectiveness of collaboration in the future.

4. CONCLUSION

Based on the research findings, it can be concluded that the Hexahelix collaboration in flash flood disaster management in the Lake Toba area has generally been implemented and demonstrates synergy among actors, particularly between the regional government, private sector, academia, community, and media. The Regional Disaster Management Agency of North Sumatra Province has carried out its coordinating role in accordance with governance principles, where disaster management is no longer centered solely on the government but involves multiple stakeholders. However, the implementation of Hexahelix collaboration has not yet been fully optimal. Collaborative strengthening remains more dominant during the emergency response phase compared to the pre-disaster stage, particularly in mitigation and preparedness aspects. Cross-sector program integration, utilization of academic studies in decision-making, and institutionalization of partnerships with the private sector still require strengthening to ensure more systematic and sustainable collaboration. Internal constraints mainly relate to the limited number and capacity of human resources with certified disaster management competencies, as well as the lack of full integration of the disaster information system. Meanwhile, external constraints include the high vulnerability of communities residing in flash flood-prone areas due to livelihood factors, as well as uneven levels of disaster literacy and community preparedness. Therefore, the future effectiveness of Hexahelix collaboration will largely depend on strengthening institutional capacity, improving the quality of disaster management human resources, integrating cross-sector systems and data, and sustainably empowering communities based on disaster risk reduction.

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