

THE ROLE OF THE PENTAHHELIX IN DISASTER MANAGEMENT IN GUNUNGKIDUL: A CASE STUDY OF THE 2025–2027 REGIONAL ACTION PLAN

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Abstract. Gunungkidul Regency is a region with high disaster vulnerability due to its karst geomorphological characteristics, climate variability, and the social dynamics of its communities. Disaster management in this area requires a structured and sustainable cross-sector collaborative approach. This article aims to analyze the roles of pentahelix actors—government, academia, business sector, community/society, and media—in disaster management in Gunungkidul Regency based on the Regional Action Plan for Disaster Risk Reduction (RAD PRB) 2025–2027 document. The method used is policy document analysis with a qualitative-descriptive approach. The results indicate that the local government still plays a dominant role as the primary actor; however, the involvement of academia, communities, and media has begun to be integrated into various capacity-building, mitigation, and preparedness programs. The role of the business sector remains relatively limited and largely supportive. These findings emphasize that strengthening pentahelix synergy is key to effective disaster management in Gunungkidul, particularly in the context of karst-based and hydrometeorological disasters.

Keywords: Disaster Management; Gunungkidul; Multi-Actor Collaboration; Pentahelix; RAD PRB

1. INTRODUCTION

Disaster management in the contemporary context can no longer be understood as the exclusive domain of the state or local governments. The global disaster management paradigm has shifted from a reactive–responsive approach toward one that emphasizes disaster risk reduction (DRR), collaborative governance, and the strengthening of multi-actor capacities (UNDRR, 2015). The complexity of disaster risk has increased due to the interaction of climate change, environmental degradation, unplanned urbanization, and socio-economic inequalities that exacerbate community vulnerability (IPCC, 2022). Risk is no longer viewed merely as natural hazards, but rather as a social construct shaped by the relationship between hazard, vulnerability, and capacity (Wisner et al., 2015).

Within the framework of modern risk governance, the government retains regulatory and coordinating functions; however, the effectiveness of disaster risk reduction heavily depends on the active participation of non-state actors. The concept of collaborative governance highlights the importance of horizontal interactions among stakeholders in formulating adaptive and evidence-based public policies (Ansell & Gash, 2008; Emerson et al., 2012). In the disaster context, collaborative approaches have been shown to enhance policy legitimacy, implementation effectiveness, and the sustainability of risk reduction programs (Agranoff & McGuire, 2020).

One of the emerging models in collaborative governance is the pentahelix approach. This model expands the triple helix concept (academia–government–industry) into five key actors: government, academia, business sector, community/society, and media. In disaster management policy, the pentahelix approach positions cross-sector collaboration as a fundamental prerequisite for systemic and sustainable risk reduction (Carayannis et al., 2018).

The government acts as regulator and policy coordinator; academia contributes through risk research, vulnerability mapping, and evidence-based intervention models; the business sector provides resource support, technological innovation, and strengthens local economic resilience; communities serve as key actors in preparedness, local knowledge, and early response; while the media plays a role in disseminating risk information, public education, and shaping collective perceptions of threats (OECD, 2020).

Normatively, this approach aligns with the global framework of the Sendai Framework for Disaster Risk Reduction 2015–2030, which emphasizes a whole-of-society approach across all phases of disaster management—from mitigation and preparedness to response and recovery (UNDRR, 2015). Its implementation requires the integration of scientific knowledge and local wisdom, strengthened cross-sector coordination mechanisms, and clearly defined and measurable role distribution.

Gunungkidul Regency provides a relevant empirical context for examining the effectiveness of the pentahelix approach. Geomorphologically, the region is part of the Gunungsewu karst area, characterized by complex underground hydrology, limited water storage capacity, and vulnerability to structural droughts, karst flooding, and sinkholes. The interaction between geomorphological factors, rainfall variability due to climate change, and the socio-economic conditions of rural communities reinforces the multidimensional nature of risk (IPCC, 2022; UNDRR, 2023). The intensification of hydrometeorological disasters over the past decade further underscores the need to shift disaster management systems in this region from reactive approaches toward preventive, risk-based strategies.

In this context, the formulation of the Regional Action Plan for Disaster Risk Reduction (RAD PRB) of Gunungkidul Regency for 2025–2027 serves as a strategic policy instrument. RAD PRB functions not only as a technocratic document but also as an institutional arena that articulates the roles, commitments, and coordination mechanisms among pentahelix actors. This document is expected to integrate data-driven risk analysis with community-based preparedness practices, while also encouraging the involvement of the business sector and media in fostering a culture of disaster risk awareness.

However, in practice, cross-sector collaboration at the local policy level often remains at a normative-administrative stage without transforming into substantive and sustainable partnerships (Agranoff & McGuire, 2020). Therefore, examining the extent to which pentahelix roles have been formulated and operationalized within the RAD PRB 2025–2027 is both academically and practically significant. Such analysis enables an evaluation of the depth of cross-sector integration, the clarity of role distribution, and the consistency between policy design and implementation.

Findings from this type of study are expected to contribute to strengthening disaster risk reduction governance in Gunungkidul, while also serving as a comparative lesson for other regions with similar risk characteristics—particularly karst and rural areas facing the pressures of climate change and complex socio-economic vulnerabilities.

2. RESEARCH METHODS

This study employs a qualitative approach with a descriptive-analytical design to examine the configuration of roles and patterns of collaboration among actors within disaster risk reduction policy documents. This approach is selected because the objective of the study is not to test quantitative hypotheses, but rather to gain an in-depth understanding of institutional structures, the distribution of responsibilities, and the construction of relationships embedded in formal planning documents.

The method used is document analysis, which enables the researcher to systematically and contextually examine policy content. The primary data source is the Recapitulation Matrix of the Regional Action Plan for Disaster Risk Reduction (RAD PRB) of Gunungkidul Regency for 2025–2027, particularly focusing on components such as targets, programs, activities, responsible

agencies, and supporting institutions/groups. This matrix is selected because it represents the operational structure of policy implementation more concretely than the general narrative of the document.

The author is part of the drafting team for the RAD PRB of Gunungkidul Regency 2025–2027. This position provides direct access to the dynamics of policy formulation and the rationale underlying program design. However, in the research process, a clear distinction is maintained between the role as a document drafter and as a researcher through a reflective approach to ensure the integrity and objectivity of the analysis.

The analytical process is conducted through several stages. First, identifying and inventorying all actors listed in the action matrix. Second, categorizing these actors into the five elements of the pentahelix—government, academia, business sector, community/society, and media—based on their institutional functions and structural mandates. Third, mapping the roles and levels of involvement of each actor, whether as the main responsible party or as a supporting entity.

The subsequent stage involves analyzing the patterns of relationships among actors within each activity and strategic objective. This analysis aims to assess the nature of collaboration formed, whether it remains hierarchical-coordinative or has evolved into substantive, participatory, and sustainable partnerships. The findings of this analysis serve as the basis for evaluating the level of operationalization of the pentahelix model within the RAD PRB 2025–2027.

3. RESULTS AND DISCUSSION

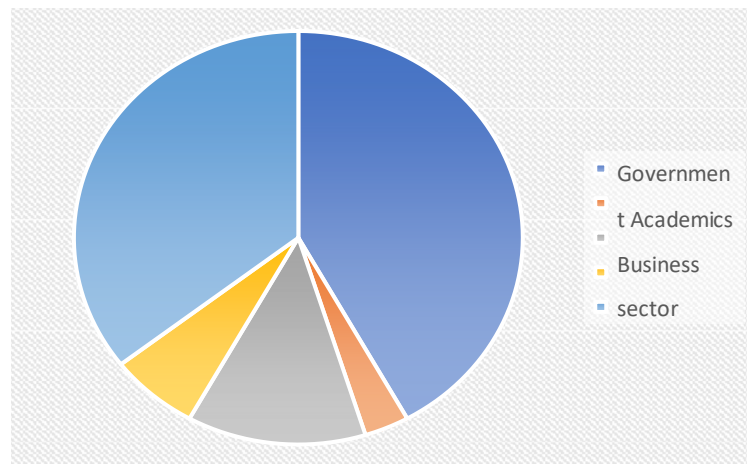


Figure 1. The Role of the Pentahelix in the Regional Action Plan for Disaster Risk Reduction (RAD PRB) of Gunungkidul Regency 2025–2027

The graph in Figure 1 not only represents the quantitative distribution of pentahelix actor involvement in the RAD PRB of Gunungkidul Regency for 2025–2027, but also reflects deeper dimensions of power structure, relational patterns, and the overall orientation of disaster risk reduction (DRR) governance at the local level. Government institutions account for the largest proportion at 42%, reaffirming the dominant role of the state as the primary actor in planning and implementing DRR programs. This position is consistent with the formal functions of government as regulator, coordinator, and principal authority responsible for public policy at the regional level.

From a governance perspective, this dominance illustrates the persistence of a state-centric model in disaster management. The government retains control over key stages of the policy cycle, including risk identification, priority setting, program formulation, and resource allocation.

Such a configuration is institutionally justified, given that the state possesses legal mandates, bureaucratic capacity, and political legitimacy in managing disaster risks (UNDRR, 2015; BNPB, 2020). As the primary duty bearer, the government is obligated to ensure public safety and manage collective risk (UNDRR, 2023). However, this concentration of authority also suggests limited decentralization of roles and an underdeveloped distribution of responsibilities to non-state actors.

In contrast, volunteer communities occupy the second-largest share at 36%, indicating a relatively strong presence of civil society in supporting DRR efforts. This substantial proportion reflects a significant base of social participation, particularly in preparedness activities, emergency response, and recovery support. The prominence of community involvement suggests that DRR governance in Gunungkidul is not entirely top-down, but incorporates grassroots actors to a considerable extent. From the perspective of social capital theory (Putnam, 1993), this reflects the existence of trust, social networks, and shared norms that facilitate collective action during crises.

Nevertheless, it is important to distinguish between the extent and the depth of participation. While communities are actively involved, their roles are often concentrated at the operational level rather than in strategic decision-making processes. This indicates a pattern of instrumental participation, where communities contribute to implementation but have limited influence over policy design and agenda-setting. As a result, although collaborative elements are present, power relations among actors remain asymmetrical and have not yet evolved into fully egalitarian partnerships.

The business sector accounts for 13% of involvement, suggesting a moderate but still limited contribution from private actors. In most cases, this involvement takes the form of corporate social responsibility (CSR), which tends to be philanthropic, short-term, and reactive. However, contemporary risk governance frameworks emphasize the strategic role of the private sector in fostering innovation, investing in resilient infrastructure, and strengthening adaptive local economies. In regions like Gunungkidul, where risks such as karst-related drought and environmental degradation are chronic, the business sector has the potential to contribute to risk-informed development—integrating risk considerations into economic planning and investment decisions. The relatively limited role of the private sector in the RAD PRB indicates a disconnect between economic development agendas and DRR strategies.

Meanwhile, the media's contribution, at 6%, reflects its involvement in information dissemination, public education, and risk awareness-building. Despite this, the relatively small proportion suggests that the strategic function of risk communication has not been fully optimized. In the literature, media is recognized as a key actor in shaping public perception, influencing behavioral responses, and sustaining attention toward risk issues. The current pattern of media engagement in the RAD PRB appears to be predominantly top-down, focusing on the transmission of information rather than facilitating interactive and participatory communication processes. In the context of recurrent and slow-onset disasters, such as those experienced in Gunungkidul, sustained public awareness depends heavily on consistent and context-sensitive risk communication.

Academics represent the smallest proportion, at only 3%, highlighting a critical gap in the integration of scientific knowledge into policy processes. While academic institutions contribute through data provision, risk assessment, and technical recommendations, their involvement remains sporadic and insufficiently institutionalized. This limitation constrains the development of evidence-based DRR, which requires continuous integration of research into policy cycles (Aitsi-Selmi et al., 2016; IPCC, 2022). The quintuple helix innovation model positions academia as a central actor in knowledge production for sustainability and environmental adaptation (Carayannis et al., 2018). Without structured mechanisms linking research institutions and policy actors, the potential for local innovation and applied research remains underutilized.

Overall, the distribution of actors illustrated in the graph reveals that the collaborative

structure within the RAD PRB is still imbalanced. While there is a clear foundation for multi-actor engagement, the configuration remains dominated by government institutions and volunteer communities. Other actors—particularly academics, the business sector, and media—are not yet proportionally integrated. This indicates that the pentahelix model has been adopted at a normative level but has not been fully operationalized in practice.

The persistence of government dominance suggests that the transition toward collaborative governance is still in progress. According to OECD (2020), a whole-of-society approach requires not merely the presence of multiple actors, but their substantive involvement in decision-making and implementation. In increasingly complex risk environments shaped by climate change, urbanization, and socio-economic inequality, hierarchical and command-based approaches are less effective in addressing systemic and interconnected risks (IPCC, 2022; UNDRR, 2023). Consequently, the success of DRR depends not only on state capacity but also on the quality and intensity of cross-sector interactions.

The role of academia in the RAD PRB, while important, remains largely confined to technical support functions. Universities and research institutions are not yet fully embedded in strategic policy processes. This limits opportunities for policy learning, innovation, and adaptive governance. Strengthening the knowledge-policy interface is therefore essential to ensure that scientific insights—particularly those related to karst ecosystems, disaster psychology, and community resilience—are systematically incorporated into policy design.

Similarly, the private sector's role needs to shift from a supportive to a strategic orientation. Rather than being limited to CSR-based contributions, businesses should be integrated into long-term resilience-building efforts, including sustainable investment, innovation ecosystems, and resilient supply chain development. This is particularly important in addressing chronic risks that require structural solutions rather than short-term interventions.

Communities, although highly involved, need to be repositioned from beneficiaries to co-producers of policy. The concept of community resilience emphasizes the importance of local knowledge, social capital, and shared ownership in building long-term adaptive capacity (UNDRR, 2017; Twigg, 2015). In Gunungkidul, local practices related to water management, environmental stewardship, and social solidarity represent valuable assets that should be systematically integrated into DRR strategies. Without recognizing and institutionalizing these capacities, interventions risk being externally driven and insufficiently contextualized.

The role of media also requires expansion beyond information dissemination. As an actor in risk communication, media has the capacity to shape narratives, influence public discourse, and hold institutions accountable. Strengthening media engagement can enhance disaster literacy, sustain public attention, and support behavioral change toward risk reduction.

The observed imbalance among pentahelix actors indicates that DRR governance in Gunungkidul is still in a transitional phase, moving from a hierarchical model toward a more collaborative framework. Achieving this transformation requires structural changes, including the establishment of permanent multi-stakeholder platforms, operational coordination mechanisms, and clearer distribution of roles and responsibilities (Ansell & Torfing, 2016; Emerson & Nabatchi, 2015). Without such institutional strengthening, collaboration risks remaining at a symbolic or administrative level.

The urgency of strengthening the pentahelix approach is further amplified by the nature of risks in Gunungkidul, which are chronic, structural, and recurrent. Reports from IPCC (2022) and UNDRR (2023) emphasize that future risks will become increasingly complex and interconnected, often manifesting as compound risks. In this context, sectoral and short-term approaches are insufficient. DRR must be understood as a long-term process of socio-ecological transformation requiring coordinated action across multiple actors and sectors.

Therefore, the RAD PRB of Gunungkidul Regency 2025–2027 should be positioned not merely as a technocratic planning document, but as a governance platform that facilitates collective learning, negotiation, and collaboration among pentahelix actors. Strengthening this platform

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involves improving not only the quantity but also the quality of participation—ensuring that all actors are meaningfully engaged across the policy cycle.

Ultimately, the effectiveness of disaster risk reduction in Gunungkidul depends on the ability to orchestrate substantive multi-actor collaboration. In the face of increasingly complex and interconnected risks, building adaptive, inclusive, and context-sensitive collaborative governance is not optional, but a fundamental prerequisite for achieving sustainable regional resilience.

CONCLUSION

The pentahelix approach in disaster management in Gunungkidul Regency has been formally incorporated into the RAD PRB 2025–2027; however, its implementation remains predominantly government-driven. While community groups and the media have begun to be integrated into various programs—particularly in preparedness, response, and risk communication—the roles of academics and the business sector remain relatively limited and not yet fully institutionalized within the policy framework. This condition suggests that the current collaboration model is still in a transitional phase, where multi-actor engagement exists but has not yet evolved into a fully balanced and substantive partnership. Strengthening the roles of academics is essential to enhance evidence-based policymaking and innovation, while greater involvement of the business sector is needed to support sustainable financing, technological development, and risk-informed economic resilience. Looking ahead, the effectiveness of disaster management in Gunungkidul will depend on the region's capacity to foster a more equitable, adaptive, and context-sensitive pentahelix synergy. This includes improving cross-sector coordination mechanisms, ensuring clearer role distribution, and promoting meaningful participation across all actors throughout the policy cycle—from planning to implementation and evaluation.

RECOMMENDATION

Several recommendations derived from the analysis of the RAD PRB 2025–2027 are as follows:

1. Strengthening formal collaboration mechanisms among pentahelix actors in disaster risk reduction (DRR).
2. Promoting strategic and sustainable engagement of the business sector.
3. Optimizing the role of academics in karst- and community-based disaster research.
4. Developing risk communication strategies based on local media.
5. Positioning communities as primary actors in area-based disaster risk reduction.

REFERENCES

- Agranoff, R., & McGuire, M. (2020). *Collaborative public management: New strategies for local governments*. Georgetown University Press.
- Aitsi-Selmi, A., Blanchard, K., Al-Khudhairy, D., Ammann, W., Basabe, P., Johnston, D., & Murray, V. (2016). UNISDR STAG 2015 report: Science is used for disaster risk reduction. *International Journal of Disaster Risk Science*, 7(2), 213–225.
- Ansell, C., & Torfing, J. (2016). *Handbook on theories of governance*. Edward Elgar.
- BNPB. (2020). *Rencana Nasional Penanggulangan Bencana 2020–2024*. Badan Nasional Penanggulangan Bencana.
- Carayannis, E. G., Grigoroudis, E., Campbell, D. F. J., Meissner, D., & Stamati, D. (2018). The ecosystem as helix: An exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *R&D Management*, 48(1), 148–162.
- Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory*, 22(1), 1–29.
- IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Cambridge University Press.
- OECD. (2020). *Building resilience to disasters: A whole-of-society approach*. OECD Publishing.

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Bandung, Indonesia, July 25, 2026

- Putnam, R. D. (1993). *Making democracy work: Civic traditions in modern Italy*. Princeton University Press
- UNDRR. (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030*. United Nations Office for Disaster Risk Reduction.
- UNDRR. (2023). *Global Assessment Report on Disaster Risk Reduction 2023*. United Nations Office for Disaster Risk Reduction.
- Wisner, B., Gaillard, J. C., & Kelman, I. (2015). *The Routledge handbook of hazards and disaster risk reduction*. Routledge.
- Twigg, J. (2015). *Disaster risk reduction*. Overseas Development Institute.
- UNDP. (2021). *Risk-informed development guide*. United Nations Development Programme.
- UNDRR. (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030*. United Nations Office for Disaster Risk Reduction.
- UNDRR. (2017). *Words into action guidelines: National disaster risk assessment*. United Nations Office for Disaster Risk Reduction.
- UNDRR. (2019). *Private sector and disaster risk reduction*. United Nations Office for Disaster Risk Reduction.
- UNDRR. (2023). *Global Assessment Report on Disaster Risk Reduction 2023*. United Nations Office for Disaster Risk Reduction.