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The Role of Local Government in Non-Structural Mitigation of Hydrometeorological Disasters for Tourism Infrastructure Resilience in Batam City

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Abstract

Hydrometeorological disasters are the most dominant type of disasters in Indonesia and have been increasing due to climate change. Batam City, as an archipelagic region highly dependent on the tourism sector, faces significant risks to infrastructure disruption caused by such disasters. This study aims to analyze the role of local government in non-structural mitigation and its implications for the resilience of tourism infrastructure.

This research employs a qualitative approach using descriptive-analytical methods based on literature review and policy analysis. The findings indicate that local governments play a strategic role in regulatory formulation, institutional capacity building, public education, and cross-sectoral coordination. However, the implementation of non-structural mitigation still faces several challenges, including limited resources, weak inter-agency coordination, and low public participation.

This study recommends strengthening disaster risk governance through collaborative approaches and integrating mitigation policies into tourism development planning to enhance sustainable infrastructure resilience.

Keywords: Non-structural mitigation, disaster risk governance, hydrometeorology, tourism, resilience.

INTRODUCTION

Hydrometeorological disasters such as floods, extreme rainfall, and strong winds have

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become major threats in the current global disaster landscape. These phenomena are not only driven by natural factors but are also exacerbated by climate change, rapid urbanization, and environmental degradation (IPCC, 2021). In the global context, the disaster risk reduction (DRR) framework emphasizes that disaster risk must be systematically reduced through preventive and governance-based approaches (UNDRR, 2015).

One of the key international frameworks serving as a global reference is the *Sendai Framework for Disaster Risk Reduction 2015–2030*, which highlights four main priorities: understanding disaster risk, strengthening disaster risk governance, investing in disaster risk reduction, and enhancing disaster preparedness for effective response and recovery (UNDRR, 2015). Within this framework, non-structural mitigation plays a crucial role as it focuses on policy, behavioral, and institutional aspects rather than solely on physical infrastructure (Tierney, 2014).

Batam City, as one of Indonesia's economic and tourism growth centers, is highly vulnerable to hydrometeorological disasters. Tourism infrastructure, which serves as the backbone of the local economy, is particularly exposed to disaster-related disruptions that can directly affect economic sustainability. Previous studies indicate that disaster impacts on tourism infrastructure can significantly reduce destination competitiveness and economic resilience (Becken, 2013). In contrast to structural mitigation, which focuses on physical development, non-structural mitigation emphasizes behavioral change, policy development, and the enhancement of institutional and community capacity. This type of mitigation is considered more sustainable and adaptive, as it enables risk reduction from the planning stage (Shaw, 2012). Furthermore, non-structural mitigation is often associated with social engineering processes that aim to influence human behavior and risk perception toward environmental hazards (Wisner et al., 2012).

However, the implementation of non-structural mitigation is not without challenges, particularly in terms of institutional coordination and community participation. Weak governance structures, limited resources, and fragmented policy implementation often hinder the effectiveness of disaster risk reduction efforts at the local level (Ahrens & Rudolph, 2006). Therefore, an in-depth analysis is needed to examine the role of local governments in optimizing non-structural mitigation to enhance the resilience of tourism infrastructure in Batam City.

RESEARCH METHOD

This study employs a qualitative approach using a descriptive-analytical method to examine the role of local government in non-structural mitigation of hydrometeorological

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disasters and its implications for tourism infrastructure resilience in Batam City. A qualitative approach is considered appropriate as it allows for an in-depth understanding of governance dynamics, institutional roles, and policy implementation in disaster risk reduction (Creswell, 2014).

The data used in this study are secondary data obtained from various sources, including scientific journal articles, books, official government documents, and international reports related to disaster risk reduction and tourism resilience. These sources provide comprehensive insights into both theoretical and empirical aspects of non-structural mitigation.

Data analysis was conducted through three stages: data reduction, data display, and conclusion drawing, following the framework proposed by Miles, Huberman, and Saldaña (2014). This analytical process enables the researcher to systematically interpret the data and identify key patterns related to local government roles and mitigation strategies.

This study also adopts a governance perspective, particularly the concept of *disaster risk governance*, which emphasizes the importance of institutional arrangements, coordination mechanisms, and stakeholder involvement in disaster risk management (UNDRR, 2015).

RESULTS AND DISCUSSION

Non-Structural Mitigation in the Context of Disaster Risk Governance

Non-structural mitigation is a fundamental component of disaster risk reduction that focuses on policies, regulations, awareness, and institutional capacity rather than physical infrastructure. Within the framework of disaster risk governance, non-structural approaches are essential for building long-term resilience and reducing vulnerability (Tierney, 2014).

According to UNDRR (2015), effective disaster risk governance requires strong institutional coordination, inclusive policies, and active stakeholder participation. Non-structural mitigation measures such as land-use planning, early warning systems, and public education play a crucial role in minimizing disaster impacts, particularly in vulnerable sectors such as tourism.

Furthermore, Wisner et al. (2012) emphasize that disaster risk is socially constructed, meaning that vulnerability is shaped by social, economic, and political factors. Therefore, non-structural mitigation must address these underlying conditions through policy and behavioral interventions.

THE ROLE OF LOCAL GOVERNMENT IN NON-STRUCTURAL MITIGATION

Local governments play a central role in implementing non-structural mitigation strategies, particularly in the context of decentralized governance systems. Their roles can be

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categorized into several key functions:

a) **Policy and Regulatory Framework**

Local governments are responsible for formulating and implementing disaster risk reduction policies, including integrating risk considerations into spatial planning and tourism development policies. Effective policy frameworks can significantly reduce vulnerability and enhance resilience (Ahrens & Rudolph, 2006).

b) **Institutional Capacity Building**

Strengthening institutional capacity is essential to ensure effective disaster management. This includes improving human resources, organizational structures, and inter-agency coordination mechanisms (Coppola, 2015).

c) **Public Awareness and Education**

Raising public awareness is a critical aspect of non-structural mitigation. Educational programs and community engagement initiatives can improve disaster preparedness and reduce risk at the local level (Shaw, 2012).

d) **Multi-Stakeholder Coordination**

Disaster risk reduction requires collaboration among various stakeholders, including government agencies, the private sector, and local communities. This aligns with the concept of collaborative governance, which emphasizes collective decision-making and shared responsibility (Ansell & Gash, 2008).

CHALLENGES IN IMPLEMENTATION

Despite the strategic role of local governments, the implementation of non-structural mitigation often faces several challenges.

First, limited financial and human resources constrain the ability of local governments to effectively implement disaster risk reduction programs. This is particularly evident in developing regions where competing development priorities exist (Ahrens & Rudolph, 2006).

Second, weak inter-agency coordination often leads to fragmented policy implementation. Lack of clear roles and responsibilities among institutions can hinder effective disaster management.

Third, low levels of community participation remain a significant barrier. Although awareness of disaster risks may exist, active involvement in mitigation programs is often limited (Shaw, 2012).

TOURISM INFRASTRUCTURE RESILIENCE

Tourism infrastructure resilience refers to the ability of tourism systems to withstand, adapt to, and recover from disaster impacts. This resilience is not solely determined by physical

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infrastructure but also by governance systems, institutional capacity, and community preparedness (Becken, 2013).

In the context of Batam City, strengthening resilience requires integrating disaster risk considerations into tourism planning and development. This includes risk-sensitive land-use planning, disaster preparedness training for tourism stakeholders, and the development of early warning systems.

Moreover, a collaborative governance approach is essential to enhance resilience. By involving multiple stakeholders, local governments can ensure more comprehensive and effective mitigation strategies that address both structural and non-structural dimensions of disaster risk.

CONCLUSION AND POLICY RECOMMENDATIONS

Conclusion

This study highlights the critical role of local governments in implementing non-structural mitigation strategies to address hydrometeorological disaster risks and enhance the resilience of tourism infrastructure in Batam City. Within the framework of disaster risk governance, non-structural mitigation emerges as a strategic approach that emphasizes policy development, institutional strengthening, and community engagement.

The findings indicate that local governments play a central role in formulating regulatory frameworks, integrating disaster risk considerations into development planning, strengthening institutional capacity, and promoting public awareness. These functions are essential in reducing vulnerability and ensuring the sustainability of tourism infrastructure, which serves as a key driver of the local economy. However, the implementation of non-structural mitigation remains constrained by several challenges, including limited financial and human resources, weak inter-agency coordination, and low levels of community participation. These limitations hinder the effectiveness of disaster risk reduction efforts and highlight the need for more integrated and collaborative approaches.

Furthermore, this study confirms that tourism infrastructure resilience is not solely dependent on physical robustness but also on the strength of governance systems, institutional arrangements, and social preparedness. Therefore, strengthening non-structural mitigation is essential to building long-term resilience in disaster-prone regions such as Batam City.

Policy Recommendations

Based on the findings, several policy recommendations are proposed to enhance the

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effectiveness of non-structural mitigation and strengthen tourism infrastructure resilience:

1. **Strengthening Disaster Risk Governance**
   Local governments should enhance governance structures by clearly defining institutional roles, improving coordination mechanisms, and ensuring policy coherence across sectors. Strengthening governance capacity is essential for effective disaster risk management (UNDRR, 2015).
2. **Integrating Disaster Risk into Tourism Planning**
   Disaster risk considerations must be systematically integrated into tourism development policies, including spatial planning, infrastructure development, and investment strategies. Risk-sensitive planning can significantly reduce vulnerability and improve long-term sustainability (Becken, 2013).
3. **Enhancing Institutional Capacity**
   Capacity-building programs should be prioritized to improve the competencies of local government officials and disaster management agencies. This includes training, resource allocation, and the development of technical expertise in disaster risk reduction (Coppola, 2015).
4. **Promoting Community Participation**
   Active community involvement is crucial for the success of non-structural mitigation. Governments should encourage participatory approaches through public education, awareness campaigns, and community-based disaster risk reduction programs (Shaw, 2012).
5. **Strengthening Collaborative Governance**
   Collaboration among stakeholders—including government, private sector, and local communities—should be enhanced to ensure comprehensive and inclusive mitigation strategies. Collaborative governance can improve decision-making processes and resource mobilization (Ansell & Gash, 2008).

THEORETICAL FRAMEWORK (STRENGTHENING ACADEMIC CONTRIBUTION)

To enhance the analytical depth of this study, the discussion is grounded in two major theoretical perspectives: **Disaster Risk Governance** and **Collaborative Governance**.

Disaster Risk Governance

Disaster risk governance refers to the system of institutions, mechanisms, and

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relationships that guide disaster risk reduction efforts. According to UNDRR (2015), effective governance requires clear institutional arrangements, policy coherence, stakeholder participation, and accountability mechanisms.

This framework emphasizes that disaster risk is not merely a technical issue but also a governance challenge that involves decision-making processes, coordination among actors, and the integration of risk considerations into development planning. In this study, disaster risk governance is used to analyze how local governments in Batam City manage non-structural mitigation policies and coordinate stakeholders.

Collaborative Governance

Collaborative governance, as defined by Ansell and Gash (2008), refers to a governing arrangement where public agencies directly engage non-state stakeholders in a collective decision-making process. This approach is particularly relevant in disaster management, where multiple actors including government institutions, private sector entities, and local communities must work together.

The collaborative governance model highlights several key elements, including:

- Face-to-face dialogue
- Trust building
- Shared understanding
- Commitment to the process

In the context of this study, collaborative governance is essential for strengthening non-structural mitigation, particularly in the tourism sector, where private stakeholders play a significant role.

Practical Implications

This study provides several practical implications for policymakers and practitioners:

1. **Policy Integration**
   Local governments need to integrate disaster risk reduction into all sectors, particularly tourism, to ensure policy alignment and effectiveness.
2. **Institutional Reform**
   Strengthening institutional capacity and clarifying roles among agencies can improve coordination and reduce policy fragmentation.
3. **Community-Based Approach**
   Encouraging community participation can enhance local resilience and improve the

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sustainability of mitigation efforts.

4. **Private Sector Engagement**
   Involving tourism businesses in disaster risk reduction initiatives can strengthen overall system resilience.

Limitations and Future Research

This study has several limitations. First, it relies on secondary data, which may limit the depth of empirical analysis. Second, the study focuses on a single case (Batam City), which may affect the generalizability of the findings.

Future research is recommended to:

- Conduct field-based empirical studies (interviews, surveys)
- Compare multiple regions to identify best practices
- Explore the role of technology (e.g., early warning systems, digital governance) in disaster mitigation

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