Adaptive Governance in Mining Environmental Governance in POHUWATO District

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ABSTRACT:

Illegal gold mining has become a persistent environmental governance challenge in Pohuwato Regency, Indonesia, causing environmental degradation and increasing public health risks, particularly malaria associated with abandoned mining pits. Conventional regulatory approaches have been insufficient to address these interconnected socio-ecological problems. This study examines actor and institutional relationships, explores adaptive governance mechanisms, and identifies the factors shaping institutional adaptive capacity in mining environmental governance. An interpretive qualitative case study was employed using in-depth interviews with twelve key informants, field observations, and document analysis. Data were analyzed thematically using the four dimensions of adaptive governance proposed by Folke et al., namely cross-actor collaboration, policy learning, polycentric governance, and institutional adaptive capacity. The findings reveal an adaptive governance paradox, where strong community-based collaboration, social learning, and local knowledge support environmental resilience, while formal governance remains constrained by centralized authority, fragmented institutional coordination, regulatory overlap, and unequal resource distribution. Consequently, local adaptive capacities fail to influence formal policy learning, allowing environmental degradation and related health crises to persist. The study contributes to adaptive governance theory by explaining the disconnect between informal adaptive systems and formal governance institutions and provides policy recommendations for strengthening collaboration, decentralization, and adaptive environmental governance.

Keywords: Adaptive governance; environmental governance; illegal gold mining

Introduction.

Mining activities have long played an important role in supporting economic growth and regional development by providing strategic mineral resources and employment opportunities. However, the rapid expansion of mining, particularly illegal and unregulated mining, has increasingly generated complex environmental and governance challenges that extend beyond ecological degradation. Across many developing countries, illegal mining contributes to deforestation, water pollution, biodiversity loss, land degradation, and deteriorating public health, creating interconnected socio ecological problems that cannot be effectively addressed through conventional regulatory approaches alone. These challenges have intensified

international interest in environmental governance models capable of responding to uncertainty, institutional fragmentation, and rapidly changing social ecological conditions. Recent reviews indicate that adaptive governance has emerged as one of the most influential approaches for understanding environmental governance under conditions of complexity and uncertainty because it emphasizes learning, institutional flexibility, and collaboration among multiple stakeholders.

Illegal gold mining represents one of the most persistent environmental governance problems in many resource rich regions. While mining generates substantial economic benefits for local communities, weak institutional coordination, overlapping authorities, and ineffective enforcement frequently allow environmentally destructive practices to persist. Unlike legal mining operations, illegal mining commonly operates outside environmental management standards, resulting in cumulative environmental impacts that affect both ecosystems and human wellbeing. Previous studies have demonstrated that environmental degradation caused by uncontrolled mining is rarely the consequence of technical failures alone. Instead, it reflects governance failures involving fragmented institutions, conflicting interests, limited policy learning, and inadequate collaboration among government agencies, local communities, and other stakeholders. Consequently, environmental degradation should be understood not merely as an ecological problem but as a governance challenge embedded within complex social ecological systems.

Indonesia illustrates this challenge vividly. Although the country possesses comprehensive mining regulations and environmental management policies, illegal gold mining continues to expand across several provinces, including Gorontalo Province. Pohuwato Regency has become one of the most prominent examples where illegal gold mining activities have intensified during the past decade. The widespread operation of unauthorized mining has contributed to river pollution, forest degradation, landscape alteration, and declining environmental quality. More importantly, environmental degradation has also produced broader social consequences, including increased vulnerability to malaria outbreaks associated with abandoned mining pits that provide breeding habitats for disease vectors. These interconnected environmental and public health consequences demonstrate that illegal mining is no longer simply a legal or economic issue but represents a multidimensional governance problem requiring integrated institutional responses. The empirical situation in Pohuwato therefore provides an important context for examining how environmental governance functions under conditions of institutional complexity.

Conventional environmental governance has generally relied on hierarchical regulation, command and control mechanisms, and sectoral policy implementation. Although these approaches remain essential for establishing legal certainty, they often prove insufficient for addressing environmental problems characterized by uncertainty, multiple stakeholders, and rapidly changing socio ecological interactions. Environmental governance increasingly requires institutions capable of learning from experience, adapting policies to evolving conditions, coordinating actors across administrative boundaries, and incorporating local knowledge into decision making processes. Recent literature emphasizes that governance systems characterized by flexibility, collaboration, and continuous learning are more capable of responding to environmental disturbances than rigid bureaucratic structures that depend exclusively on formal regulations.

Adaptive governance has therefore become an increasingly influential analytical perspective for understanding environmental governance in complex socio ecological systems. Rather than viewing governance as a fixed institutional arrangement, adaptive governance conceptualizes governance as a dynamic process through which actors continuously interact, learn, negotiate, and reorganize institutional arrangements in response to changing environmental conditions. The framework

emphasizes four interrelated dimensions, namely cross actor collaboration, policy learning and adaptation, polycentric governance, and institutional adaptive capacity. Together, these dimensions explain how governance systems develop resilience while responding to uncertainty, complexity, and environmental change. Recent systematic reviews further demonstrate that adaptive governance research has expanded considerably during the last two decades, particularly within environmental governance, climate adaptation, and natural resource management. Nevertheless, empirical applications remain concentrated in water governance, climate adaptation, and forest management, while mining governance continues to receive comparatively limited scholarly attention. Existing studies on mining governance have predominantly focused on environmental impacts, regulatory compliance, sustainable mining practices, and corporate social responsibility. Although these studies provide valuable insights into mining management, they generally treat governance as a relatively static institutional arrangement rather than as an adaptive process shaped by continuous interactions among actors and institutions. Likewise, previous adaptive governance studies have largely emphasized climate adaptation, watershed management, biodiversity conservation, and community based natural resource management. Comparatively little attention has been devoted to understanding how adaptive governance operates within illegal mining contexts characterized by institutional fragmentation, overlapping authority, informal actor networks, and persistent governance failures. Furthermore, few studies have explicitly examined how environmental degradation resulting from illegal mining simultaneously generates public health risks, thereby linking environmental governance with broader social ecological resilience. This study addresses these gaps by positioning adaptive governance not as a normative governance model but as an analytical lens for understanding the governance dynamics surrounding illegal gold mining in Pohuwato Regency. Unlike previous studies that primarily evaluate governance effectiveness or environmental outcomes, this research investigates how actor relationships, policy learning processes, institutional arrangements, and adaptive capacities collectively shape environmental governance within a highly centralized regulatory environment. The study introduces the concept of an **adaptive governance paradox**, referring to the coexistence of strong informal adaptive capacities at the community level alongside highly rigid and centralized formal governance structures. This paradox provides a novel explanation for why environmental degradation and associated public health crises continue despite the existence of comprehensive regulatory frameworks.

Accordingly, this study aims to analyze actor and institutional relationships within mining environmental governance, examine adaptive governance mechanisms operating in practice, and identify factors shaping institutional adaptive capacity in Pohuwato Regency. By integrating adaptive governance theory with environmental governance and public administration perspectives, this research contributes theoretically to expanding adaptive governance scholarship within illegal mining governance and socio ecological systems. Practically, the findings are expected to provide insights for designing more adaptive, collaborative, and context sensitive environmental governance capable of addressing the complex interactions among environmental degradation, institutional dynamics, and community resilience in resource dependent regions.

Methods

Research Design

This study employed a qualitative research approach using an interpretive case study design to investigate the dynamics of adaptive governance in mining environmental governance in Pohuwato Regency, Gorontalo Province, Indonesia. A qualitative case study was considered appropriate because the research sought to understand complex institutional interactions, governance processes, and stakeholder perceptions within a real-world context characterized by uncertainty, conflicting

interests, and socio-ecological complexity. Rather than measuring causal relationships quantitatively, the study aimed to interpret how governance actors construct meanings, negotiate institutional arrangements, and respond to environmental challenges associated with illegal gold mining. This approach is widely recommended for exploring governance systems where contextual understanding and multiple perspectives are essential for explaining institutional dynamics (Yin, 2018; Creswell & Poth, 2018). The adaptive governance framework proposed by Folke et al. (2005) served as the primary analytical lens through which governance processes were interpreted.

Research Context

The study was conducted in Pohuwato Regency, Gorontalo Province, one of Indonesia's major hotspots for illegal gold mining (Pertambangan Emas Tanpa Izin or PETI). The region has experienced rapid expansion of informal mining activities that have generated significant environmental degradation, including river pollution, deforestation, land degradation, and increasing public health risks associated with malaria outbreaks. Despite the existence of national mining regulations, governance responses remain fragmented because authority is distributed across multiple governmental levels while informal mining activities continue to evolve through local social networks. These characteristics make Pohuwato an appropriate case for examining adaptive governance within a complex socio-ecological system where environmental, institutional, and social dimensions interact simultaneously.

Data Collection

Data were collected between the research period through three complementary techniques consisting of in-depth interviews, field observation, and document analysis. In-depth semi-structured interviews constituted the primary source of empirical data because they enabled participants to explain governance experiences, institutional interactions, and policy implementation processes in detail. Field observations were undertaken to document environmental conditions, mining activities, and interactions among governance actors within the study area. Documentary evidence, including government regulations, institutional reports, policy documents, and other relevant records, was also examined to strengthen contextual understanding and facilitate data triangulation. The combination of multiple data sources increased the comprehensiveness of the findings while allowing cross-validation of emerging themes, consistent with qualitative research principles (Patton, 2015).

Participants

Participants were selected using purposive sampling because the study required informants possessing direct knowledge and practical experience regarding mining environmental governance. Twelve key informants participated in the research, representing multiple stakeholder groups, including local government officials, environmental authorities, community leaders, traditional leaders, and the head of the local miners' association. This diversity enabled the study to capture multiple perspectives regarding institutional coordination, governance challenges, adaptive responses, and policy implementation. Participant selection continued until information redundancy was achieved, indicating that sufficient depth and variation of perspectives had been obtained for thematic interpretation.

Table 1. Characteristics of Research Informants

Stakeholder Category	Number of Informants	Primary Role
Government officials	4	Environmental governance and policy implementation
Environmental agencies	2	Environmental monitoring and regulation
Community leaders	3	Community representation

		and local governance
Traditional leaders	2	Indigenous knowledge and customary institutions
Miners' association	1	Representation of mining communities
Total	**12**	

Source: Research data.

Data Analysis

The collected data were analyzed using thematic analysis following the interactive model proposed by Miles, Huberman, and Saldaña (2020). The analytical process consisted of data condensation, data display, and conclusion drawing with continuous verification throughout the study. Interview transcripts, observation notes, and documentary evidence were systematically coded to identify recurring themes related to governance practices. Subsequently, these themes were interpreted according to the four analytical dimensions of adaptive governance developed by Folke et al. (2005), namely cross-actor collaboration, policy learning and adaptation, polycentric governance, and institutional adaptive capacity. This analytical strategy enabled the study to connect empirical findings with broader theoretical discussions on adaptive environmental governance while preserving the contextual complexity of the case.

Trustworthiness

To ensure the credibility and trustworthiness of the findings, several validation strategies were employed. Data triangulation was achieved by comparing evidence obtained from interviews, field observations, and documentary analysis. Source triangulation was conducted by collecting information from participants representing different institutional backgrounds, allowing diverse viewpoints to be compared and interpreted. Member checking was performed by confirming key interpretations with selected participants to enhance the accuracy of the findings, while peer discussion throughout the analytical process helped strengthen interpretive consistency. An audit trail documenting coding decisions, analytical procedures, and interpretation development was maintained to improve dependability and confirmability. These procedures followed widely accepted qualitative research standards for establishing rigor and trustworthiness (Lincoln & Guba, 1985; Creswell & Poth, 2018).

Results

Actor and Institutional Relationship Patterns in Mining Environmental Governance

The findings reveal that actor relationships in mining environmental governance in Pohuwato Regency are characterized by a paradoxical governance structure. Although collaboration among local stakeholders is relatively strong at the grassroots level, formal institutional collaboration remains fragmented due to centralized authority over mining governance. This condition creates two contrasting governance arenas: an informal governance network driven by social capital and community initiatives, and a formal governance system constrained by rigid administrative structures.

Strong Informal Collaboration Amid the Absence of Formal Authority

Interview findings consistently demonstrate that the most effective collaboration occurs informally among local governments, community leaders, illegal miners, and local residents. During environmental crises such as flooding, river sedimentation, and infrastructure damage, community members and illegal miners voluntarily cooperate with village and subdistrict governments to restore environmental conditions. Heavy equipment owned by miners is frequently mobilized to normalize rivers, repair damaged public facilities, and assist disaster response activities without financial compensation from the government. This pattern indicates that collaborative action emerges from shared social responsibility rather than formal institutional mandates.

These findings indicate the existence of a de facto adaptive co-management arrangement in which responsibilities and resources are shared

voluntarily among actors. Local governments facilitate coordination, while mining communities contribute financial resources, labor, and equipment. Such collaboration reflects a high level of trust and social capital that enables communities to respond rapidly to environmental disturbances despite the absence of formal governance mechanisms.

Institutional Disintegration and the Absence of Formal Collaboration

In contrast to the strong informal collaboration observed at the community level, formal coordination among government institutions remains weak. Interviews with provincial and district officials reveal that authority over mining governance has been centralized following the enactment of Law No. 3 of 2020 concerning Mineral and Coal Mining and the Job Creation Law. As a result, district governments no longer possess sufficient authority to formulate or implement mining policies independently. Decision-making processes are concentrated at the central government level, while provincial agencies function primarily as administrative intermediaries.

This institutional arrangement creates fragmented governance, characterized by overlapping responsibilities, unclear administrative boundaries, and limited horizontal coordination among environmental agencies, mining authorities, and local governments. Consequently, environmental management becomes reactive rather than preventive, reducing institutional responsiveness to rapidly evolving environmental challenges.

Power Relations and the Central Role of Non-State Actors

The governance vacuum created by centralized authority has enabled non-state actors to assume increasingly significant roles in local environmental governance. The Indonesian People's Mining Association (APRI), community leaders, and customary institutions function as mediators between mining communities and government agencies. Their influence derives not from formal legal authority but from economic resources, social legitimacy, and community trust. Traditional leaders also contribute by preventing conflicts through persuasive approaches and moral guidance, while APRI facilitates communication between miners and government institutions. These findings demonstrate that practical environmental governance in Pohuwato is negotiated primarily through informal social networks rather than formal bureaucratic structures.

Adaptive Governance Mechanisms in Mining Environmental Governance

Dysfunctional Polycentric Governance under Centralized Authority

The analysis indicates that the adaptive governance mechanism is substantially constrained by the collapse of polycentric governance. Rather than distributing authority across multiple interacting governance centers, Indonesia's current mining governance framework has become increasingly centralized. Licensing, environmental approval, and mining policy decisions are controlled predominantly by the central government, limiting opportunities for local governments to adapt governance strategies according to local environmental conditions.

Consequently, governance flexibility has declined considerably. Local governments possess extensive knowledge of environmental problems but lack sufficient authority to translate that knowledge into adaptive policy responses.

Policy Learning Failure

The study further identifies a significant failure of policy learning within formal governance institutions. Environmental crises, including recurring floods, river degradation, and increasing malaria incidence associated with abandoned mining pits, have not resulted in substantial policy reform or institutional innovation. Instead, government responses remain largely administrative, regulatory, and enforcement-oriented without generating organizational learning capable of addressing the underlying governance problems.

The interruption of policy learning is closely associated with centralized governance

structures, where local experiences and institutional feedback rarely influence higher-level decision making. As a result, governance remains static despite continuously changing socio-ecological conditions.

Social Learning at the Community Level

Unlike formal institutions, local communities demonstrate strong adaptive learning capacities. Residents and mining communities continuously develop practical strategies to reduce environmental risks and protect public health. These include voluntary river restoration, rehabilitation of abandoned mining pits, collective environmental clean-up activities, and household-level malaria prevention measures such as mosquito control and environmental sanitation. These adaptive practices emerge through direct experience and collective learning rather than government intervention. However, this locally generated knowledge is rarely incorporated into official policymaking processes. Consequently, a substantial disconnect exists between social learning occurring at the community level and policy learning within formal governmental institutions.

Factors Shaping Institutional Adaptive Capacity

Drivers of Local Adaptive Capacity

The findings identify three principal factors supporting adaptive capacity in Pohuwato. First, strong social capital characterized by mutual cooperation and community solidarity enables rapid collective responses to environmental disturbances. Second, grassroots leadership and collective awareness encourage voluntary participation in environmental restoration despite limited governmental intervention. Third, local ecological knowledge, including customary environmental values and indigenous philosophies emphasizing collective responsibility, continues to guide community responses to environmental degradation.

These bottom-up capacities enable communities to maintain resilience despite institutional constraints imposed by formal governance arrangements.

Constraints on Adaptive Capacity

Conversely, adaptive governance is significantly constrained by several structural factors. The most influential limitation is the centralization of governmental authority, which restricts local institutional flexibility and delays policy responses. Additional barriers include overlapping regulations, unequal resource distribution, lengthy licensing procedures, and insufficient financial resources for environmental rehabilitation. An important finding of this study is the emergence of double exposure, whereby environmental governance failure simultaneously generates ecological degradation and public health crises. Abandoned mining pits create mosquito breeding habitats that contribute to increasing malaria transmission, illustrating how environmental and health vulnerabilities are interconnected consequences of ineffective governance. Overall, these findings demonstrate that while adaptive capacity and social learning continue to develop at the community level, formal governance institutions remain constrained by rigid administrative structures and centralized authority. This imbalance produces what this study conceptualizes as an adaptive governance paradox, in which informal adaptive systems evolve successfully, whereas formal governance mechanisms fail to adapt to complex socio-ecological challenges.

5. Conclusion

This study demonstrates that mining environmental governance in Pohuwato Regency is characterized by an adaptive governance paradox, in which strong adaptive dynamics emerge at the community level while formal governance institutions remain constrained by rigid and centralized administrative structures. Informal collaboration among local governments, community leaders, customary institutions, and mining communities has enabled practical responses to environmental disturbances through collective action, mutual trust, and shared responsibility. However, these adaptive initiatives operate independently of formal governance because centralized authority limits institutional flexibility, weakens cross-level

coordination, and interrupts policy learning processes. Consequently, governance responses remain predominantly reactive despite the recurrence of environmental degradation and associated public health risks, including malaria outbreaks linked to abandoned mining sites.

Theoretically, this research extends the adaptive governance literature by introducing the concept of the adaptive governance paradox, highlighting the coexistence of robust informal adaptive capacity and ineffective formal governance within a single socio-ecological system. The findings suggest that adaptive governance should be understood not only through institutional design but also through the interaction between community resilience, policy learning, and multi-level governance arrangements. Practically, the study underscores the need to strengthen policy learning, decentralize selected governance functions, improve coordination among governmental institutions, and integrate local knowledge into environmental decision-making processes. Such reforms are essential for developing governance systems capable of responding effectively to complex and interconnected environmental challenges.

This study is limited to a single qualitative case in Pohuwato Regency and therefore does not seek statistical generalization. Future research could employ comparative case studies across mining regions or mixed-method approaches to examine whether the adaptive governance paradox identified in this study also characterizes environmental governance in other resource-dependent regions.

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