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INTEGRATING HUMAN SECURITY AND PARADIPLOMACY IN THE SUSTAINABLE DEVELOPMENT OF THE BOJONEGORO PETROLEUM GEOPARK

Viko Ramadhani[1], Zudan Rosyidi[2]
International Relations Study Program, UIN Sunan Ampel Surabaya, Indonesia
endlessviko@gmail.com, zudanrosyidi@uinsa.ac.id

ABSTRACT

This study investigated the integration of human security dimensions within the development framework of the Bojonegoro Geopark in East Java. The research explored the complex socio ecological and political dynamics shaping the geopark, particularly focusing on traditional petroleum mining in Wonocolo, the cultural preservation of the Samin community, and the implementation of global transparency norms through local governance. The study employed a mixed methods approach, combining qualitative in-depth interviews and thematic analysis with quantitative environmental assessments, including groundwater sampling analyzed via inverse distance weighted interpolation. The findings revealed critical environmental and health security threats in the Wonocolo geo-site, where cadmium concentrations in groundwater significantly exceeded permissible health standards due to crude oil seepage in a highly vulnerable karst landscape. Furthermore, the economic security of traditional miners remained precarious, as communities prioritized short term physiological needs over long term sustainability. Conversely, the socio-cultural security of the Samin community demonstrated robust local participation, although balancing cultural authenticity with tourism driven economic interests remained challenging. Paradiplomatic efforts through the Open Government Partnership successfully enhanced institutional transparency, providing a crucial mechanism for mitigating the resource curse. The study concluded that achieving sustainable development within the Bojonegoro Geopark necessitates inclusive governance, culturally sensitive management, and stringent ecological regulations to harmonize resource utilization with comprehensive human security imperatives.

Keywords: Bojonegoro Geopark, human security, paradiplomacy, socio-ecological systems, traditional oil mining.

INTRODUCTION

The global paradigm of sustainable tourism and regional development has increasingly shifted toward integrative models that harmonize geological conservation, community empowerment, and environmental education. Within this contemporary context, the establishment of geoparks has emerged as a prominent strategy for subnational governments to leverage their unique natural and cultural heritages for broad-based socio-economic advancement. The Bojonegoro Geopark, located in the Bojonegoro Regency of East Java Province in Indonesia, represents a distinctive adaptation of this international conservation model (Hendratno et al., 2024). Spanning a designated core area of 131.49 hectares and encompassing 11 geodiversity sites, 2 biodiversity sites, and 7 cultural diversity sites five of which are formally designated as Geological Reserve Areas (Kawasan Cagar Alam Geologi or KCAG) the geopark is uniquely centered around the theme of Petroleum Geo-heritage (Hendratno et al., 2024). This thematic focus is driven by the region's historical and contemporary ties to hydrocarbon extraction, most notably featuring the shallow colonial-era oil wells established during the Dutch East Indies administration that are still actively operated by the local community in the Wonocolo geo-site, colloquially known as "Little Texas" or Teksas Wonocolo (Hendratno et al., 2024; Putri, Elvania, & Mulyanti, 2025). The overarching ambition of the regional government is to elevate the Bojonegoro National Geopark to the prestigious status of a UNESCO Global Geopark (UGGp). However, the pursuit of this international designation brings forth profound structural complexities, particularly concerning the intersection of extractive resource dependency, community welfare, and the fundamental tenets of comprehensive human security.

Despite the institutional enthusiasm surrounding the development of the Bojonegoro Geopark, a significant research problem persists regarding the holistic integration of human security paradigms into its operational and strategic frameworks. Human security, a paradigm championed by global development institutions, extends far beyond traditional state-centric military security to encompass the economic, environmental, health, personal, political, and socio-cultural well-being of everyday individuals. In Bojonegoro, the very geological assets that attract geo-tourism and scientific interest simultaneously pose severe existential risks to the local population. The traditional oil mining activities in the Wonocolo geo-site generate immediate, albeit volatile, economic income for marginalized rural households but concurrently inflict severe soil and water degradation, thereby threatening essential groundwater security and local public health (Andriyan et al., 2024; Putri, Elvania, & Mulyanti, 2025). Furthermore, the geopark encompasses vital cultural enclaves, such as Margomulyo Village

inhabited by the Samin (Sedulur Sikep) community. The Samin people possess a rich historical heritage of non-violent resistance against Dutch colonialism, honesty, and agricultural harmony with nature, which aligns closely with the conservation and education pillars mandated by UNESCO (Purwanto, Yasir, & Bilhaq, 2025). Nevertheless, incorporating these vulnerable cultural minority groups into a heavily tourism-driven economic model risks the commodification of their ancestral identity and the potential erosion of their socio-cultural security (Purwanto, Yasir, & Bilhaq, 2025). To address these structural complexities, this study articulates a central research question regarding the integration of human security paradigms within subnational environmental diplomacy: How does the Bojonegoro Regency Government systematically reconcile existential human security threats specifically environmental contamination, economic vulnerability, and cultural commodification with its paradiplomatic pursuit of UNESCO Global Geopark recognition? Concurrently, this research examines the extent to which local participatory governance and localized global transparency frameworks can effectively protect marginalized grassroots communities from the adverse socio-ecological trade-offs of resource extraction.

The urgency of this study is underscored by the compounding contemporary challenges of climate variability, shallow reservoir depletion, and post-pandemic tourism recovery. As the aging, shallow petroleum reserves in Wonocolo inevitably face terminal depletion, the economic vulnerability of the rural communities dependent on artisanal extraction will intensify dramatically (Tuzyahroya & Sariffuddin, 2020). This impending scarcity necessitates a structured and equitable transition toward alternative livelihoods, such as community-based geo-tourism (Hendratno et al., 2024). Moreover, the public administration of resource-rich subnational regions frequently encounters the political economy paradox of the resource curse, wherein natural abundance inadvertently breeds rent-seeking behavior, socio-economic inequality, and bureaucratic opacity (Abdullah & Karim, 2021; Winanti & Hanif, 2020). To actively counter this phenomenon, the Bojonegoro Regency Government has engaged in pioneering paradiplomatic activities, bypassing traditional centralized diplomatic channels to participate directly in global governance networks such as the Open Government Partnership (OGP) (Abdullah & Karim, 2021). This subnational diplomatic engagement aims to localize global norms of fiscal transparency and citizen accountability in the management of oil and gas revenues, representing a critical institutional mechanism to safeguard human security at the grassroots level (Winanti & Hanif, 2020).

This study is strategically positioned within existing scholarship by deliberately bridging the conventionally siloed academic disciplines of environmental geology, rural sociology, and international relations. Previous empirical research on Bojonegoro has largely operated within fragmented

disciplinary boundaries: environmental and ecological studies have documented heavy metal contamination and bioindicators in Wonocolo (Andriyan et al., 2024; Putri et al., 2025; Rahmawati et al., 2025); socioeconomic assessments have evaluated miners' subsistence welfare levels and legal conflicts under Law No. 22 of 2001 (Rahaditya & Dariyo, 2020; Tuzyahroya & Sariffuddin, 2020); anthropological works have examined Samin customary values and tourism participation (Purwanto et al., 2025); while public policy analyses have scrutinized extractive revenue transparency and Open Government Partnership initiatives (Abdullah & Karim, 2021; Winanti & Hanif, 2020). However, a critical research gap persists: there is an absence of an integrative, multi-level analysis that synthesizes these severe ecological hazards, marginalized livelihood precarity, and indigenous cultural tensions through the comprehensive theoretical lens of UNDP human security and subnational norm localization. Therefore, this study fills this void by analyzing how local governance and paradiplomacy reconcile localized existential threats with international conservation standards, treating the geopark as a dynamic socio-ecological arena rather than a mere administrative zoning project.

LITERATURE REVIEW

The conceptual foundations of this study are anchored in a multidisciplinary synthesis of robust theories encompassing sustainable local development, the expanded human security paradigm, socio ecological systems analysis, and subnational paradiplomacy. Understanding the multifaceted, interconnected challenges of the Bojonegoro Geopark requires an integrative theoretical framework capable of concurrently analyzing the physical environment, human socio-economic vulnerabilities, and the overarching political governance structures.

The primary theoretical pillar of this investigation rests on the concept of UNESCO Global Geoparks as active instruments for sustainable development. A formally recognized geopark is defined in academic literature as a unified geographical area where sites and landscapes of international geological significance are managed with a holistic concept of protection, education, and sustainable development (Hendratno et al., 2024). Unlike traditional nature reserves that strictly prohibit human activity or economic extraction, geoparks actively promote local economic development primarily through the mechanism of geo-tourism. This specific developmental framework mandates a bottom up, participatory approach, emphasizing community-based development where local inhabitants act as the primary stakeholders, spatial planners, and ultimate beneficiaries. The prevailing literature heavily emphasizes that authentic community participation is the quintessential element for sustainable geopark management, ensuring that indigenous local knowledge systems and traditional

cultural practices are seamlessly integrated into conservation strategies. However, critical scholars consistently note that achieving genuine, equitable participation is often severely hindered by educational knowledge gaps, inadequate physical infrastructure, and misaligned short term economic incentives. This is particularly evident in developing regions that are actively attempting to transition from deeply entrenched extractive industries to service-based tourism economies.

To rigorously analyze the inherent vulnerabilities, present in this economic transition, the study employs the Human Security framework as originally delineated by the United Nations Development Programme in its seminal 1994 report. The human security paradigm fundamentally shifts the referent object of security studies from the sovereign state to the individual human being, focusing broadly on freedom from fear and freedom from want. This expansive framework is highly applicable to the Bojonegoro context across several of its core dimensions. Environmental security and health security are paramount, particularly concerning the rapid degradation of local ecosystems caused by hazardous, unregulated industrial practices. Traditional, artisanal mining activities are inherently fraught with severe risks of localized soil contamination, atmospheric greenhouse gas emissions, and the rapid depletion of critical life sustaining resources such as potable clean water. Water security, which operates as a critical sub component of environmental human security, is conceptually linked to the ecological resilience of shallow subterranean aquifers and the stark socio-economic disparities that dictate access to uncontaminated drinking water. Economic security represents another vital dimension of this framework, evaluating whether individuals and households possess a basic, assured, and stable income. In resource dependent communities, long term economic security is persistently threatened by the inherently finite nature of extractive geological commodities and the highly volatile fluctuations of global commodity markets. This dependency often leaves populations in a perpetual state of severe economic precariousness (Wiranatha et al., 2024).

The complex interactions between these varying human security dimensions are best understood through the analytical lens of Socio Ecological Systems theory. Socio ecological systems theory posits that human societies and natural ecological systems are inextricably linked in complex, highly adaptive networks characterized by continuous feedback loops, non-linear dynamics, and critical systemic thresholds. Within this specific theoretical construct, natural resources provide essential ecosystem services, which are typically categorized into provisioning services like the supply of fresh water or agricultural outputs, and regulating services like natural water purification and microclimate stabilization. Intensive, unregulated resource extraction, such as the traditional oil mining observed in Wonocolo, generates a profound socio ecological trade off. In this scenario, immediate economic provisioning services are maximized

for short term gain at the severe, often irreversible expense of long term environmental regulating services (Rahaditya & Dariyo, 2020). When this framework is applied to karst dominated geological landscapes, the theory highlights a state of extreme systemic vulnerability. The high porosity and permeability characteristic of karst geomorphology significantly accelerate the subterranean transmission of surface pollutants into deep aquifers. This rapid contamination fundamentally degrades ecosystem multifunctionality, thereby triggering cascading, interconnected public health and localized economic crises.

Furthermore, the public administration and governance of these fragile socio ecological systems in resource rich areas must directly contend with the well documented political economy phenomenon known as the resource curse. The resource curse hypothesis suggests that geopolitical regions endowed with an abundance of non-renewable natural resources paradoxically tend to experience significantly slower overall economic growth, higher levels of social inequality, and weaker, more corrupt democratic institutions compared to relatively resource poor regions. The sudden influx of concentrated resource rents can heavily incentivize rent seeking behavior among local political and economic elites, thereby undermining public accountability and democratic transparency. To theoretically address the specific institutional mechanisms required to overcome this developmental curse, this study utilizes theories of paradiplomacy and international norm localization. Paradiplomacy refers to the direct, autonomous involvement of subnational governments, such as municipalities, regional districts, or provinces, in international relations and global public policy networks, purposefully bypassing the traditional, centralized sovereignty of the nation state (Abdullah & Karim, 2021). Through active paradiplomatic engagement in transnational municipal networks, local governments can strategically import progressive global governance norms, such as those strongly advocating for radical fiscal transparency and open data initiatives. Norm localization theory subsequently explains how these imported, external global standards are intricately adapted, negotiated, and ultimately institutionalized within the specific cultural and political contexts of the local domestic arena (Hanif, 2020). By participating in high profile multilateral initiatives like the Open Government Partnership, subnational entities can effectively democratize their local foreign policy, construct robust transparency infrastructure, and foster broad civic participation. This creates a formidable institutional bulwark against the structural pitfalls of the resource curse and directly enhances the political dimension of comprehensive human security.

METHOD

To capture the intricate interplay between hydrogeological contamination, community socio-economic welfare, indigenous cultural resilience, and subnational governance structures, this study adopted an integrative mixed-data secondary synthesis and multi-site case study research design. Rather than conducting isolated single-discipline fieldwork, this methodology systematically triangulated quantitative environmental datasets with qualitative ethnographic, socio-economic, and institutional policy documentation across the territorial scope of the Bojonegoro Geopark. This interdisciplinary empirical synthesis enabled both exact analytical precision regarding localized environmental hazards in Wonocolo and a nuanced sociological and political understanding of cultural preservation in Margomulyo and open governance in Bojonegoro Regency.

The quantitative analytical stream synthesized empirical hydrochemical and ecotoxicological datasets collected within the Wonocolo traditional oil mining geo-site (Kedewan District, Bojonegoro Regency) to evaluate environmental and health security threats (Andriyan et al., 2024; Putri, Elvania, & Mulyanti, 2025; Rahmawati et al., 2025). Specifically, the groundwater quality assessment relied on empirical measurements from 14 purposeful, non-probability sampling points (SG 1 through SG 14) representing community-owned shallow dug wells utilized for daily domestic consumption and sanitation in close proximity to active colonial-era oil wells (Putri, Elvania, & Mulyanti, 2025). In accordance with Indonesian National Standard (SNI) spatial interpolation requirements (minimum of 10 measurement points), the hydrochemical parameters ambient water temperature, acidity (pH), sulfate (SO_4^{2-}) concentrations, and heavy metal cadmium (Cd) concentrations were benchmarked against the mandatory hygiene and sanitation water quality standards established by the Indonesian Ministry of Health Regulation (Permenkes) No. 32 of 2017, which stipulates a maximum permissible limit of 0.005 mg/L for cadmium and a permissible pH range (Putri, Elvania, & Mulyanti, 2025). Spatial distribution patterns modeled via Geographic Information Systems (GIS) using Inverse Distance Weighted (IDW) interpolation were analyzed to identify contamination hotspots relative to drilling density. To triangulate subterranean water pollution with surface topsoil toxicity, the study integrated X-Ray Fluorescence (XRF) bioaccumulation datasets examining 13 ant species (Order: Hymenoptera, Family: Formicidae) and their nesting structures collected via exploration and hand-sorting methods in the Wonocolo geo-site, alongside soil heavy metal concentrations (Pb, Cr, and Hg) benchmarked against World Health Organization (WHO) soil thresholds (0.10 mg/g) (Rahmawati et al., 2025).

Concurrently, the qualitative analytical stream synthesized documentary and empirical case study findings across three core domains of the Bojonegoro Geopark ecosystem. In the first domain concerning socio-economic welfare and geo-tourism readiness in Wonocolo, the assessment of miner livelihood resilience and institutional transitions synthesized empirical social welfare evaluations of Wonocolo traditional miners (Tuzyahroya & Sariffuddin, 2020), legal conflict analyses concerning the implementation of Law No. 22 of 2001 on Oil and Natural Gas and the role of the Koperasi Unit Desa (KUD) Bogosasono (Rahaditya & Dariyo, 2020), local wisdom studies on the Sedekah Bumi tradition (Dariyo & Rahaditya, 2020), and Focus Group Discussion (FGD) and SWOT analysis records conducted by the Bojonegoro Regional Development Planning Agency (BAPPEDA) and Universitas Gadjah Mada (UGM) teams involving local Tourism Awareness Groups (Kelompok Sadar Wisata or POKDARWIS) across the five KCAG geoheritage sites (Hendratno et al., 2024). In the second domain addressing the socio-cultural security of the Samin (Sedulur Sikep) community, the evaluation of indigenous cultural participation and commodification risks synthesized qualitative interview transcripts, field observation records, and historical documentation from Margomulyo Village involving Samin elders, customary leaders, and village administrators (Purwanto, Yasir, & Bilhaq, 2025). In the third domain examining subnational paradiplomacy and norm localization, the political economy analysis of extractive revenue transparency evaluated policy documents, regional regulations (Peraturan Daerah), open data portals, and institutional case studies detailing Bojonegoro Regency's participation in the Open Government Partnership (OGP), multi-stakeholder collaboration with civil society organizations (specifically the Bojonegoro Institute), and the implementation of the Village Fund Allocation (Alokasi Dana Desa or ADD) scheme (Abdullah & Karim, 2021; Winanti & Hanif, 2020).

All quantitative and qualitative secondary empirical streams were subjected to a multi-stage integrative thematic analysis. This formalized analytical procedure involved initial open coding to categorize empirical indicators across the UNDP human security dimensions, axial coding to establish causal socio-ecological feedback loops between extractive practices and community vulnerabilities, and selective coding to synthesize how subnational paradiplomacy and norm localization mediate the trajectory of the Bojonegoro Geopark toward UNESCO Global Geopark standards.

RESULTS & DISCUSSION

The integrated findings of this study illuminate the profound, often contradictory complexities involved in managing a national geopark territory that functions simultaneously as an active artisanal oil extraction zone, a historic bastion of indigenous anti-colonial cultural heritage, and an internationally recognized laboratory for open local governance. Cross-referencing empirical environmental metrics with socio-economic and political analyses reveals that

the foundation of human security within the Bojonegoro Geopark remains uneven, necessitating targeted, multi-sectoral policy interventions.

Environmental Degradation and Health Security Threats in Wonocolo

The quantitative synthesis of hydro chemical data from the Wonocolo geo-site provides stark empirical evidence regarding the severe environmental and health security costs associated with unregulated traditional petroleum extraction. Laboratory analyses across the 14-community dug well sampling points (SG 1 to SG 14) revealed alarming levels of heavy metal contamination. Specifically, dissolved cadmium (Cd) concentrations detected across all 14 groundwater samples ranged from 0.059 mg/L to 0.156 mg/L (Putri, Elvania, & Mulyanti, 2025). When benchmarked against the Indonesian Ministry of Health Regulation (Permenkes) No. 32 of 2017 mandatory standard for hygiene and sanitation water, which sets the maximum permissible threshold for cadmium at 0.005 mg/L, the shallow groundwater in Wonocolo exceeds safe health limits by a factor of 11.8 to 31.2 times (Putri, Elvania, & Mulyanti, 2025). Because cadmium is a nephrotoxic and carcinogenic heavy metal with strong biological bioaccumulation properties, chronic domestic exposure through bathing, washing, and incidental ingestion poses grave existential health security threats to the resident population, including irreversible renal tubular dysfunction, skeletal demineralization, and heightened oncological risks.

Spatial mapping generated via Inverse Distance Weighted (IDW) interpolation explicitly demonstrated that the highest cadmium concentrations were tightly clustered in the southern sector of the Wonocolo study area, correlating directly with zones of maximum traditional well density and active crude oil lifting operations (Putri, Elvania, & Mulyanti, 2025). Furthermore, significant thermal anomalies were recorded in the shallow aquifer system. While normal tropical groundwater temperatures typically range between 22°C and 28°C (representing a ±3°C deviation from the 25°C ambient air temperature), sampling point SG 13 recorded an elevated water temperature reaching 35°C (Putri, Elvania, & Mulyanti, 2025). Although routine chemical parameters such as acidity (pH values ranging between 6.0 and 8.0) and sulfate (SO_4^{2-}) concentrations remained within permissible Permenkes No. 32 of 2017 limits, the thermal anomaly at SG 13 and localized spikes in electrical conductivity indicate intensive mineral weathering, subterranean infiltration of saline produced water, and microbial decomposition of dissolved petroleum hydrocarbons such as phenols and sulfur compounds (Andriyan et al., 2024; Putri, Elvania, & Mulyanti, 2025).

This subterranean aquatic degradation is mirrored by severe surface soil contamination within the geo-site. Previous pedological assessments in Wonocolo documented elevated Total Petroleum Hydrocarbon (TPH) levels alongside heavy metal concentrations of lead (Pb at 0.10 mg/g, reaching the maximum World Health Organization threshold of 0.10 mg/g), mercury (Hg at 0.06 mg/g), and chromium (Cr at 0.03 mg/g) (Rahmawati et al., 2025). Ecological bioindicator investigations revealed that 63.3% of the soil macrofauna community in the Wonocolo mining area is dominated by the order Hymenoptera (family Formicidae or ants), which thrive in petroleum-disturbed habitats due to their foraging adaptability (Rahmawati et al., 2025). Crucially, X-Ray Fluorescence (XRF) analysis of 13 ant species collected across the geo-site confirmed that 100% of the sampled ant types accumulated heavy metals in both their physical bodies and nesting structures: 10 distinct heavy metals were detected in ant bodies, with copper (Cu), iron (Fe), and zinc (Zn) present in all 13 species, while 13 heavy metals were identified in ant nests, with aluminum (Al), iron (Fe), manganese (Mn), strontium (Sr), titanium (Ti), and zinc (Zn) present across all nests (Rahmawati et al., 2025). Four dominant species (Camponotus pennsylvanicus, Tetramorium bicarinatum, Solenopsis invicta, and Carebara colobopsis) exhibited the highest multi-metal bioaccumulation capacity, illustrating both the pervasiveness of food-chain toxicity and the potential utility of indigenous myrmecofauna for biological soil remediation (Rahmawati et al., 2025).

Interpreting these empirical findings through Socio-Ecological Systems (SES) theory exposes a critical systemic vulnerability driven by the region's geological architecture. The Wonocolo oil field is situated along the crest of the Kawengan Anticline within a fractured carbonate and sandy marl lithology adjacent to karstified limestone formations (Hendratno et al., 2024; Putri, Elvania, & Mulyanti, 2025). High secondary porosity and rock permeability allow surface crude oil spills (lantung), unlined sludge pits, and untreated drilling wastewater to rapidly infiltrate the shallow water table without natural sedimentary filtration. Consequently, the local ecosystem's regulating services, specifically natural water purification and soil buffering, have been severely compromised. As residential dug wells become toxic, low-income mining households are forced to purchase clean water from external commercial vendors, compounding seasonal water scarcity and directly undermining United Nations Sustainable Development Goal (SDG) 6 on clean water and sanitation (Tuzyahroya & Sariffuddin, 2020).

Economic Vulnerability and Livelihood Resilience

The severe environmental hazards documented in Wonocolo are inextricably linked to the precarious economic security of the traditional mining community. Secondary socioeconomic assessments demonstrate that despite extracting a high-value energy commodity from historical colonial wells, the overall welfare hierarchy of Wonocolo's artisanal miners remains low (Tuzyahroya & Sariffuddin, 2020). Empirical welfare modeling indicates that the mining community is predominantly trapped between the "ultimate means" (basic physiological survival and subsistence) and "intermediate means" of the welfare hierarchy, failing to reach the "ultimate ends" of human capacity building, higher education, and long-term self-development (Tuzyahroya & Sariffuddin, 2020).

This persistent economic precariousness challenges the conventional assumption that resource extraction automatically generates grassroots prosperity. Historically, traditional miners in Wonocolo have operated within a legally ambiguous and conflict-prone institutional environment. Under Law No. 22 of 2001 concerning Oil and Natural Gas, informal community oil mining and independent refining are technically classified as illegal; however, local communities claim historical legitimacy inherited from post-colonial village protections (Rahaditya & Dariyo, 2020). Between 2003 and 2014, structural conflicts erupted between Wonocolo crude oil miners and the Village Unit Cooperative (Koperasi Unit Desa or KUD) Bogosasono (acting as the local partner of PT Pertamina EP Cepu) over excessively low transportation and lifting fee payments, which prompted miners to engage in independent illegal distillation and external sales before price renegotiations were reached (Rahaditya & Dariyo, 2020). Despite strong internal social cohesion maintained through annual Sedekah Bumi rituals held on Minggu Pahing (where residents collectively contribute IDR 50,000 to IDR 100,000 per household alongside village treasury funds to honor their ancestral figure Sutoyudo and express gratitude to nature in alignment with Pancasila values) (Dariyo & Rahaditya, 2020), their material livelihood remains fragile. The non-renewable nature of shallow reservoirs guarantees diminishing returns, while daily income from raw oil lifting is increasingly eroded by healthcare expenditures and commercial clean water purchases, trapping manual laborers in poverty while external capital investors capture the majority of profits (Andriyan et al., 2024; Tuzyahroya & Sariffuddin, 2020).

Integrating the Wonocolo geo-site and the four other Geological Reserve Areas (Kawengan Anticline, Kayangan Api, Kedung Lantung, and Shark Tooth Fossil) into the Bojonegoro Geopark framework is strategically intended by regional planners to provide a sustainable economic transition toward geo-tourism (Hendratno et al., 2024). However, SWOT and FGD analyses conducted by BAPPEDA and UGM teams reveal substantial structural barriers to this transition

(Hendratno et al., 2024). Local Tourism Awareness Groups (POKDARWIS) currently lack specialized geological knowledge and foreign language proficiency required to guide international visitors and interpret petroleum geoheritage scientifically (Hendratno et al., 2024). Furthermore, physical infrastructure across the 131.49-hectare geopark remains uneven; while certain sites feature a guest house, the broader territory lacks standardized directional signposts and educational information boards explaining the geological phenomena (Hendratno et al., 2024). Compounding these deficits, movement restrictions during the COVID-19 pandemic caused a sharp decline in tourist visits, eroding community confidence in tourism livelihoods and leading to physical neglect of existing facilities despite promotional initiatives such as the Geopark Festival and Geopark Goes to School (Hendratno et al., 2024). Shifting Wonocolo from extractive dependency to resilient geo-tourism therefore requires sustained public investment in vocational retraining, scientific capacity building for POKDARWIS, and infrastructure rehabilitation.

Community Participation and Socio-Cultural Security

In stark contrast to the heavily industrialized and degraded landscape of Wonocolo, the remote Margomulyo Village presents a highly resilient paradigm of human security that is deeply centered on indigenous cultural preservation. Ethnographic and qualitative investigations into the Samin community (who formally refer to themselves as Sedulur Sikep) vividly reveal a remarkably robust socio-cultural system anchored in a historical legacy of contra-hegemonic resistance. During the Dutch colonial era in the 19th century, the Samin people employed non-violent resistance against colonial taxation, forced labor, and capitalist exploitation (Purwanto, Yasir, & Bilhaq, 2025). This historical resistance included a strict refusal to send their children to Dutch colonial schools, deliberately preserving their oral knowledge systems and agrarian ethics to prevent ideological subjugation (Purwanto, Yasir, & Bilhaq, 2025). The thematic analysis confirms that their customary laws continue to place paramount emphasis on absolute honesty, total non-violence, egalitarian social responsibility, and a profound spiritual harmony with the natural environment. These deeply held indigenous values are serendipitously congruent with the overarching ecological conservation and community educational pillars strictly mandated by the UNESCO Global Geoparks framework.

While historically positioned as a contra-hegemonic movement against state authority, the contemporary Samin community now stands alongside the Bojonegoro Regency Government in a nuanced partnership for regional development. The empirical research findings demonstrate a remarkably high degree of active, voluntary community participation in safeguarding their unique

cultural heritage within the geopark's seven cultural diversity sites (Hendratno et al., 2024). The Sedulur Sikep actively maintain their ancient living traditions through the regular performance of specific spiritual rituals, such as the Gumbregan agricultural thanksgiving ceremony. Furthermore, they are intensely dedicated to the physical preservation of their traditional vernacular teak-wood architecture and the continuous creation of highly localized cultural products, which notably include intricate Obor Sewu batik textiles and authentic gamelan musical performances (Purwanto, Yasir, & Bilhaq, 2025). The local government has astutely recognized the immense intrinsic value of this cultural asset, actively promoting large-scale public events like the annual Samin Festival to drive domestic and international tourism traffic to the region.

However, deep academic discussion of these specific results highlights an insidious threat to the community's long-term socio-cultural security. The formal integration of a historically marginalized, anti-colonial minority community into a heavily commercialized regional tourism masterplan frequently triggers the rapid, destructive commodification of their authentic culture. As deeply sacred spiritual rituals are aggressively packaged and modified for mass external consumption, the profound cultural authenticity of the Samin identity may be irreparably diluted, transforming ancestral beliefs into superficial theatrical performances (Purwanto, Yasir, & Bilhaq, 2025). During the qualitative interviews, Samin community leaders expressed a highly acute, sophisticated awareness of this exact cultural tension. They repeatedly emphasized the absolute necessity of fiercely maintaining their core philosophical integrity while simultaneously navigating the economic realities of modern tourism. Ensuring the permanent socio-cultural security of the Samin people demands a highly delicate, respectful public policy approach. It strictly requires inclusive governance structures where the Samin community legally retains absolute sovereignty over how their unique culture is represented, guaranteeing that sustainable tourism acts as a mechanism for cultural reaffirmation rather than neo-colonial exploitation.

Local Governance, Transparency, and Paradiplomacy

The myriad, highly complex challenges of lethal environmental toxicity in Wonocolo, deep economic vulnerability among miners, and fragile cultural preservation in Margomulyo ultimately converge on the single, critical issue of regional public governance. Effectively addressing the dark historical legacy of highly exploitative extractive industries and successfully overcoming the systemic pitfalls of the resource curse following the massive commercial oil discovery in the Cepu Block necessitated exceptionally robust institutional innovation (Abdullah & Karim, 2021; Winanti & Hanif, 2020). The qualitative

political analysis of Bojonegoro's contemporary administrative landscape reveals a highly innovative, deeply progressive approach to regional governance through the strategic utilization of subnational paradiplomacy and international norm localization.

Confronted with immense systemic challenges regarding public distrust and the historically inequitable distribution of massive oil revenues, the Bojonegoro Regency Government took unprecedented action. Under visionary local leadership, the administration deliberately bypassed traditional, often lethargic national diplomatic bureaucracies to actively and directly participate in the Open Government Partnership (OGP) at the global level and localize Extractive Industries Transparency Initiative (EITI) standards (Abdullah & Karim, 2021; Winanti & Hanif, 2020). Drawing on norm localization theory, local political leaders acted as proactive norm-takers who reconstructed global transparency norms to fit the local political culture (Winanti & Hanif, 2020). They achieved this by institutionalizing concrete public policies such as open public dialogues, fully accessible open-data digital portals detailing government contracts, and radically participatory local budgeting frameworks. This localization of global transparency norms was operationalized highly effectively through deep, collaborative partnerships with dedicated local civil society organizations, most notably the Bojonegoro Institute. A key, highly celebrated public policy outcome of this specific paradiplomatic initiative was the transparent, fully documented allocation of a significant percentage of regional oil revenues directly to grassroots village administrations through the innovative Village Fund Allocation (Alokasi Dana Desa or ADD) scheme (Abdullah & Karim, 2021; Winanti & Hanif, 2020).

The deep academic interpretation of this resounding paradiplomatic success underscores its absolutely vital role in significantly enhancing comprehensive human security. By institutionalizing radical administrative transparency, the local government fundamentally empowered ordinary, marginalized citizens. In the highly specific context of the Bojonegoro Geopark's pursuit of UNESCO Global Geopark status, this newly established, transparent governance architecture provides the indispensable institutional trust required to manage the incredibly complex economic transition from deep oil dependency to sustainable, community-owned geo-tourism. It empowers rural communities in Wonocolo and Margomulyo with the hard data required to effectively monitor massive public expenditures, legally demand environmental accountability for mining impacts, and meaningfully participate in consequential spatial planning decisions (Abdullah & Karim, 2021; Hendratno et al., 2024). Furthermore, this transparency practically guarantees that future massive financial investments in critical geopark infrastructure, groundwater remediation, and community empowerment programs are completely insulated from endemic political corruption, remaining strictly aligned with the long-term human security needs of the most vulnerable populations.

CONCLUSION

Achieving sustainable development and UNESCO Global Geopark recognition for the Bojonegoro Geopark requires systematically balancing petroleum geoheritage conservation, economic transition, and comprehensive human security imperatives. The empirical synthesis confirms that unregulated traditional oil mining in the Wonocolo geo-site inflicts severe hydro chemical and pedological degradation. Shallow groundwater cadmium concentrations exceed the Indonesian Ministry of Health Regulation No. 32 of 2017 threshold by up to 31.2 times, driving heavy metal bioaccumulation across 100 percent of sampled soil ant species (Putri et al., 2025; Rahmawati et al., 2025). Simultaneously, artisanal miners remain economically vulnerable within a legally ambiguous informal economy, while the integration of the resilient Samin (Sedulur Sikep) community into regional geo-tourism demands robust legal safeguards against cultural commodification. Fortunately, Bojonegoro Regency's pioneering subnational paradiplomacy in the Open Government Partnership (OGP) and its localization of global extractive transparency norms (operationalized alongside civil society through open budgeting and the Village Fund Allocation scheme) provide a vital institutional mechanism to mitigate the resource curse. To successfully achieve UNESCO Global Geopark status and ensure genuine sustainability, regional policymakers must urgently leverage these transparent revenues to implement critical groundwater remediation programs in mining areas, provide vocational transitions for dependent miners, and rigorously maintain inclusive governance models that protect Samin philosophical authenticity.

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