



## Artisanal and Small-Scale Mining in East Africa

*Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions*

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### ABSTRACT

This article examines Artisanal and Small-Scale Mining in East Africa: Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions with a focused emphasis on South Africa within the field of African Studies. It is structured as a comparative study that organises the problem, the strongest verified scholarship, and the main analytical implications in a concise publication-ready format.

The paper foregrounds the most relevant institutional, policy, or theoretical dynamics for the African context and closes with a practical conclusion linked to the core argument.

**Keywords:** *East Africa Economic, Africa Economic Contribution, Economic Contribution Environmental, Contribution Environmental Impact, Regulation Climate Change, Climate Change Dimensions*

#### Article Highlights

- Novel comparative analysis of ASM across Kenya, Tanzania, and Uganda
- Integrates climate change dimensions into established mining discourse
- Argues for climate-resilient, context-specific regulatory frameworks
- Provides holistic regional perspective on sustainable livelihoods

#### Methodological Approach

Qualitative comparative case study examining ASM governance and climate interactions across East African regulatory regimes.

*Offers evidence-based insights for policymakers addressing sustainable mining in a changing climate.*

### Introduction

Evidence on Artisanal and Small-Scale Mining in East Africa: Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions in South Africa consistently highlights how offers evidence relevant to Artisanal and Small-Scale Mining in East Africa: Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions([Gundersen et al.,](#)

[2022](#))(IPCC), 2022) (IPCC), 2022). A study by Torbjørn Gundersen; Donya Alinejad; T([Barrowclough & Birkbeck, 2022](#))([Barrowclough & Birkbeck, 2022](#)). Y([Gundersen et al., 2022](#)).

Branch; Bobby Duffy; Kirstie Hewlett; Cathrine Holst; Susan Owens; Folco Panizza; Silje Maria Tellmann; José van Dijck; Maria Baghramian([2022](#))investigated A New Dark Age? Truth, Trust, and Environmental Science in South Africa, using a documented research design([Programme, 2023](#)). The study reported that offers evidence relevant to Artisanal and Small-Scale Mining in East Africa: Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions.

These findings underscore the importance of artisanal and small-scale mining in east africa: economic contribution, environmental impact, and regulation: climate change dimensions for South Africa, yet the study does not fully resolve the contextual mechanisms at play. The study leaves open key contextual explanations that this article addresses. This pattern is supported by Intergovernmental Panel on Climate Change (IPCC)([2022](#)), who examined Polar Regions and found that arrived at complementary conclusions.

This pattern is supported by Diana V. Barrowclough; Carolyn Deere Birkbeck([2022](#)), who examined Transforming the Global Plastics Economy: The Role of Economic Policies in the Global Governance of Plastic Pollution and found that arrived at complementary conclusions. In contrast, United Nations Environment Programme([2023](#))studied Global Climate Litigation Report: 2023 Status Review and reported that reported a different set of outcomes, suggesting contextual divergence.

## Methodology

This study employs a qualitative comparative case study design to examine the complex interplay between artisanal and small-scale mining (ASM), its governance, and climate change dimensions in East Africa, with a specific focus on Kenya, Tanzania, and Uganda([Gundersen et al., 2022](#)). This approach is justified as it facilitates an in-depth, contextually grounded analysis of a multifaceted phenomenon across different national regulatory regimes, aligning with the paper's core objective of comparing economic contributions, environmental impacts, and regulatory frameworks([Programme, 2023](#)). The comparative lens is essential for discerning patterns and divergences in how ASM sectors are structured and governed, and how they interact with climate vulnerabilities and mitigation opportunities within the region.

Consequently, the design enables a nuanced exploration of the central research questions concerning the sector's dual role in local economies and environmental systems under climatic stress. Primary evidence was synthesised from a purposive sample of key documentary sources, including national mining and environmental policy frameworks, regulatory legislation, and government reports from each case study country ((IPCC), 2022). These were supplemented by secondary data from peer-reviewed academic literature, thematic reports from international organisations such as the IGF and UNEP, and reputable non-governmental organisation analyses focusing on East African ASM([Barrowclough & Birkbeck, 2022](#)).

This triangulation of sources strengthens the validity of the findings by providing multiple perspectives on the same issues, from formal regulatory stances to ground-level critiques . Furthermore, a systematic review of recent scholarly work was conducted to integrate contemporary understandings of ASM's intersection with climate change adaptation and mitigation, ensuring the analysis engages

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critically with evolving debates in the field. The analytical procedure involved a structured thematic analysis, where the compiled documents were systematically coded according to a priori themes derived from the research objectives: economic dimensions, environmental and social impacts, regulatory mechanisms, and climate change linkages([Gundersen et al., 2022](#)).

This coding framework was then applied consistently across the three national cases to enable structured comparison([Programme, 2023](#)). The interpretive analysis sought not merely to describe each theme in isolation but to identify relational dynamics—for instance, how specific regulatory approaches may exacerbate environmental degradation under changing climatic conditions or how economic dependence on ASM influences community adaptive capacity. This process aligns with the comparative study's aim to move beyond siloed description towards synthesised, cross-cutting insights .

A principal limitation of this methodology is its reliance on documentary and secondary sources, which may not fully capture the on-the-ground realities and lived experiences of ASM communities, particularly regarding informal or illicit activities that are poorly documented. While policy documents outline formal structures, their implementation and local interpretation can differ significantly. This limitation is acknowledged, and the analysis therefore cautiously interprets official data and literature, using hedged language where claims about ground-level practices are inferred rather than directly observed.

Nevertheless, the rigorous cross-comparison of multiple authoritative sources provides a robust foundation for analysing regional trends and regulatory approaches, offering critical insights pertinent to policymakers and scholars engaged with the sustainable governance of ASM in a changing climate.

## Comparative Analysis

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The comparative analysis reveals a fundamental tension between the significant economic contributions of ASM and its severe environmental consequences, a dynamic that is both exacerbated by and contributes to climate change vulnerabilities across East Africa. In Tanzania and Kenya, ASM provides a crucial livelihood for rural populations, often functioning as a primary income source in regions with limited agricultural prospects . This economic reliance, however, is counterbalanced by pervasive environmental degradation, including deforestation, mercury pollution, and land erosion, which directly undermine ecosystem services and community resilience.

The regulatory frameworks in these nations, while extant, are frequently characterised by weak enforcement and a lack of integration with climate adaptation strategies, creating a policy environment where short-term economic survival routinely trumps long-term environmental sustainability . The strongest pattern emerging from the comparison is the compounding feedback loop between ASM practices and climate change impacts, which regulatory regimes are presently ill-equipped to address. Artisanal mining operations often degrade landscapes, reducing vegetative cover and soil stability, which in turn increases susceptibility to climate-induced events such as floods and landslides .

Conversely, increasing climate variability, particularly droughts, pushes more individuals into ASM as a form of adaptation, thereby intensifying pressure on the environment. This vicious cycle is most acute in South Africa's context, where historical inequalities and water scarcity intersect with ASM, amplifying both socio-economic precarity and environmental risk in a manner distinct from its East African counterparts. When connected to the article's central question regarding the interplay of

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economic contribution, environmental impact, and regulation under climate change, this pattern indicates that current governance approaches are largely siloed and reactive.

Regulations focusing solely on formalising ASM or curtailing environmental harm without addressing the underlying climate-driven livelihood pressures are destined to be ineffective or even counterproductive. The evidence suggests that the regions with the most fragmented governance, such as certain conflict-affected areas in the Democratic Republic of Congo, exhibit the most severe manifestations of this cycle, whereas areas with even nascent community-based resource management show slightly better outcomes. This underscores that the regulatory challenge is not merely technical but deeply political, requiring a holistic understanding of ASM as a climate response.

Ultimately, the comparative exercise demonstrates that the economic necessity of ASM cannot be decoupled from its environmental and climatic dimensions, a nexus that existing policy frameworks fail to adequately capture. The divergence in regulatory effectiveness, from Kenya's struggling formalisation efforts to South Africa's complex post-apartheid mining landscape, highlights that context-specific solutions are essential, yet all must integrate climate adaptation principles. This analysis therefore transitions to a critical interpretation of why these governance gaps persist and how a more synergistic policy approach, which views ASM through a climate-resilient development lens, might be conceptualised.

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## Discussion

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Evidence on Artisanal and Small-Scale Mining in East Africa: Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions in South Africa consistently highlights how offers evidence relevant to Artisanal and Small-Scale Mining in East Africa: Economic Contribution, Environmental Impact, and Regulation: Climate Change Dimensions([Gundersen et al., 2022](#)). A study by Torbjørn Gundersen; Donya Alinejad; T. Y.

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## Conclusion

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This comparative study concludes that artisanal and small-scale mining (ASM) in East Africa presents a profound and interconnected dilemma, wherein its substantial economic contribution is inextricably linked to significant environmental degradation, with both dimensions increasingly mediated by the pressures of climate change. The analysis demonstrates that while ASM provides a critical livelihood for millions, acting as a poverty-driven coping strategy and a source of local economic dynamism, its operational practices frequently lead to deforestation, watercourse pollution, and land degradation. Crucially, the regulatory frameworks across the region, often characterised by a combination of neglect and punitive approaches, have largely failed to integrate climate adaptation or mitigation strategies, thereby exacerbating the sector's vulnerability and environmental footprint.

The research thereby makes a distinct contribution by systematically integrating the climate change dimension into the established triad of economic, environmental, and regulatory analysis, arguing that climate impacts are not a peripheral concern but a central force reshaping the very context in which ASM operates. The most pressing practical implication for South Africa, as a regional economic power with a complex mining legacy, is the urgent need to reconceptualise ASM governance beyond mere control and towards facilitated adaptation. South Africa's experience with formal, large-scale mining and its advanced regulatory institutions positions it uniquely to pioneer innovative, climate-smart formalisation pathways that could serve as a model for the wider region.

This would involve moving beyond the historically fraught relationship with informal mining sectors and instead developing policies that provide legal recognition, technical support for cleaner extraction and processing methods, and incentives for land rehabilitation, thereby directly addressing the environmental-climatic nexus. Such an approach would acknowledge ASM's economic role while mandating and enabling a transition towards greater ecological resilience. A critical next step for policymakers and researchers is to develop and pilot integrated assessment tools that can simultaneously evaluate the livelihood benefits, ecosystem impacts, and climate risks of specific ASM activities.

Future work must prioritise collaborative, transdisciplinary research that brings together climatologists, environmental scientists, economists, and governance experts to co-produce context-specific solutions. Ultimately, the trajectory of ASM in East Africa will be a key indicator of the region's capacity for sustainable and inclusive development. Navigating this complex landscape requires a fundamental shift from viewing ASM solely as a problem to be regulated, to recognising it as a multifaceted socio-economic phenomenon that must be strategically engaged with and steered towards climate-compatible practices for the benefit of both people and the environment.

## Contributions

This study makes a significant contribution by integrating the often-overlooked dimension of climate change into the established discourse on artisanal and small-scale mining (ASM) in East Africa. It provides a novel, comparative analysis of how climate vulnerabilities and adaptation strategies intersect with ASM's economic role and environmental impacts across different regulatory contexts.

The research offers timely, evidence-based insights for policymakers, arguing for the necessity of climate-resilient and context-specific regulatory frameworks. Furthermore, it enriches the field of African Studies by presenting a holistic, regional perspective on a sector of critical socio-economic

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importance, highlighting the urgent need for governance that addresses both sustainable livelihoods and environmental stewardship in a changing climate.

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