UN environment programme

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GLOBAL SAND ANALYSIS SERIES

Sand Policy Review 1: Sierra Leone

Case Study

UNEP/GRID-Geneva

GRID-Geneva is part of the UN Environment Programme (UNEP) Science Division and a member of the Global Resource Information Database (GRID) network. Established by UNEP, the Swiss Federal Office for the Environment, and the University of Geneva in 1985, our mission is to transform data into information and knowledge in support decision making processes related to environmental issues.

About this document

The Global Sand Observatory initiative is UNEP/GRID-Geneva's response to requests to identify knowledge gaps under the UNEA-4 Mineral Resource Resolution (UNEP/EA.4/Res.19). During 2020 and 2021, we reviewed and assessed current terminologies, data classifications, structures, and availabilities as a contribution to orienting future actions on sand, gravel, and crushed rock extraction, transport, and use. **This document is the 1st case study of a series of 3 case study explorations. This analysis will also support academic publications currently in production at UNEP/GRID-Geneva following the UNEA-5 Minerals and Metals Management Resolution (UNEP/EA.5/Res. 12).**

Recommended citation

UNEP/GRID-Geneva. (2023). Sand Resource Policy Review – The Case of Sierra Leone. GSOI-GSA-2022-004. DOI: 10.13097/archive-ouverte/unige:166547

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Layout & referencing style

This document is designed as a digital resource not intended for print. APA style (7th edition) applies for references.

Acknowledgements

This research received funding from the Federal Office of the Environment, Government of Switzerland and from the Sustainable Minerals Institute, University of Queensland.

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Abbreviations

ASM	Artisanal and small-scale mining
EIAs	Environmental Impact Assessment(s)
EPA	Environmental Protection Agency (Of the Republic of Sierra Leone)
EPAA	Environmental Protection Agency Act of 2008 (Of the Republic of Sierra Leone)
FDI	Foreign Direct Investment
ILOSTAT	International Labor Organization Statistics
MMA	Mines and Minerals Act of 2009 (of the Republic of Sierra Leone)
MMMR	Ministry of Mines and Mineral Resources (of the Republic of Sierra Leone)

PIDA	Program for Infrastructure Development in Africa
Sand	The term 'sand' is used in this report to denote sand, gravel, and crushed rock resources generally.
USD	US dollar

Overview

What? Sierra Leone's sand and minerals sector are facing a challenging future outlook. Sand mining is a crucial source of livelihood. Yet, the sector is associated with a range of sustainability issues including coastal erosion, sand mining fuelled by violence and socio-economic tensions within communities: a consistent trend in the mining of the country's sand resources.

In this case study, we describe a complex picture of failed resource governance, with small administrative entities having responsibility for policy implementation and enforcement without adequate human resources and financial capacity. Transitioning towards responsible sand sourcing will ultimately require harmonising Sierra Leone mining and environmental management regulation alongside poverty alleviation objectives.

Why? Identifying current governance initiatives at country, regional and global is needed for effective, equitable and coherent interventions on sand and sustainability challenges. Simultaneously, mapping the stakeholders along sand's value chain is needed to enhance connections and broker a transition to responsible management of sand resources.

This case study frames key governance and regulatory issues in Sierra Leone and considers solutions for sustainably managing sand resources in the Western African context, including the nascent uptake of alternative materials.

Who? The intended audience for this work is analysts and researchers, particularly in Western Africa within policy science government institutions, academic institutions and civil society organizations aiming to support or develop research agendas on the topic of sand and sustainability.

How? We employ desktop research and interviews with Sierra Leone-based practitioners to frame situational elements key in understanding *how* to transition to a responsible sourcing and use of sand resources.

Limitations: While we were able to identify and frame the governance and value chain governing Sierra Leone's sand resources, this case study will benefit from future exchanges with local stakeholders and evaluating substitute materials

Global Sand Analysis Series: The Case of Sierra Leone

1. Introduction

Sand, gravel, and crushed rock (hereafter referred to as 'sand') use has tripled in the last two decades to reach 40-50 billion metric tons/year globally (UNEP, 2014), with demand still growing[1]. This consumption is driving environmental and social sustainability problems that are both local and global given the high number of places affected. Some countries have tailored policies for the sand extractive sector, while others have a more fragmented policy environment[2]. Whether this situation allows for appropriate governance risks of extraction from dynamic environments like coastal, marine, and riverine sufficiently and equitably is however unclear.

1.1 Relevance

UNEA-4 specifically recognised sand's sustainability challenge in terms of its extraction[3] and its use[4] (being the major component of modern infrastructure). UNEA-5[5] emphasises sand's important role and that of technical standards applied to minerals sourced for construction and infrastructure development in post-COVID-19 recovery packages. In supporting this global level discussion, this case study responds to requests from UNEA-5's Mineral Resource Resolution[6] to:

1) Share knowledge and experiences with regards to regulatory approaches, implementation practices, technologies, and strategies.

2) Identify knowledge gaps and policy options and undertake an overview of existing governance initiatives for sustainable management.

3) Enhance connections between stakeholders along the minerals' supply chain.

In facilitating this endeavour, these case explorations identify and frame common challenges and promising solutions essential in brokering a transition to the sustainable and responsible sand sourcing and management[7].

1.2 Case Selection

The Republic of Sierra Leone (henceforth Sierra Leone) is amongst the world's 10 most vulnerable countries to climate-change (USAID, 2016). Mining exacerbates its climatic vulnerabilities, threatening the access and availability of freshwater resources and contributing to deforestation and coastal erosion (Mebratu-Tsegaye et al., 2020).

Regionally, infrastructural development is also driving economic development in West Africa, raising local sand demand.

[1] Refer to (Friot & Gallagher, 2021) for an assessment of global sand stocks.
[2] Refer to (UNEP, 2019) for a review of regulations, public policies, standards and practices regarding sand use and extraction.
[3] Refer to the mineral resource governance resolution (UNEA/EA.4/L.19).
[4] Refer to the sustainable infrastructure resolution (UNEA/EA.4/L.5).
[5] Refer to the report on mineral resource governance's implementation (UNEA/EA.5/L.14)
[6] Ibid.
[7] Refer to (UNEP/GRID-Geneva 2022a) for a review of key terms in the sand and sustainability field.

2. Background

2.1 Country Profile

2.1.1 Rocky Post-conflict Growth

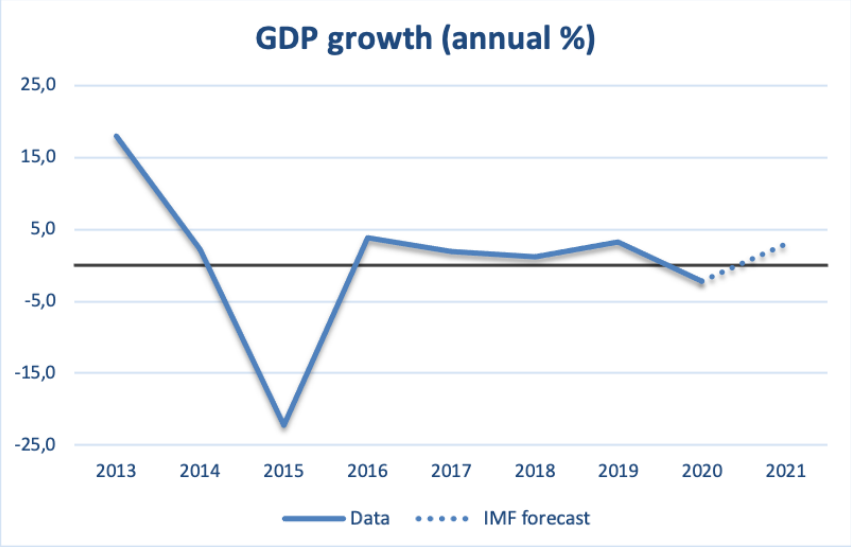
Sierra Leone is a factor-driven economy, heavily dependent on unskilled labour and natural resources. Following volatile economic growth in the country's post-conflict period, its fortunes made a turnaround thanks to its mining sector which recorded an unprecedented 20.7% GDP growth in 2013 (*Figure 1)*. Sierra Leone's economy took a nosedive in 2015, reflecting the twin shocks from Ebola and collapsing international iron ore prices (African Development Bank Group, 2020). With lower commodity prices and declining FDI and tourism revenue resulting from COVID19, the economy contracted another -2.6% in 2020 (World Development Indicators, 2020).

Sierra Leone also faces significant structural challenges. Development is constrained by high infrastructure deficit, weak institutions, low human capacity, high youth unemployment and low economic diversification (African Development Bank Group, 2020).

2.1.2 Unemployment

While total unemployment is falling (*Figure 2),* youth unemployment in Sierra Leone is rising dramatically (*Figure 3*). Sand mining provides an income source and employment for the country's growing number of unemployed young men (Ankenbrand et al., 2021). As one interviewee pointed out: *"It's not a business that makes people wealthy, but it keeps people employed"* (Interviewee 008_UG_20210316_LG, 2021). Like its diamond sector[8], sand mining in Sierra Leone has been driven by poverty and its ability to generate a livelihood for many, including youths, local governments and even the police force who is taking bribes for illegal mining.

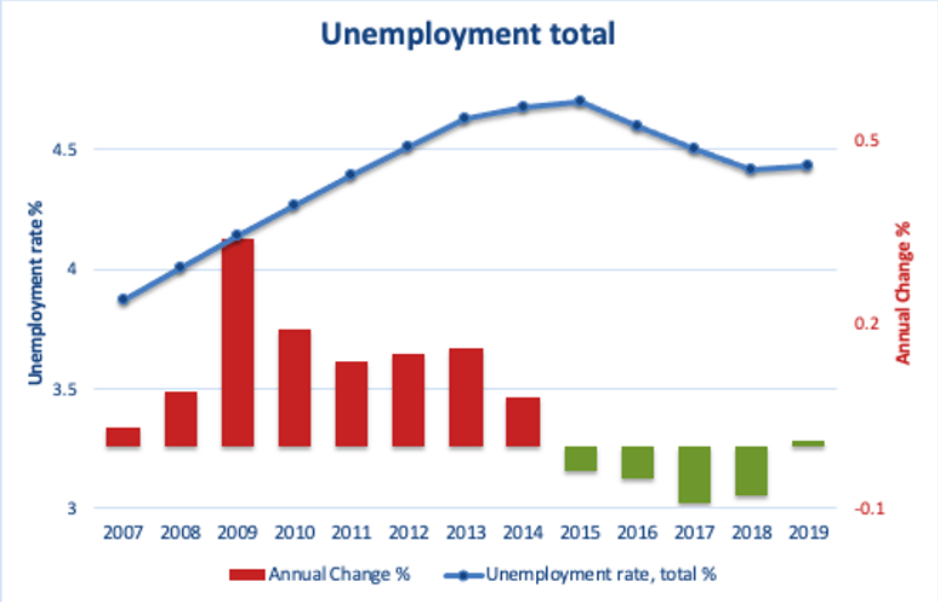
Figure 1: GDP per capita growth (annual %) (2013-2021)



Sources: (IMF, 2021; World Development Indicators 2020)

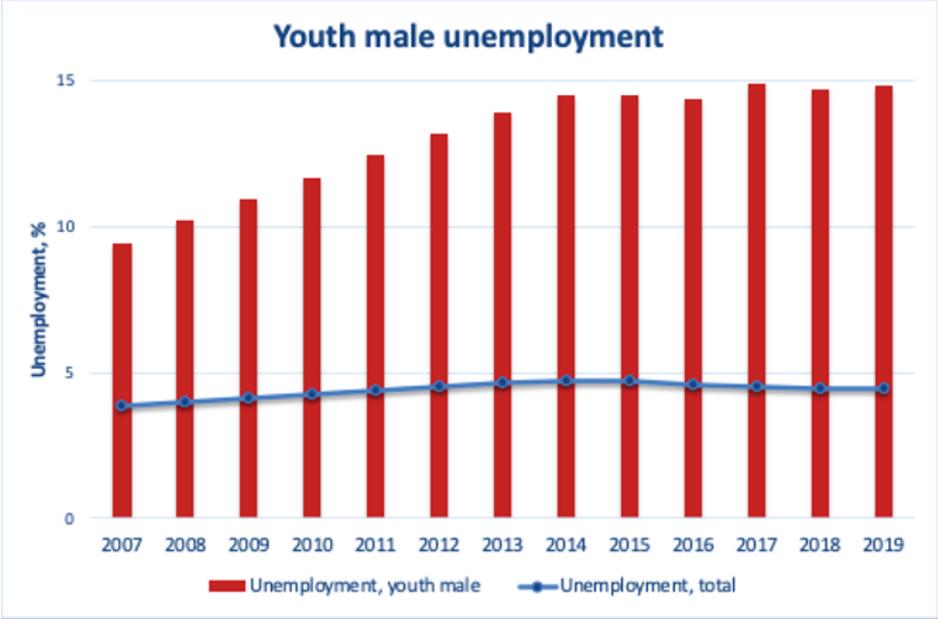
[8] Refer to (Wilson, 2013) for a study of Sierra Leone's diamond mining sector's socio-economic implications, and in particular for youth marginalization.

Figure 2: Unemployment, total (% of total labor force)



Source: (International Labour Organization, 2021a)

Figure 3: Unemployment, youth male (% of male labor force aged 15-24)



Source: (International Labour Organization, 2021b)

2.2 Western Africa's Regional Economic Corridors

2.2.1 Mining for Development

Infrastructural development has been the bedrock of Sierra Leone's post-conflict recovery. This development is largely paid for by its mining sector; expenditure in infrastructure constitutes over 20% of the GDP and the sector directly employs over 30,000 people and another 300,000 indirectly[9].

2.2.2 An Infrastructure-heavy Vision for Development

Sierra Leone's territorial development policy sits within a shared regional strategy in West Africa to address poverty alleviation through improved access to better infrastructure networks and services (African Development Bank Group, 2019)[10]. Initiatives like the African Development Bank's PIDA strategically targets investments in inter-regional energy, transport, water, and sanitation infrastructure to drive human development (Ibid.). Closing this infrastructure deficit is primordial for economic prosperity and has been driving up demand for sand across Western Africa's urban corridors[11].

Country Profile

- **Mining for income:** Sand mining is a poverty-driven activity in Sierra Leone, providing economic livelihood for many, a situation exacerbated with COVID19.
- **Unemployed youth:** Sand mining provides income and employment for many unemployed young Sierra Leonean men.
- **Regional demand in West Africa:** Sierra Leone's development falls within a regional strategy to address poverty alleviation through improved access to infrastructure. This strategy emphasising infrastructure as a means of development drives up sand demand across Western Africa' s urban corridors.

[9] Figures given for 2013; (Department of Commerce, United States of America, 2020)

[10] See (Brenneman & Kerf, n.d.) for a review of how improved infrastructure acts as a catalyst to development and poverty alleviation.

[11] For further work on these dynamics within infrastructural development along Western Africa's urban corridors, refer to (Choplin, 2020).

3. The Present

With Sierra Leone's infrastructural needs in mind, this case study maps the mechanisms governing its sand resources.

3.1 Current Governance

Sierra Leone's formal governance structure has resulted in small administrative entities being responsible for policy implementation and enforcement without adequate human resources and financial capacity. This lack of resources hinders regulatory oversight within the under-resourced EPA and local authorities prioritizing high-value extractives.

The 2004 Local Government Act (Government of Sierra Leone (GoSL), 2004) decentralized the governance of mining to local councils (henceforth referred to as 'local authorities'), creating two issues:

- A reliance by local authorities on mining license fees as income.
- Regulatory confusion as to which governmental agency manages mining licenses.

3.1.1 Rent seeking local authorities

With few alternatives available, Sierra Leone's local authorities derive their income largely from issuing mining licenses. Moreover, little is known about local authorities' licensing processes, extraction volumes and pricing mechanisms.

3.1.2 A tricky licensing processes

One reason underpinning Sierra Leone's challenges in responsibly governing sand mining is the blurry division of responsibilities between national sub-administrative entities. On paper, the Ministry of Mines and Mineral Resources (MMMR) issues mining licenses, a role previously held by the Ministry of Lands and Country Planning. When the specialized Environmental Protection Agency (EPA) was formed, previously a sub-division within the MMMR, this agency started to regulate the extraction of sand resources. However, a shortage of qualified staff (Mason, 2014, p. 20) and EPA's limited mandate made it hard to achieve any meaningful governance.

3.1.3 Contradictory laws

Sierra Leone's natural resources laws are contradictory. Notable laws include the *2009 Mines and Minerals Act* (MMA 2009)[12] and the *2008 Environment Protection Agency Act* (EPAA 2008)[13]. However, in granting a mining license, the MMMR, not the EPA, needs an EIA undertaken as stipulated by the EPAA 2008[14]. While in theory, the environmental provisions of the MMA 2009 reasserts the MMMR's legal superiority, in practice companies have prioritized the EPAA 2008.

[12] (Government of Sierra Leone (GoSL), 2009)
[13] (Government of Sierra Leone (GoSL), 2008)
[14] For a rigorous review of Sierra Leone's 2009 Mines and Mineral Act, refer to: (Mebratu-Tsegaye et al., 2020)

3.1.4 A Regulatory Black Spot for EIAs

One of the most obvious ways that Sierra Leone's legislation distorts the provision and implementation of sectoral mining laws is the implementation of the very EIA process. While EIAs are mandatory for large-scale sand extraction from lakes, rivers, and beaches (Department of Commerce, United States of America, 2020), the legislation is either insufficient and/or not enforced adequately by local authorities due to corruption, absence of monitoring, and/or lack of resources to prosecute offenders. Moreover, the growing artisanal and small-scale mining (ASM) sector does not require EIAs. Sierra Leone's sand governance is therefore marked by contradictory policies and failed property rights.

Characterizing Sierra Leone's sand governance

- **Decentralization** has led to local authorities' reliance on mining license fees as income. Little is known about local authorities' licensing processes, the extraction volumes and sand's pricing.
- **Sierra Leone's two main natural resources laws** (EPPA & MMA) are contradictory, leading to confusion as to which law gives legal superiority in undertaking EIAs for sand mining.
- **While EIAs are mandatory for sand extraction from lakes, rivers and beaches, the legislation is currently insufficient and/or not enforced adequately** by local authorities due to corruption, absence of monitoring, and/or lack of resources to prosecute offenders.

3.2 Sierra Leone's Resource Regime

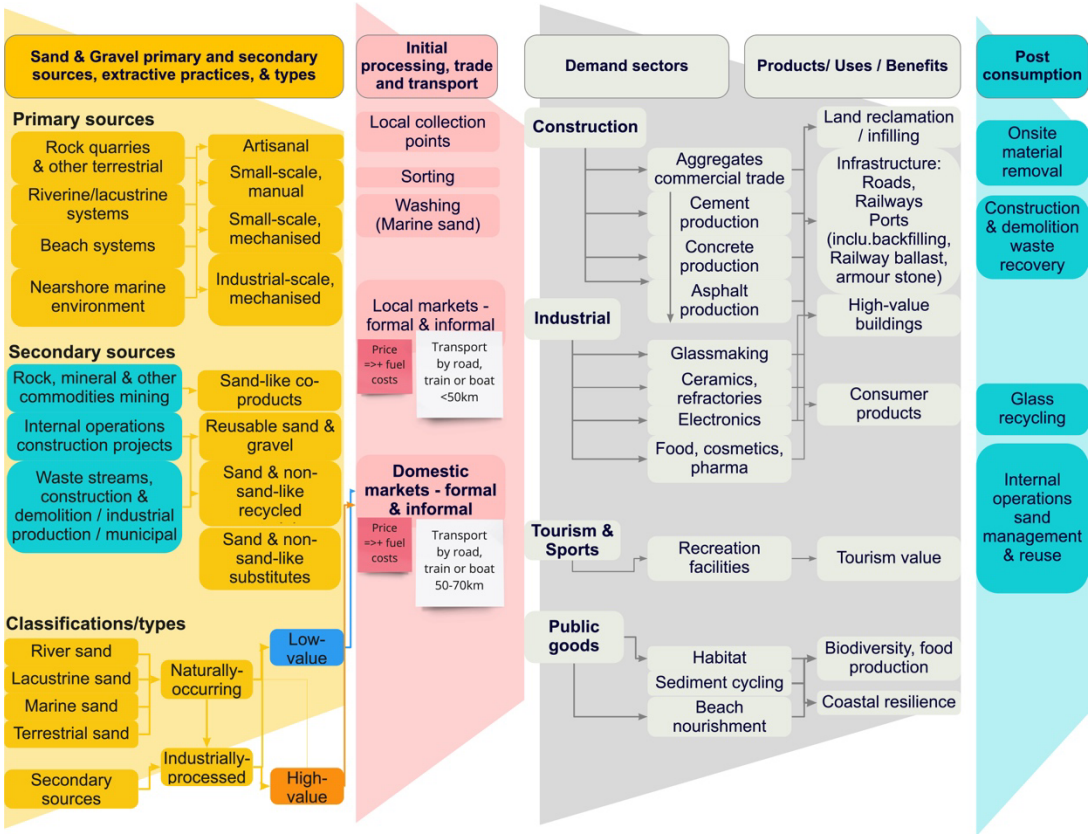
To capture the interplay between the institutional and political dimensions of sand resource governance, we map its value chain (Figure 4).

3.2.1 Value Chain

This value chain serves as a diagnostic tool to map the policy options and trade-offs in the management of Sierra Leone's sand. By doing this, we:

- Characterize the different types of sand resources.
- Distinguish between resource users.
- Highlight the institutions governing their actions

Figure 4: Sierra Leone's sand value chain



Source: (Authors' Compilation 2021)

Primary & secondary sourcing: At artisanal scale, sand is sourced from nearshore rivers and beach systems. Larger-scale extraction occurs along coastal sites.

Processing, trade, and transport: Once processed, sand is transported by trucks to construction areas 50 to

70 km away through a well-organized, albeit informal, network. Every truck driver charges approximately 200 USD per 10 tons of sand that is transported. This sand is rarely stockpiled.

Demand: Sand extraction feeds local construction, in particular for cement and concrete production for roads.

However, sand also serves in the tourism sector, as one activist

emphasized that sand is also used in the construction of mansions for foreigners[15].

Demand from neighboring Guinea is growing as its glass manufacturing industry grows, raising the question whether export restrictions should be imposed to manage sand demand[16]. Tellingly, Sierra Leone's sand prices increased from around 25 USD per ton in 2012 to 200 USD in 2021 (Ibid.).

3.2.2 Simple Resource Regime

This value chain underscores that the sustainable management of sand lies

[15] (Interviewee 008_UG_20210316_LG, 2021)

[16] (Interviewee 003_UG_20210303_LG, 2021)

in the hands of numerous institutions and actors. To capture their relationship, we draw on institutional resource regime studies (Gerber et al., 2020) to highlight the formal and informal rules governing sand resources' extraction, originating from public policies and the property-rights system. In this process, we stress the uncoordinated distribution of usage rights.

As interviews revealed, efforts to regulate sand by controlling usage increased rivalries between users in Sierra Leone. This situation is compounded by incoherent property rights and policies.

For one, there are more entitled claimants for sand extraction than stocks estimated available. This incoherence is made worse by contradicting policies governing use and protection, and do not restrict land usage rights. Tellingly, local village chiefs informally oversee sand mining.

This lack of coherent policies and property rights governing sand mining and local authorities' behavior aggravates sand's over-exploitation.

As a *simple resource regime*, this regime primordial *raison d'être* is neither the protection of sand nor controlled access, but the guarantee of long-term economic use.

3.3 Stakeholder Analysis

To capture this fragmented governance, we map how actors are integrated into the value chain. Who are the influential stakeholders, what are their interests and how do they leverage their *power* in brokering a transition[17]? In this process, we identified elements of 'responsible sand sourcing, barriers to change and drivers of perceived deficiencies[18]. Further research on stakeholders involved in sand governance would be valuable[19], especially when assessing a natural resource not (only) characterized by centralized decision-making (Ostrom, 1990; Pretty & Ward, 2001).

3.3.1 Stakeholder classification

We classify stakeholders by their decisional level along the vertical axis and involvement in the sand value chain (Table 1).

[17] Recent systematization has provided a typology of stakeholder analysis methods (Reed et al., 2009)

[18] A stakeholder analysis seems particularly suitable for this research underscoring the multi-actor character of sand extraction which transcends hierarchical boundaries.

[19] Refer to (Lienert, 2013) as example.

Table 1: Stakeholders in Sierra Leone's sand governance

Stakeholder	Decisional level	Value chain stage
MMMR	National	Transversal/centralised
EPA	National	Transversal/centralised
Extraction & construction companies	Global	Primary source; Secondary sources; Initial processing, trade, and transport
Local authorities	Local	Primary source; Initial processing, trade, and transport
Village chiefs	Local	Primary sources; Initial processing, trade, and transport
Artisanal mining community	Local	Primary sources; Initial processing, trade, and transport
Foreigner community	Local	Demand sectors & uses

Source: (Authors' compilation, 2021)

MMMR & EPA are amongst Sierra Leone's main regulatory bodies, managing EIAs.

Local authorities: Decentralization and informal networks accentuated their power in managing sand, especially in coastal mining sites.

Village chiefs influence the licensing process, approve extraction quantity and on-site pricing. Their power is underscored by Sierra Leone's distinction between ownership of land surface rights and the rights over the minerals beneath them. Whereas all minerals are state-owned, surface rights are owned by land-owning families, with village chiefs acting as custodians of these lands[20].

Artisanal communities of young miners and truck drivers' control (the often illegal) sand extraction. This informal network operates on a '24/7' basis, communicating through WhatsApp.

3.3.2 Stakeholders' Power

Sierra Leone's sand governance is characterized by vertical fragmentation, with minimal collaboration between stakeholders.

Important stakeholders:

- Village chiefs and local authorities at sourcing stages are of primary importance.
- Although the national stakeholders in Sierra Leone set indispensable strategic goals, local authorities are powerfully integrated into the sand sourcing and trading processes.

Represented interests: Interests are largely local and short-term (e.g.: "make a profit"), rather than driven by longer-term sustainability objectives

[20] A trend recurrent in Sierra Leone's mining industry. Refer to (Conteh, 2017) for example.

(e.g., intergenerational equity and/or integrated planning).

Characterizing Sierra Leone's resource regime

- **Sand sourcing:** Larger-scale sand extraction occurs along coastal sites, hiring young men attracting by the cash-in-hand job.
- **Sand demand:** Sand extraction feeds local construction, namely cement and concrete used in roads. The tourism sector and the construction of mansions for foreigners is another important driver.
- **Regulatory incoherencies:** The lack of coherent policies and property rights governing sand extraction among mining communities and local authorities aggravates sand's over-exploitation.

4. Future Outlook

In brokering a just transition to circular economy solutions for sand consumption and production, we evaluate Sierra Leone's future outlook, including substitute materials[21] and policy options.

4.1 Substitute Materials

In terms of resource substitution, Sierra Leone is experimenting with several materials (Table 2)

Table 2: Potential Substitute Materials in Sierra Leone

Material	Stage
Bauxite mining tailings	• Bauxite companies in Sierra Leone are conducting preliminary research on the restoration of mining tailings.
Clay earth bricks	• Used extensively in rural areas for public housing and residential construction. • Applied as plaster on buildings. • A promising alternative given cement's high cost for lower-income households. • Challenge: not easily procured for urban construction sites.

Source: (Authors' compilation, 2021)

However, uncertainties remain around these substitutes' technical and economic viability. Barriers[22] to adoption at scale include:

Compatibility: Unlike clay, concrete has a strong appeal with both urban and rural communities with its architectural 'clean' design.

Relative advantage over status quo: For one, Sierra Leone is locked into a path dependency situation with the MMMR's long-term bauxite exploitation agreements and resulting tailings. Another factor limiting an interest in substitutes to naturally occurring sand[23] is cost. Reducing the high cost of alternative materials is essential, namely through pilot tests.

Trialability: Few opportunities to test alternative materials.

Observable results: Lack of demonstrations in practice showcasing these materials' safety and performance.

4.2 Robust and effective institutions

Drawing on (Bennett & Satterfield, 2018)'s framework for governance analysis and evaluation, we suggest action points for improving this finite and non-excludable resource's

[21] By substitute materials, we refer to by-products of economic activities that displace the use of sand sourced from the natural environment.

[22] We use (Kapoor et al., 2014)'s innovation adoption framework to capture a set of interrelated hypotheses for what will influence adoption of substitute materials in accordance with motivations.

[23] For a review of the definitions of sand, refer to (UNEP/GRID-Geneva, 2022b).

management. Given sand's localized nature, any capacity-building intervention should adopt a regional, rather than global scale of action.

4.2.1 Strengthen mining & EIA regulations

A comprehensive EIA framework integrated into Sierra Leone's mining law is essential to manage the environmental effects arising from sand mining. This requires:

Expanding EIA's scope of action to include an assessment of sand mining's implications for water use, GHG emissions, waste, and soil erosion.

Improving oversight across the EIA process, namely by harmonising Sierra Leone's mining regulations, and coordinating the MMMR's and EPA's planning processes.

4.2.2 Formalisation

Formalizing Sierra Leone's ASM sector could help overcome planning barriers, through better vertical collaboration between mining communities, local authorities, and central-level ministries. The resulting stronger regional planning can enhance livelihoods, improve working conditions in sand mines and ensure benefits derived from ASM are directed to local communities[24].

4.3 Technology transfer

Regional frameworks for capacity-building and best practices should go together with mapping and monitoring technologies. Technology transfer is a promising resource substitution strategy in reducing river and marine sand extraction and simultaneously providing an income source[25]. Indeed, a total ban on sand mining would be highly disruptive to the country's economy. "*If we don't have alternatives for people dependent on this as a livelihood, and as a source of business, we will have a backlash*" [26] (Researcher, Sierra Leone).

Evaluating alternatives: What is possible?

- **Clay earth bricks** are used for residential rural construction purposes. However, a lack of observable results and high costs limits their use in urban construction.
- **Robust & effective institutions:** A comprehensive EIA framework integrated within Sierra Leone's mining laws is essential for managing the environmental effects arising from sand mining. This requires expanding EIAs' scope of action and improving oversight.

[24] Research has demonstrated that formalizing ASM - a generally low-tech, labor-intensive mineral processing and extraction sector - could help governments in sub-Saharan Africa meet development targets. See (Maconachie & Conteh, 2021)

[25] (Interviewee 001_UG_20210223_LG, 2021)

[26] (Interviewee 003_UG_20210303_LG, 2021)

References

African Development Bank Group. (2019, April 18). Programme for Infrastructure Development in Africa (PIDA) [Text]. African Development Bank - Building Today, a Better Africa Tomorrow; African Development Bank Group. https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/programme-for-infrastructure-development-in-africa-pida

African Development Bank Group. (2020). Republic of Sierra Leone, Bank Group Country Strategy Paper 2020-2024 (West African Region).

Ankenbrand, C., Welter, Z., & Engwicht, N. (2021). Formalization as a tool for environmental peacebuilding? Artisanal and small-scale mining in Liberia and Sierra Leone. International Affairs, 97(1), 35–55. https://doi.org/10.1093/ia/iiaa199

Bennett, N. J., & Satterfield, T. (2018). Environmental governance: A practical framework to guide design, evaluation, and analysis. Conservation Letters, 11(6), e12600. https://doi.org/10.1111/conl.12600

Brenneman, A., & Kerf, M. (n.d.). Infrastructure and Poverty Alleviation, A Literature Review. International Labour Organisation, 122. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_policy/---invest/documents/publication/wcms_asist_8281.pdf

Choplin, A. (2020). Matière grise de l'urbain. La vie du ciment en Afrique. Métis Presses.

Conteh, F. M. (2017). Politics, development and the instrumentalisation of (de)centralisation in Sierra Leone. Review of African Political Economy, 44(151), 30–46. https://doi.org/10.1080/03056244.2016.1267618

Department of Commerce, United States of America. (2020, September 29). Sierra Leone—Mining and Mineral Resources [Government website]. http://www.trade.gov/country-commercial-guides/sierra-leone-mining-and-mineral-resources

Friot, D., & Gallagher, L. (2021). An early exploration of data and knowledge availability for sand resources status. Part 1. Identification of sand data and knowledge gaps: Setting priorities for further research (Technical report GSOI-GSA-2021-001.P1). UNEP/GRID- Geneva.

Gerber, J.-D., Lieberherr, E., & Knoepfel, P. (2020). Governing contemporary commons: The Institutional Resource Regime in dialogue with other policy frameworks. Environmental Science & Policy, 112, 155–163. https://doi.org/10.1016/j.envsci.2020.06.009

Government of Sierra Leone (GoSL). (2004). The Local Government Act, Vol. CXXXV, No. 14. The Sierra Leone Gazette, Sierra Leone. http://extwprlegs1.fao.org/docs/pdf/sie89633.pdf

Government of Sierra Leone (GoSL). (2008). Environmental Protection Agency Act. Vol. CXXXIX, No. 44. The Sierra Leone Gazette. https://unipsil.unmissions.org/sites/default/files/old_dnn/20088environ_protectn_agency.pdf

Government of Sierra Leone (GoSL). (2009). The Mines and Minerals Act. Vol. CXLI, No. 3. The Sierra Leone Gazette, Sierra Leone. http://www.sierra-leone.org/Laws/2009-12.pdf

International Labour Organization. (2021a). Unemployment, total (% of total labor forced) (modelled ILO estimate)—Sierra Leone. ILOSTAT database, The World Bank. https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=SL&name_desc=true

International Labour Organization. (2021b). Unemployment, youth male (% of male labor force ages 15-24) (modeled ILO estimate)—Sierra Leone. ILOSTAT database. The World Bank. https://data.worldbank.org/indicator/SL.UEM.1524.MA.ZS

Interviewee 003_UG_20210303_LG. (2021, March 3). [Personal communication].

Interviewee 008_UG_20210316_LG. (2021, March 16). [Personal communication].

Kapoor, K. K., Dwivedi, Y. K., & Williams, M. D. (2014). Rogers' Innovation Adoption Attributes: A Systematic Review and Synthesis of Existing Research. Information Systems Management, 31(1), 74–91. https://doi.org/10.1080/10580530.2014.854103

Lienert, J. (2013). Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. Journal of Environmental Management, 15. https://doi.org/10.1016/j.jenvman.2013.03.052

Maconachie, R., & Conteh, F. (2021). Artisanal mining policy reforms, informality and challenges to the Sustainable Development Goals in Sierra Leone. Environmental Science & Policy, 116, 38–46. https://doi.org/10.1016/j.envsci.2020.10.011

Mason, N. H. (2014). Environmental governance in Sierra Leone's mining sector: A critical analysis.

Resources Policy, 41, 152–159. https://doi.org/10.1016/j.resourpol.2014.05.005
Mebratu-Tsegaye, T., Toledano, P., & Thomashausen, S. (2020). A Review of Sierra Leone's Mines and Minerals Act. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3726420
Ostrom, E. (1990). Governing the commons: The evolution of institutions for collective action. Cambridge University Press.
Pretty, J., & Ward, H. (2001). Social Capital and the Environment. World Development, 29(2), 209–227. https://doi.org/10.1016/S0305-750X(00)00098-X
Reed, M. S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C. H., & Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. Journal of Environmental Management, 90(5), 1933–1949. https://doi.org/10.1016/j.jenvman.2009.01.001
UNEP. (2014). Sand, rarer than one thinks. Environmental Development, 11, 208–218. https://doi.org/10.1016/j.envdev.2014.04.001
UNEP. (2019). Sand and Sustainability: Finding new solutions for environmental governance of global sand resources. GRID-Geneva, United Nations Environment Programme.
UNEP/GRID-Geneva (2022a). Sand and sustainability terminology. Technical report GSOI-GSA-2022-003. DOI: 10.13097/archive-ouverte/unige:160293.
UNEP/GRID-Geneva (2022b). What is sand? Result from a UNEP/GRID-Geneva expert discussion. Technical report GSOI-GSA-2022-002. DOI:10.13097/archive-ouverte/unige:160291
Mineral resource governance, L.19 EA.4 § 4/19 (2019). https://wedocs.unep.org/bitstream/handle/20.500.11822/28501/English.pdf?sequence=3&isAllowed=y
Sustainable Infrastructure, L.5 EA.4 § II/A (2019). https://wedocs.unep.org/bitstream/handle/20.500.11822/28470/English.pdf?sequence=3&isAllowed=y
Progress in the implementation of resolution 4/19 on mineral resource governance, L.14 EA.5 § 2/1 (2020). https://wedocs.unep.org/bitstream/handle/20.500.11822/34654/K2002669-E.pdf?sequence=1&isAllowed=y
USAID. (2016, August). USAID Fact Sheet: "Climate Change Risk Profile: Sierra Leone." https://www.climatelinks.org/resources/climate-risk-profile-sierra-leone
Wilson, S. A. (2013). Diamond exploitation in Sierra Leone 1930 to 2010: A resource curse? GeoJournal, 78(6), 997–1012. https://doi.org/10.1007/s10708-013-9474-1
World Development Indicators. (2020). GDP per capita growth (annual %)—Sierra Leone | Data. The World Bank. https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?end=2019&locations=SL&start=2007