

GLOBAL SAND ANALYSIS SERIES

Sand Policy Review 2: Kenya

Case Study

About 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.



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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 2nd 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).**

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Abbreviations

CSOs	Community based organization(s)
GDP	Gross Domestic Product
EIAs	Environmental impact assessments
EIAAR	Environmental Impact Assessment and Audit Regulations (of the Republic of Kenya)
EMCA	Environmental Management and Coordination Act (of the Republic of Kenya)

HPC	High-performance concrete
NEMA	National Environmental Management Authority (of the Republic of Kenya)
Sand	The term ‘sand’ is used in this report to denote sand, gravel, and crushed rock resources generally.
USD	US dollar

Overview

What? This case study examines Kenya's sand and gravel resources, highlighting national and sub-national policies, best practices and solutions currently implemented. In this process, we identify innovations that can alter the path dependencies in current the country's sand extraction and use.

In this case study, we map a rich picture of sand resource governance, with strong inter-regional diversities between the Nairobi and Mombasa regions, both in their regulatory framework and the market maturity for alternatives materials. In this vein, we highlight a promising substitute material, namely rock dust which is already displacing river sand as a default component in Kenya's concrete's production.

In parallel, we put forward a bright example of sand governance in a Kenyan county, showing foresight in what sand's regulated management could resemble. Recognizing the environmental issues arising with river sand mining. Makueni County adopted a mixture of sub-national and national regulations to regulate local sand mining. Simultaneously, the county relies on local communities to monitor and assess its scarce sand reserves.

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

This case study frames key governance and regulatory issues in Kenya and considers solutions for sustainably managing sand in the Eastern African context, including the integration of rock dust into concrete production and usage.

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

How? Through desktop research and by engaging with Kenyan practitioners, we synthesize the latest thinking and developments in Kenya's sand governance. This engagement helped identify rules governing Kenya's sand extraction and use, a potential substitute material and the economic actors needed to drive a paradigm shift.

Limitations. While we were able to identify and frame the governance and value chain governing Kenya's sand and gravel resources, this case study will benefit from further exchanges with local stakeholders in evaluating substitute materials.

1. Introduction

Sand, gravel, and crushed rock (hereafter referred to as ‘sand’) use has tripled the last two decades to reach 40-50 billion metric tons/year globally (UNEP, 2014), with demand still growing¹. 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 environment². 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 recognized sand’s sustainability challenge in terms of its extraction³ and its use⁴ (being the major component of modern infrastructure). UNEA-5⁵ emphasizes the important role and 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 Resolution⁶ to:

increased soil erosion (Padmalal & Maya, 2014; USAID, 2018; UNEP 2022). This is particularly problematic for arid regions dependent on agriculture for local livelihood.

- 1) Share knowledge and experiences regarding regulatory approaches, implementation practices, technologies, and strategies.
- 2) Identify knowledge gaps and policy options and undertake an overview of existing governance initiatives for its sustainable management.
- 3) Enhance connections between stakeholders along the minerals’ supply chain.

In facilitating this endeavor, these case studies identify and frame common challenges and promising solutions, essential in brokering a transition to the sustainable and responsible sand sourcing and management⁷.

1.2 Case Selection

The Republic of Kenya (henceforth Kenya) faces dire climatic challenges, triggered namely by river sand mining. Sand mining in riverbeds leads to a myriad of environmental problems, including reduced water availability, dried out boreholes and

Simultaneously, system-scale changes are in play with Eastern Africa’s LAPSSAT infrastructure project (Government of the Republic of Kenya, n.d.), driving Kenya’s economic development and providing an output for its locally sourced sand.

¹ See (Friot & Gallagher, 2021) for an assessment of global sand stocks.

² Refer to (UNEP, 2019) for a review of regulations, 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 Water Scarcity

Kenya's scarce water resources are under strain from population growth, drought and changing precipitations. Water scarcity is further stressed by sand mining (USAID, 2018). Sand in Kenya is predominantly sourced from rivers, dating back to the early 1950s. Yet, river sand mining puts pressure on water resources availability and quality, a worrying situation given the country's reliance on surface water.

2.2 Economic Profile

2.2.1 Mineral Wealth

Kenya's economy is amongst Africa's most diversified non-resource-based economies, with the extractive sector contributing only around 1% of GDP (Government of the Republic of Kenya, 2016). Despite this limited contribution, Kenya's extractive sector is forecasted to increase 4 to 10% in the coming years (Ibid.), driven by new minerals' discoveries, renewed government interest and upcoming geological surveys. Minerals found in Kenya include namely: sand, gravel, crushed stones, and slag. Unsurprisingly, Kenya seeks to position itself as an investment and export hub for East Africa's mining sector (Ibid.).

2.2.2 Infrastructure-Powered Development

These export ambitions speak to Kenya's national emphasis on infrastructure as a pillar in its long-term development strategy⁸. The flagship LAPPSET infrastructure project fits within this ambition to transform Kenya into an industrialized country by 2030. The project aims to connect Eastern African through a transport corridor spanning Ethiopia,

Kenya, and South Sudan (Government of the Republic of Kenya, 2016).

Kenya's infrastructure-powered development goes in hand with rapid urbanization and a boosted construction industry. These trends fuel demand for sand extraction in rural Kenya, not least with the proximity of large-scale infrastructure projects like the Mombasa-Nairobi highway.

2.2.3 Post Covid-19 Recovery Impact

For large-scale sand extraction: Covid-19 reinforced a government interest in infrastructure-led economic recovery. This demand sends a positive signal to the construction industry, further raising sand demand.

For artisanal and small-scale sand extraction: With the loss of tourism-related jobs, artisanal scale sand mining risks serving as a cash-in-hand supplement for lost income among lower-income Kenyan households (Perks & Schneck, 2021). We foresee that this switch to sand mining is particularly likely to take place in areas with a depressed tourism industry and large sand reserves, like the Mombasa region.

2.3 Social Issues

Sand extraction and its trade are fueling a myriad of social issues in Kenya, with violence and deaths related to sand trade widely documented ((Constable, 2017); (Beiser, 2017)).

Incentivized by the easy money and low barriers to entry, high school dropouts often engage in sand mining as a cash-in-hand activity. As one senior Kenyan civil

⁸ Refer to Kenya's national development Plan labelled Vision 2030. (Government of the Republic of Kenya, 2008)

servant observed, “*All you need is a spade*”⁹. Consequently, deteriorating security, teenage pregnancies, alcohol, and drug abuse are on the rise amongst among local Kenyan communities.

3. The Present

With Kenya’s infrastructural ambitions in mind, we map the mechanisms governing sand in this East African country.

3.1 Current Governance

Following Kenya’s decentralization in 2010 (County Governments Act, 2012), sand’s management has fallen under sub-national County Governments’ mandate. Like in other cases of decentralized governance, revenue generation, through namely mining and quarrying license fees, remains these sub-national authorities’ priority.

3.2 Incoherent Regulatory Framework

An incoherent regulatory framework characterizes sand’s governance in Kenya, with no effective authoritative institution to manage the resource along its value chain.

No bans are in place on sand extraction, except for one sub-national county. As a senior civil servant¹⁰ noted: “*all you need to do is pay*”.

Up until the enactment of the Mining Act in 2016 (The Mining Act, 2016), colonial-era mining legislation governed Kenya’s mineral extractive sector and the licensing process. This most recent legislation categorizes mining operations between large, small, and artisanal scale, and regulates these across the entire value

chain.¹¹ The Mining Act makes two noteworthy contributions:

- 1) Obtaining a mining license is mandatory for large-scale sand extraction from terrestrial and marine surfaces. However, artisanal scale mining remains outside of the Mining Act’s scope.
- 2) The Mining Act makes provisions for County Government’s formalized involvement in the provision and management of sand mining licensing operations, surface rights and operators. However, the Mining Act fails to identify how these County Governments will receive sufficient staff and funding to monitor sand extraction activities (KPMG, 2016).

3.3 Poorly Implemented EIAs

Any sand mining prospecting and processing activity in Kenya should by law, undergo an EIA to receive a license. These activities are coordinated by Kenya’s National Environmental Management Authority (NEMA) as per the Environmental Management and Coordination Act (EMCA, 1999) and its subsidiary legislation, the Environmental Impact Assessment and Audit Regulations act (EIAAR, 2003). However, gaps within Kenya’s regulatory framework makes EIAs an opaque auditing process. We identify the challenges plaguing Kenya’s EIAs process in the context of sand.

3.3.1 Limited public participation

Barriers remain high to public participation in the EIA awarding process, especially among affected communities impacted by sand mining. Barriers include insufficient available information and lack of awareness of the public’s role and rights in the EIA drafting, monitoring and compliance phases (Okello et al., 2009). Yet, local communities often hold

⁹ (Interviewee 006_UG_20210308_LG, 2021)

¹⁰ (Interviewee 006_UG_20210308_LG, 2021)

¹¹ For a more extensive review of Kenya’s licensing regime within its mineral sector, please refer to (Transparency International Kenya, 2017).

important information about sand mining sites' ecological and biodiversity outlook.

Consequently, these communities are unable to question EIAs' validity, an issue if these assessments don't provide sufficient rehabilitation measures. One Kenyan natural resources management expert¹² confirmed that, with currently poor public participation, rehabilitation work rarely follows in Kenya's land-based sand mining projects.

3.3.2 Corruption

EIAs are most often undertaken by private contractors hired by mining companies, rarely addressing the true extent of environmental degradations associated with these sand mining projects¹³.

This lack of verification of EIAs' accuracy is further compounded by reports of corruption incidents in the licensing award process. NEMA, whose role is to review these EIAs, often faces interference from public servants seeking bribes and threatening to delay and/or block the project (Transparency International Kenya, 2017). These capacity gaps within Kenya's very institutions mandated to govern EIAs, land use and mining permit hinders any forms of responsible sand governance.

3.4 Makueni County: An Advocate for Responsible Sand Governance

One sub-national example with an integrated policy and legal framework to oversee sand activities is the case of Makueni County. Makueni is the first and only county in Kenya to regulate sand, setting a high standard for responsible sand governance.

Artisanal scale sand mining has historically been amongst the economic bedrock of Makueni County, with young people dropping out of school to work in the County's informal sand extractive industry. Unrestricted sand mining widely contributed to dried riverbeds and water scarcity, school dropouts, teenage pregnancies, increased criminality, and alcohol-related violence (Environment Justice Atlas, 2018).

3.4.1 Regulatory Arrangements

However, following strong citizen-led protests and calls for clamp-down on this open-access sand mining in some parts of the County, the Makueni County Sand Conservation and Utilization Authority (henceforth the Sand Authority), was appointed under the Sand Conservation and Utilization Act 2015¹⁴. The Act provides for a legal framework targeting exclusively sand utilization, i.e., the removal, extraction, harvesting of sand from sites and restoration of degraded sites¹⁵. This is operationalized through a dedicated government agency and a County Sand Conservation Fund.

3.4.2 Responsibilities

Ban: sand extraction destined for utilization outside the county. As of writing, this sub-national export ban is still in place, with mining allowed exclusively for sand used within the county.

Licensing and registration of sand utilization activities: The Sand Authority manages the mandatory EIA process and designates authorized extraction sites. Concessions depend on the volume of sand extracted and only applies to sand mining

¹² (Interviewee 011_UG_20210416_JL, 2021)

¹³ An issue also documented by (Kahonge, 2015)

¹⁴ (Makueni County Sand Conservation and Utilization Act, 2015). The official mandate of the Act is "to regulate and to ensure sustainable conservation and utilization of sand and to provide for protection of the environment and equitable

sharing of the accruing benefits and for connected purposes" page 3.

¹⁵ Refer to the (Government of Makueni County, 2016). <https://makueni.go.ke/sand-authority/>

above two tons. Anything under two tons of sand is not subject to licensing. One reason for this volume threshold is to ensure that local communities can still access sand for residential construction purposes.

Manage revenue and restoration projects: 50% of revenues derived from authorized sand extraction activities feed into the Sand Authority's restoration and conservation activities. This includes sand dams in rivers zones previously exposed to environmental damage resulting from sand extraction.

3.4.3 Community Component

The Sand Authority's participatory committee is composed of civilians from various interest groups, who monitor sand deposits across the County. This committee namely identifies sites suitable for sand extraction and reports to the Sand Authority on suspicious and unauthorized sand activities. Their awareness raising helps demonstrate to communities the benefits of regulated sand extraction (e.g.: access to better water quality, reduced risks of drought, stable employment, social cohesion etc.).

3.4.4 Results

Following the Sand Authority's enactment, violent conflicts over control and access to sand resources and school dropouts to join sand harvesting reduced. Water availability and riparian vegetation (e.g., reed) increased, facilitating the uptake of small-scale agribusiness in the region's riparian land again.

The Makueni County's strategic integration of policy and legal frameworks is implemented but faces significant challenges. The lack of a coordinated and mutually reinforcing approach between Kenya's sub-national government institutions limits the socio-economic and environmental benefits achieved from regulating sand mining in Makueni County. Given sand's transboundary nature spanning riverbeds and basins well beyond Makueni County's geographical borders, it is essential that sub-national government institutions' actions are compatible and complementary to achieve sustainability goals.

Makueni County's Sand Authority's responsibilities:

- **Bans** sand extraction for use outside of the county. With full ownership of both terrestrial and marine sand, the Authority also designates and bans extraction in environmentally sensitive areas.
- **Licensing & registration of sand activities** are allocated based on the volume and intended usage of sand.
- **Revenue management:** from concessions serve for rehabilitation & conservation activities (e.g.: sand dams in rivers zones).

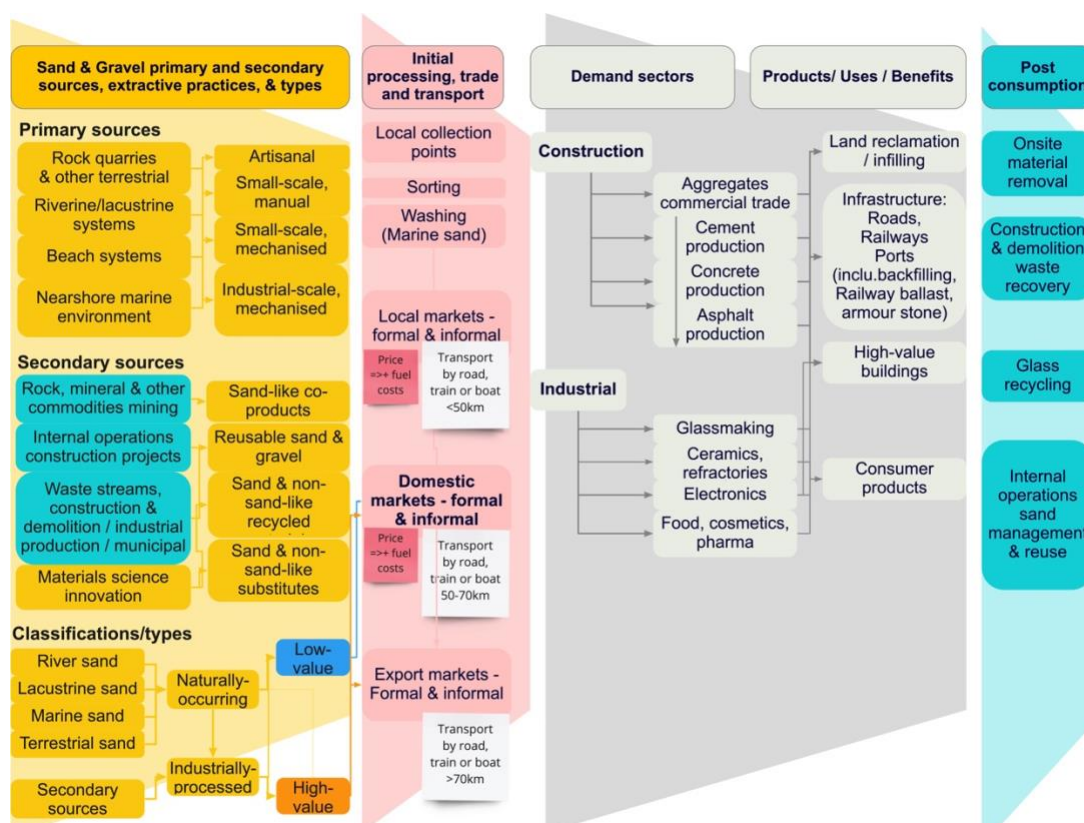
4. Regime

4.1 Value Chain

A value chain framework helps characterize the different sand

resource users, highlighting the institutions governing their actions (Figure 1).

Figure 1: Kenya's sand value chain



Source: (Authors' compilation 2021)

Primary & secondary sourcing: River sand is extracted at artisanal scales, often on an unregulated basis. Sand is also extracted from marine and beach ecosystems in the Mombasa area at industrial scale.

Processing, trade, and transport: Kenya has an abundance of minerals materials, but a poor road network for

its transport. Road networks connecting rural and urban areas have drastically improved, yet land-based sand quarries remain geographically isolated. These connectivity issues, compels construction

companies to continually stock up on their resources.

Geographical disparities also apply. In the Mombasa area, sand extracted travel travels between 45 to 56 km, whereas in Nairobi, this falls to 13 to 40 km.

Demand: Sand mainly serves in construction, including concrete production for roads and high-value buildings.

4.2 Simple Resource Regime

This value chain (Figure 1) underscores that the responsible management of sand

lies 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. This framework help stress the uncoordinated distribution of usage rights for sand.

The regulatory regime governing Kenya's sand resources and its related goods and services are in place, yet it is incoherent. The resource regime is characterized by poorly defined property rights and complicated procedures for community participation in sand mining projects' assessment and monitoring. This incoherence in both property rights and policies limits regulated and controlled access.

Simultaneously vertical fragmentation characterizes Kenya, with limited collaboration between county and national level stakeholders.

4.3 Stakeholder Analysis

To capture this fragmented governance, we map how actors are integrated into Kenya's value chain. Who are the influential stakeholders, what are their interests and how do they leverage their power in brokering a transition¹⁶? In this process, we identified elements of 'responsible sand sourcing, barriers to change and drivers of perceived deficiencies¹⁷.

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

¹⁶ Recent systematization has provided a typology of stakeholder analysis methods (Reed et al., 2009)

¹⁷ A stakeholder analysis seems particularly suitable for this research underscoring the multi-actor

character of sand extraction which transcends hierarchical boundaries.

Table 1: Stakeholders in Kenya's sand governance

Stakeholder	Decisional level	Value chain stage
Ministry of Mining	National	Transversal/centralized
NEMA	National	Transversal/centralized
County Governments	Sub-national	Primary source. Initial processing, trade, and transport
Private companies (mining, construction)	International	Transversal/centralized
Masons & quarry owners	Sub-national	Primary source. Initial processing, trade, and transport
Sand cartels	Local	Primary source. Initial processing, trade, and transport
CBOs	Local	Primary source. Initial processing, trade, and transport
Local communities	Local	Transversal/centralized

Source: (Authors' compilation, 2021)

National regulation implementers like the Ministry of Mining and NEMA are among Kenya's main regulatory bodies in the context of sand.

- The Ministry of Mining is mandated under the Mining Act (2016) to manage the quarrying and mining of rocks and industrial minerals (including sand) (Organization of the Government of The Republic of Kenya, 2013).
- NEMA is mandated under the EMCA to audit natural resources' use, examine land use patterns' impact on these resources and undertake EIAs. While EIA reports should subsequently be made public to all stakeholders (NEMA, n.d.), these reports are not proactively disclosed.

County Governments are charged with the development and implementation of sub-national level activities. Any mineral prospecting, licensing, and prospecting requires their prior notification and consent

(Government of the Republic of Kenya, 2016).

Private companies (mining, construction) are essential decision-makers in Kenya's sand's procurement landscape. They are key in promoting a substitution away from

naturally occurring sand (UNEP/GRID-Geneva, 2022b), namely through financial flows, awareness raising and sectoral initiatives reducing sand production's impact.

Masons & quarry owners source the sand feeding Kenya's construction demand. Demonstrating to this stakeholder group substitute materials' equal if not, better performance is essential in transitioning to alternatives from sand sourced from natural environments. However, these players have concerns with cost factors (logistics), and perceive risks with substituting (sufficient demonstration, ability to source sufficient volumes).

Sand cartels operate illegally across Kenya's sand extraction and transport nodes.

Local communities are informal decision makers. A positive example of local communities involved as decision-maker in sand management is the case of Makueni County, where they monitor sand stocks.

5. Future Outlook

In brokering a just transition to circular economy solutions for sand consumption and production, we evaluate Kenya's

future outlook, including substitute materials¹⁸ and policy options.

5.1 Substitute Materials: The Case of Concrete Sourced with Rock Dust

After twenty years of intensive river sand exploitation reducing water and aggregates' availability, a multi-national construction company operating in Kenya introduced a new High-Performance Concrete (HPC)¹⁹ mix in Kenya's aggregates market. This mix is based on rock sand, in norm with Kenya's national construction standards.

Rock dust is typically classified as demolition waste in land-based quarries. Yet, this substitute material has strong advantages and:

- Is equally performant in terms of construction standards.
- Uses locally available rock dust, reducing the demand for river sand.

As of 2021, unless specifically requested by clients, river sand is not used in their concrete mixes. Instead, this alternative sourced from rock dust has become their main product line.

5.1.1 Drivers to Substitution

Several factors drove this company's substitution.

River sand depletion across Kenya, and particularly in the Nairobi region pose procurement challenges. Together with increasing regulatory hurdles in several Kenyan sub-national counties, this construction company shifted its procurement strategy away from river

sand towards alternative components. Rock dust is also much cheaper than river sand²⁰, minimizing this substitute's cost in manufacturing HPC.

Research, experimentation, and testing led by academia (Cheruiyot et al., 2014) with the construction company helped explore the suitability and relative advantages of rock dust in the design and production of HPC.

Resource optimization: Rock dust accumulating as demolition waste across land-based quarries could be re-used, rather than discarded. As one senior procurement strategist in the company notes, *"What was waste is now gold"*²¹. Whereas previously, rock dust was only produced as a by-activity from this company's other operations, larger rock sizes are today specifically crushed to meet growing demand for their alternative HPC.

5.1.2 Barriers to Substitution

Yet, economic, and technical constraints remain for this substitute material's adoption of scale²².

Availability challenges pose a risk to this Kenyan construction company's ability to source sufficient rock dust. In planning their procurement strategy, construction companies generally search for a product that can be sourced on a stable basis for at least five years.

Concerns with performance norms remain high among masons. This includes concerns with:

- Complexity: This concrete using rock dust changes the preparation, mixing and usage types. Masons are especially

¹⁸ By substitute materials, we refer to by-products of economic activities that displace the use of sand sourced from the natural environment.

¹⁹ For a definition of HPC, refer to (Addis et al., 2001)

²⁰ River sand price in Nairobi: 23,20-27,84 USD per ton. Rock dust price: 11,60-13,91 USD per ton. Approximate prices as of May 2021.

²¹ (Interviewee 016_UG_20210510_LG, 2021)

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.

hesitant and/or lack the knowledge for its water needs in the mixing phase.

- Limited observable results: The learning curve is fast in Kenya's construction industry, *"You come one day you are a helper, you come the next day you are a mason"*²³. In this work environment, the skepticism among masons is high to use alternative materials, especially with limited observable results.

Limited government support is available to test and demonstrate rock dust's ease-of-use in practice.

5.1.3 Regional Contrasts within Kenya

Regional contrasts within Kenya apply to where this rock dust concrete is currently used. Factors influencing substitution include:

Price differences in the sand sourced. Rock dust is competing against cheap and readily available marine sand in Mombasa²⁴. This stands in contrast to Nairobi, where expensive and depleting river sand incentivized a substitution to rock dust²⁵.

Poor and/or absent regulations for sourcing marine sand in Mombasa further incentivize its extraction.

5.2 Policy Options

5.2.1 Communicate substitute materials' relative advantages

We recommend promoting **awareness-raising and demonstration activities**, showcasing to masons and architects how a rock dust concrete product should be

prepared and mixed, its applicability in construction sites, and its performance advantages.

5.2.2 Adopt a Localized Collaborative Framework for Action

In transitioning towards responsible sand management in Kenya, we suggest adopting a collaborative framework for action operating at local scale. As our engagement with practitioners confirmed, capacity building requires *"a close to home"* approach²⁶ which engages local stakeholders. Capacity building should consider key Kenyan actors' interests, constraints, beliefs, and habits. Themes falling within capacity building should namely include sand mining's environmental safety, land resettlement, mining's exploration process and its royalties. Tools for action include:

- **Public-led resource auditing**, asking communities to monitor sand mining projects. By having local communities auditing sand resources stocks, information is more accessible and inexpensive for local communities.
- **Asking local communities to help establish best standards** for sand mining projects' screening, EIAs and decommissioning phases, promoting a participatory and local-level monitoring approach²⁷.

Benefits:

- Improves monitoring efficacy. It trains on-the-ground communities to act as watchdogs overseeing sand mining projects' environmental risks.
- Boosts community identity.

²³ (Interviewee 016_UG_20210510_LG, 2021)

²⁴ Marine sand price in Mombasa: 15-18 USD per ton. Rock dust price: 11,60-13,91 USD per ton. Approximate prices as of May 2021.

²⁵ River sand price in Nairobi: 23,20-27,84 USD per ton. Approximate prices as of May 2021.

²⁶ (Interviewee 016_UG_20210510_LG, 2021)

²⁷ Refer to International Transparency Kenya, already implementing such a strategy in other mining projects assessments.

- Stimulates local-to-local learning. It builds on knowledge already available among communities experiencing similar situations (water scarcity namely.) and raises awareness of sand extraction's impact on water supply.

5.2.3 Promote Fit-For-Purpose Regulations

While recognizing its benefits, Makueni County's governance structure may be not applicable to Kenya's coastal regions. These regions have different topographies, economic structures and sand demand and usages. A fit-for-purpose regulatory framework is therefore essential to successfully displace river sand demand, promote substitutes materials and instigate collaboration between Kenyan counties at sub-national level. We suggest

operating through county authorities' policy development plans. These policy development plans, updated every fifth year, are an opportunity to mainstream responsible sand management practices into counties' daily working. Specific clauses should include:

- Regulations on the procedures in the acquisition of sand extraction rights at industrial scale.
- Simplified procedures for public participation in EIAs' undertaking, ensuring collaboration with NEMA.
- Stringent guidelines on EIAs' undertaking and appropriate enforcement measures for restoration activities.

What now? Options for responsibly governing sand in Kenya

- **Communicating rock dust's relative advantages:** A promising substitute to river sand, already used as a default component in Nairobi. However, barriers to market uptake include availability challenges, performance concerns and limited government support.
- **Localized collaborative framework:** A community-led framework for the monitoring, evaluation, and assessment of local sand stocks.
- **Fit-for-purpose regulations:** Implemented at sub-national level through sub-national counties' policy development plans. These should regulate the acquisition of sand mining rights, public participation in EIAs and post-mining restoration measures.

References

- Addis, B. J., Owens, G., Fulton, F. S., & Cement & Concrete Institute (South Africa). (2001). *Fulton's concrete technology*. Cement & Concrete Institute.
- Beiser, V. (2017, February 28). *He who controls the sand: The mining "mafias" killing each other to build cities*. The Guardian. <http://www.theguardian.com/cities/2017/feb/28/sand-mafias-killing-each-other-build-cities>
- Cheruiyot, J., Abuodha, S. O., & Kabubo, C. (2014). Use of Stone Dust in the Design of High Performance Concrete. *Open Journal of Civil Engineering*, 04(03), 229–239. <https://doi.org/10.4236/ojce.2014.43020>
- Constable, H. (2017). *Kenya's Sand Wars*. Al Jazeera. <https://interactive.aljazeera.com/aje/2017/kenya-sand-wars/index.html>
- County Governments Act, No 17 of 2012 (2012). http://www.parliament.go.ke/sites/default/files/2017-05/CountyGovernmentsAct_No17of2012_1.pdf
- Environment Justice Atlas. (2018, March 1). *Sand mining and related violence in Makueni County, Kenya*. <https://ejatlas.org/conflict/sand-mining-and-the-sand-related-violence-in-makueni-county-kenya>
- 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. <https://doi.org/10.13140/RG.2.2.29853.23527>
- 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 Makueni County. (2016). *Makueni County Sand Conservation and Utilization Authority* [Government website]. <https://makueni.go.ke/sand-authority/>
- Government of the Republic of Kenya. (n.d.). *LAPSSET Corridor Development Authority – Building Transformative and Game Changer Infrastructure for a Seamless Connected Africa*. Retrieved June 14, 2021, from <https://www.lapsset.go.ke/>
- Environmental Aspects of Minerals and Metals Management, L.12 EA.5 § 5/12 (2022). <https://wedocs.unep.org/bitstream/handle/20.500.11822/39927/ENVIRONMENTAL%20ASPECTS%20OF%20MINERALS%20AND%20METALS%20MANAGEMENT.%20English.pdf?sequence=1&isAllowed=y>
- Environmental Management and Co-ordination Act, No.8 of 1999 (1999). http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/EnvironmentalManagementandCo-ordinationAct_No8of1999.pdf
- Environmental Impact Assessment and Audit Regulations, (Cap. 387) (2003). <http://extwprlegs1.fao.org/docs/pdf/ken53040.pdf>
- Government of the Republic of Kenya. (2008). *Kenya Vision 2030* [Government website]. Homepage. <http://vision2030.go.ke/>
- Interviewee 006_UG_20210308_LG. (2021, March 8). [Personal communication].
- Interviewee 011_UG_20210416_JL. (2021, April 16). [Personal communication].
- Interviewee 016_UG_20210510_LG. (2021, May 10). [Personal communication].
- Organization of the Government of The Republic of Kenya, Executive Order No. 2/2013 (2013). <http://www.shitemi.com/wp-content/uploads/2013/10/executive-order-no-2-of-2013-on-the-organization-of-gok.pdf>
- Makueni County Sand Conservation and Utilization Act, No.1 (2015). <https://www.informea.org/en/legislation/makueni-county-sand-conservation-and-utilization-act-2015-no-1-2015>
- Government of the Republic of Kenya. (2016). *Kenya Mining Investment Handbook 2016*. Ministry of Mining. <https://www.tralac.org/documents/resources/by-country/kenya/1928-kenya-mining-investment-handbook-2016/file.html>
- The Mining Act, No.12 of 2016 (2016). http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/MiningAct_No12of2016.pdf
- Kahonge, John. O. (2015, October). *Environmental impact assessment: Why it fails in Kenya*. Pambazuka News. <https://land-environment/environmental-impact-assessment-why-it-fails-kenya>
- 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>
- KPMG. (2016). *Analysis of the Mining Act 2016*. <https://assets.kpmg/content/dam/kpmg/ke/pdf/kpmg-mining-act-2016-analysis.pdf>
- NEMA. (n.d.). *Environment Impact Assessment (EIA)* [Government website]. Retrieved June 16, 2021, from https://www.nema.go.ke/index.php?option=com_content&view=article&id=119&Itemid=144
- Okello, N., Beevers, L., Douven, W., & Leentvaar, J. (2009). The doing and un-doing of public participation during environmental impact assessments in Kenya. *Impact Assessment and Project Appraisal*, 27(3),

- 217–226. <https://doi.org/10.3152/146155109X465940>
- Padmalal, D., & Maya, K. (2014). Sand Mining: The World Scenario. In D. Padmalal & K. Maya (Eds.), *Sand Mining: Environmental Impacts and Selected Case Studies* (pp. 57–80). Springer Netherlands. https://doi.org/10.1007/978-94-017-9144-1_5
- Perks, R., & Schneck, N. (2021). COVID-19 in artisanal and small-scale mining communities: Preliminary results from a global rapid data collection exercise. *Environmental Science & Policy*, 121, 37–41. <https://doi.org/10.1016/j.envsci.2021.03.007>
- 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>
- Transparency International Kenya. (2017). *Corruption Risk Assessment in Mining Awards, 2017*. <https://transparency.org.au/global-mining-3/kenya/>
- 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. (2022). *Sand and Sustainability: 10 Recommendations to Avert a Crisis*. 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](https://doi.org/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](https://doi.org/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. (2018). *Climate Risk Profile: Kenya* [Fact sheet]. <https://www.climatelinks.org/resources/climate-risk-profile-kenya>