WESTERN SYDNEY UNIVERSITY

Humanitarian and Development Research Initiative

SHIFTING GROUNDS

PUTTING KENYA'S SAND INDUSTRY ON THE NATIONAL MAP

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Cite as: Bachmann, J., Kasera, O.A., Kilaka, B.M., Mbuguiro, W., Mkutu, K., Nyambedha, B., Omwoyo, N. & Owiso, M. (2026) *Shifting Grounds: Putting Kenya's Sand Industry on the National Map*. Sydney: Humanitarian and Development Research Initiative (HADRI), Western Sydney University.

Editor: Dr Valentina Baú, HADRI

DOI: 10.26183/QEXX-2E13

Front cover image: Benard Musembi, May 2023

All pictures in the report by the authors.

ABOUT THIS REPORT

This report summarises the main findings of a three-year research project on “The politics of sand in East Africa” hosted by the University of Gothenburg, Sweden, in collaboration with United States International University (USIU) - Africa and Maseno University. The report’s aim is to provide an overview of the main challenges emerging around sand harvesting and trade in Kenya. It maps economic, social, and environmental consequences of sand harvesting across different regions and ecosystems in Kenya, explores both formal and informal governance dynamics of sand harvesting and trade and finally formulates recommendations for a fairer and more sustainable way of harvesting and trading sand in Kenya.

FUNDING

The research project has been funded by FORMAS (grant number: 2020-01274_Formas) and the Swedish Research Council’s *Swedish Research Links* Programme (grant number: 2021-05162_VR). Principal investigators are Dr Jan Bachmann (University of Gothenburg), Prof Kennedy Mkutu (USIU-Africa), Dr Michael Owiso (Maseno University) and Dr Benard Musembi Kilaka (University of Gothenburg & Maseno University). Research associates in this project are Nelson Omwoyo (Government of Kenya), Wangui Mbuguiro (University of Western Australia), Odhiambo Alphonce Kasera (Maseno University), Benson Nyambedha (Maseno University), Evelyne Owino (Bonn International Centre for Conflict Studies) and Simon Maloyi (freelance researcher).

ACKNOWLEDGEMENTS

The research team wishes to express its gratitude to all the respondents and mobilisers across the case study counties. In particular, we extend our sincere appreciation to John and Joseph in Kilifi, and Agnes in Voi, whose dedication and support were instrumental in facilitating data collection and community engagement. Your efforts have been invaluable to the success of this study.

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EXECUTIVE SUMMARY

Kenya's prosperity, development and geo-strategic infrastructure projects depend on sand, the key ingredient of concrete. However, Kenya has been identified as one of the most critical countries for unsustainable sand harvesting. The industry is a lifeline for thousands of workers and their communities, but this has been threatened in the past by weak regulation, environmental degradation and in some cases conflict.

This report responds to a need for wider and deeper data on the industry and its challenges. Using both desk-based and empirical data collected between April 2022 and August 2024 in eight counties, the research identified economic, social and environmental effects and explored the sand commodity chain.

Sand harvesting is an important economic activity for communities and is quite decentralised, with many different players getting a share of profits. However, the industry is volatile and incomes may be unstable. The greatest beneficiaries in the commodity chains are large truck owners as well as the construction industry, and the county governments who collect cess revenues. Contestation between different actor groups is common and some cartel-like activities do exist, but violence is the exception.

The ecological impacts of sand harvesting are very evident in Kenya and threaten health, safety and livelihoods of communities. In terms of governance, national legislation has been lacking though new regulations have been issued at the time of writing. Informal and semi-formalised rules and norms are important in regulating the industry. In most counties, county legislation on sand harvesting is either absent, left hanging or is not being enforced. Cess revenues disincetivise implementation of regulations at the county level.

To national and county governments, we recommend to strengthen oversight; to counties, we recommend to harness local expertise in self-regulation and workable solutions. Local communities and civil society organisations are advised to raise awareness, form constructive alliances and deepen collaboration with formal institutions and donors.

ACRONYMS AND ABBREVIATIONS

ASAL	Arid and semi-arid lands
CBO	Community-based organisations
EIA	Environmental Impact Assessment
EMCA	National Environmental Management and Conservation
FGD	Focus Group Discussion
KES	Kenyan shilling
LAPSSET	Lamu Port South Sudan Ethiopia Transport Corridor
MCA	Member of the County Assembly
NEMA	National Environment Management Authority
NGO	Non-governmental organisation
SACCO	Savings and Credit Cooperative
SGR	Standard Gauge Railway
USD	United States Dollar
UNEP	United Nations Environment Programme
USIU	United States International University Africa

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1. INTRODUCTION

1.1. BACKGROUND AND CONTEXT

Kenya's prosperity depends on sand. Yet, this everyday resource remains unacknowledged by many. Though it is impossible to put a reliable number on the revenues made within the sand trade in Kenya, it is without doubt significant. Availability of sand underpins national visions of growth and development as much as it secures the livelihoods of tens of thousands of Kenyans across the country. In the last two decades, Kenya has seen unprecedented urbanisation, proliferated not least through devolution that has boosted the growth of towns hosting the new county government headquarters, as well as the advent of extensive infrastructure projects devised by former Presidents Mwai Kibaki and Uhuru Kenyatta's administrations. The Thika Superhighway, Lamu Port-South Sudan-Ethiopia-Transport (LAPSSET), the standard-gauge railway (SGR), the Nairobi Expressway as well as the Dongo Kundu bypass in Mombasa stand out as the most flamboyant amongst the thousands of kilometers of rural roads and bypasses that have come to signal the country's readiness to cross the threshold toward 'middle-income country' status.

However, any promise made about *maendeleo* (progress) hinges on the availability of tremendous amounts of sand. As the key ingredient of concrete, sand is the unrecognised pivot of modernity. Until recently, sand figured only marginally in discussions about natural resources, mineral extraction and their relation to conflict or climate change. Sand falls outside the usual categories that determine a resource's conflict potential: it is considered neither precious nor rare. It lacks the glamour of diamonds or gold; and it is not seen as a decisive mineral for the green transition as cobalt, lithium or manganese are. On the contrary, many people consider sand to be a mundane resource, that is widely available and mined for domestic use as a 'construction mineral'.

This picture has changed dramatically during the last decade. The estimated annual consumption of sand, gravel and aggregate amounts to 50 billion tonnes, which makes sand the most mined solid resource in the world. A human being uses 18 kilograms of sand every day.[1] Sand-bearing ecosystems, mainly rivers, have lost the race to replenish the volumes of sand that are currently removed worldwide. Consequently, the United Nations Environment Programme (UNEP) warns about a global sand crisis and calls effective sand harvesting and utilisation management one of the most pressing sustainability challenges. [2] The impacts are far-reaching, with widening and lowering of river beds, loss of biodiversity of rivers and floodplains, reduced water, soil and air quality. Effects on community lives and livelihoods include infrastructure destruction and disrupted access to water for domestic use and irrigation. [3] Moreover, ill-regulated sandmining and the highly unequal distribution of revenues from sand trade fuels societal conflict across the world. [4] The latter issue gained widespread attention through investigations about sand mafias operating in diverse parts of the world such as India, Morocco and Kenya.[5]

[1] UNEP 2019. *Sand and sustainability: Finding new solutions for environmental governance of global sand resources*. GRID-Geneva. United Nations Environment Programme, p. xi.

[2] See UNEP 2019. *Sand and sustainability: Finding new solutions for environmental governance of global sand resources*. GRID-Geneva. United Nations Environment Programme; as well as UNEP 2022. *Sand and sustainability. 10 recommendations to avert a crisis*. GRID Geneva. United Nations Environment Programme.

[3] Rentier, E. and L.H. Cammerat (2022) The environmental impacts of river sand mining. Science of the Total Environment. 838(1): https://doi.org/10.1016/j.scitotenv.2022.155877.

[4] Beiser, V. 2018. *The world in a grain*. Penguin Random House. Pilkey, O. et al. 2023. *Vanishing sands. Losing beaches to mining*. Duke University Press.

[5] See Le Monde. India's sand mafias have power, money and weapons. Le Monde 12 September 2022. https://www.lemonde.fr/en/environment/article/2022/09/12/in-india-sand-mafias-have-power-money-and-weapons_5996639_114.html; CSIS 2023. Morocco's sand mafias. Center for Security and International Studies. https://www.csis.org/analysis/moroccos-sand-mafias; ISS ENACT 2022. Kenya's sand cartels.

Kenya has been identified as one of the most critical countries for unsustainable sand harvesting, troubled by weak regulation, environmental degradation and conflict. Rivers and pits have seen excessive harvesting by local communities as well as organised groups, while absent or inefficient regulation of sand harvesting has led to the emergence of cartels and violent encounters between harvesters, transporters and local communities.[6] Following the clashes in Makueni County in 2015-2017, which saw the tragic death of at least nine people, social, economic and political contestations implied in the removing, transport and processing of this mundane resource have attracted nation-wide publicity. Despite a growing acknowledgement of these concerns, until now there has only been fragmentary data on concrete dynamics in the Kenyan sand trade as well as the rules, regulations and practices that govern harvesting and forwarding of this resource.[7]

Harvesting of sand is widespread in Kenya and is carried out in all major rivers that are close enough to markets. Fast growing towns and cities as well as large infrastructure projects figure as the greatest consumers of aggregate. Due to the weight of sand, long-haul transport of this resource is rarely profitable. Instead, sand is taken from ecosystems close to the point of use. In principle then, any river and pit can become subject to sand removal—a dynamic that the country has seen for years in the counties bordering Kenya's major cities. While unregulated sand removal damages ecosystems and may lead to communal tensions, sand harvesting has also turned into an important source of income for rural populations as well as a source of immense profits by more powerful stakeholders. The Kenyan sand trade is unique in one important aspect: it is where one of the highest regulated industries, that is, the construction and cement industry, meets one of the least regulated sectors. One could even argue that the prosperity of the former hinges on the non-regulation of the latter, for it is only because of the constant flow of gigantic amounts of sand, harvested in an exploitative way, that urbanisation and infrastructure development can continue at its current speed.

Unlike in other countries, sand harvesting in Kenya is entirely artisanal with a low threshold to enter the industry. It does not require exceptional skills, technology or access to large capital. Moreover, sand is widely available. As this is a highly informal and dynamic industry, any attempt to put numbers to its size is guesswork. However, extrapolating from our observations in mines and along rivers in seven Kenyan counties, the number of loaders is in the tens of thousands nationwide. For most of the loaders, scooping sand is the primary source of income and often feeds an entire household. In other words, the livelihoods of far more than one hundred thousand Kenyans are contingent on the harvesting of sand.

The potential of sand harvesting to lift people out of poverty, while critical, runs up against the insecurity of income as well as the environmental damage done by overextraction. Jobs are often seasonal, dependent on availability of sand in the rivers, as well as contingent on market dynamics. If one thing is certain in the sand economy, it is its volatility. The latter is furthered by the lack of effective regulation of sand harvesting in the country, which is in part due to the ambiguous status of the resource. Since the country's most mined solid resource is not considered critical nor scarce, it is perceived to be of limited strategic importance.

Legislation in Kenya has been ambiguous about the status of sand (during the period of this research). However, the Environmental

Institute for Security Studies; https://enact-africa.s3.amazonaws.com/site/uploads/2022-035-03-sand-research-paper-26.pdf

[6] Beiser, V. (2017) He who controls the sand: Kenya's mining Mafias. *The Guardian* 1 March. https://pulitzercenter.org/stories/he-who-controls-sand-kenyas-mining-mafias#:~:text=The%20grisly%20episode%20was%20the,police%20officers%20and%20government%20officials.

[7] The work and public engagements by Mohamed Daghar, then at the Institute for Security Studies, and Halinishi Yusuf are notable exceptions and important contributions.

Management Coordination (Sand Harvesting) Regulations 2024, were passed at the time of writing with implementation in progress. Previously the Mining Act was non-specific about sand harvesting,[8] and the National Environment Management Authority (NEMA) had provided only guidelines,[9] which were difficult to enforce. The new regulations now make the following provisions:

- NEMA to work with county governments and other agencies in managing implementation
- Oversight at the county level by County Environment Committees
- Committees to set minimum pricing for sand and minimum wage for labourers
- Establishment of Ward Sand Harvesting Committees (which include representation from local Water Resource Users Associations/Beach Management Units)
- Limits on sand harvesting depths, hours of operation, and specific locations (no harvesting at permanent rivers)
- Requirement for Environmental Impact Assessments for all harvesting activities
- Mandatory permits for transporters
- Mandatory licencing of all harvesters
- Mandatory licencing of dealers and their registration in an association/cooperative.

The regulations may be lauded for bringing clarity and providing for local oversight, but it is worth noting that NEMA's county offices often lack the resources to enforce regulations.

An additional legislative layer is added by county laws, the most studied being the Makueni County Sand Conservation and Utilization Act.[10] The enforcement of the Act greatly curbed illegal activity and allowed rivers to recover, but in other counties where large-scale sand harvesting is taking place, legislation is either absent, has been pending for extended periods, or is not enforced.[11]

There is also a wealth of informal rules set up by loaders, landowners, elders and transporters at the site governing modalities of mining and pricing. They are at times partisan and also under pressure from external interests and market dynamics. However, local stakeholders have a wealth of knowledge on governing natural resource extraction from which formal regulation efforts can benefit.

There is now a bourgeoning literature on environmental harm, livelihoods and community relations around sand mining in sub-Saharan Africa and beyond.[12] In addition, there are major reports on sand and sustainability,[13] while think tanks have started to investigate the interlinkages between sand mining, organised crime and violence.[14] With regard to the Kenyan context, a number of local studies as well as

[8] Government of Kenya 216. The Mining Act. Government of Kenya 2016. Mining and Minerals Policy Sessional Paper 7. See also Katisya-Njogore, C. 2021. Kenya's sand harvesting laws and the sustainable development license to operate: in quicksand? *J. Conflict Manage. Sustain. Dev.*, 6 (3) (2021)

[9] National Environment Management Agency 2007. Sand Harvesting Guidelines and Management. NEMA.

[10] Makueni County Government 2015. Makueni County Sand Conservation and Utilization Act. Makueni County Government.

[11] See our discussion of findings in the respective case sections.

[12] See for example, Bachmann, J. et al. 2024. (Re-)moving earth, building Kenya – The politics of sand extraction in Kedong. *Geoforum* 149; Da, S. & P. Le Billon. Sand Mining: Stopping the Grind of Unregulated Supply Chains. *The Extractive Industries and Society* 10 101070; Dawson, K. 2023. A share in the sands: trips, pits, and potholes in Accra, Ghana. *Africa* 94 pp. 40-59; Katz-Lavigne S. et al. 2022. *Mapping global sand: Extraction, research and policy options*. University of Ghent &Christian Michelsen Institute; Lamb, V. et al. 2019. Trading sand, undermining lives: Omitted livelihoods in the global trade in sand. *Annals of the American Association of Geographers* 109 (5); M. Marschke & J.F. Rousseau 2022. Sand ecologies, livelihoods and governance in Asia. A scoping review. *Resources Policy* 77.

[13] See e.g. Torres, A. et al. 2017. A looming tragedy of the sand commons. *Science* 357, pp. 970-971; A. Torres et al. 2021. Sustainability of the global sand system in the Anthropocene. *One Earth* 4 (5) pp, 639-650. Bendixen, M. et al. 2021. Sand, gravel and UN Sustainability goals: conflict, synergies and pathways forward. *One Earth* 4 (8), pp. 1095-1111.

[14] E.g. Global Initiative against Transnational Organized Crime 2022. Sand Mafias in India. https://globalinitiative.net/analysis/sand-mafias-in-india/; CSIS 2023. Morocco's sand mafias. Center for Security and International Studies.

UN-initiated policy review examining governance and regulatory issues for sand resources exist.[15] However, this report is the first comparative cross-county study of sand extraction in Kenya that integrates mapping of emergent socio-economic, environmental and governance challenges and the mapping of revenue generation along (parts of) the commodity chain.

1.2. METHODOLOGY

The methodology used for this report includes a review of academic literature and policy reports, extensive multi-sited fieldwork, key informant interviews and focus group discussions, and data collection by locally embedded stakeholders via the Kobo Toolbox reporting app.

The research was carried out by a team of ten researchers based at USIU, Maseno University and the University of Gothenburg. Cases were selected on the basis of variation in scope and spread of sand harvesting, variation in sand-bearing ecosystems, as well as the character of markets (see Table 1 below).

Fieldwork was carried out between April 2022 and August 2024 in the counties of Narok/Nakuru, Makueni, Kajiado, Taita Taveta, Kilifi, Kwale and Homabay. Field studies entailed a short pilot study followed by a three-week field research period. In addition to identifying economic, social and environmental effects in the county cases, the team carried out a commodity chain analysis between sand harvesting sites and markets in the cases where large-scale and highly organised/routinised sand harvesting takes place, namely Narok/Nakuru, Kilifi and Kajiado.

During fieldwork the team conducted approximately 350 semi-structured and structured interviews (120 of which were logged in Kobo Toolbox) and 30 focus group discussions. Informants included loaders, drivers, brokers, traders, landowners, residents, associations, women groups and county government representatives.

Preliminary findings resulted in seven case study reports, two of which were turned into Master theses and successfully defended at USIU (Mbuguiro, Omwoyo). We presented four of the reports at county-level stakeholder meetings, namely in Taita Taveta (Voi, November 2023; ca. 70 participants), Kilifi (Mjanaheri, June 2024, 35 participants), Homabay (Homabay, June 2024, 40 participants) and Kajiado (Kajiado Town, October 2025, 30 participants)

https://www.csis.org/analysis/moroccos-sand-mafias.

[15] ISS ENACT 2022. Kenya's sand cartels. Institute for Security Studies; https://enact-africa.s3.amazonaws.com/site/uploads/2022-035-03-sand-research-paper-26.pdf; Buke, M., Musau, J., Muiruri, P. (2023) Sand harvesting and its social, economic and environmental effects on household's livelihoods in Homabay County, Kenya. *International Academic Journal of Arts and Humanities*, 1(4), 40-60. Reimer Lynggard, J. and L. Gallagher (2023) Resource Policy Review – The Case of Kenya. UNEP GRID-Geneva.

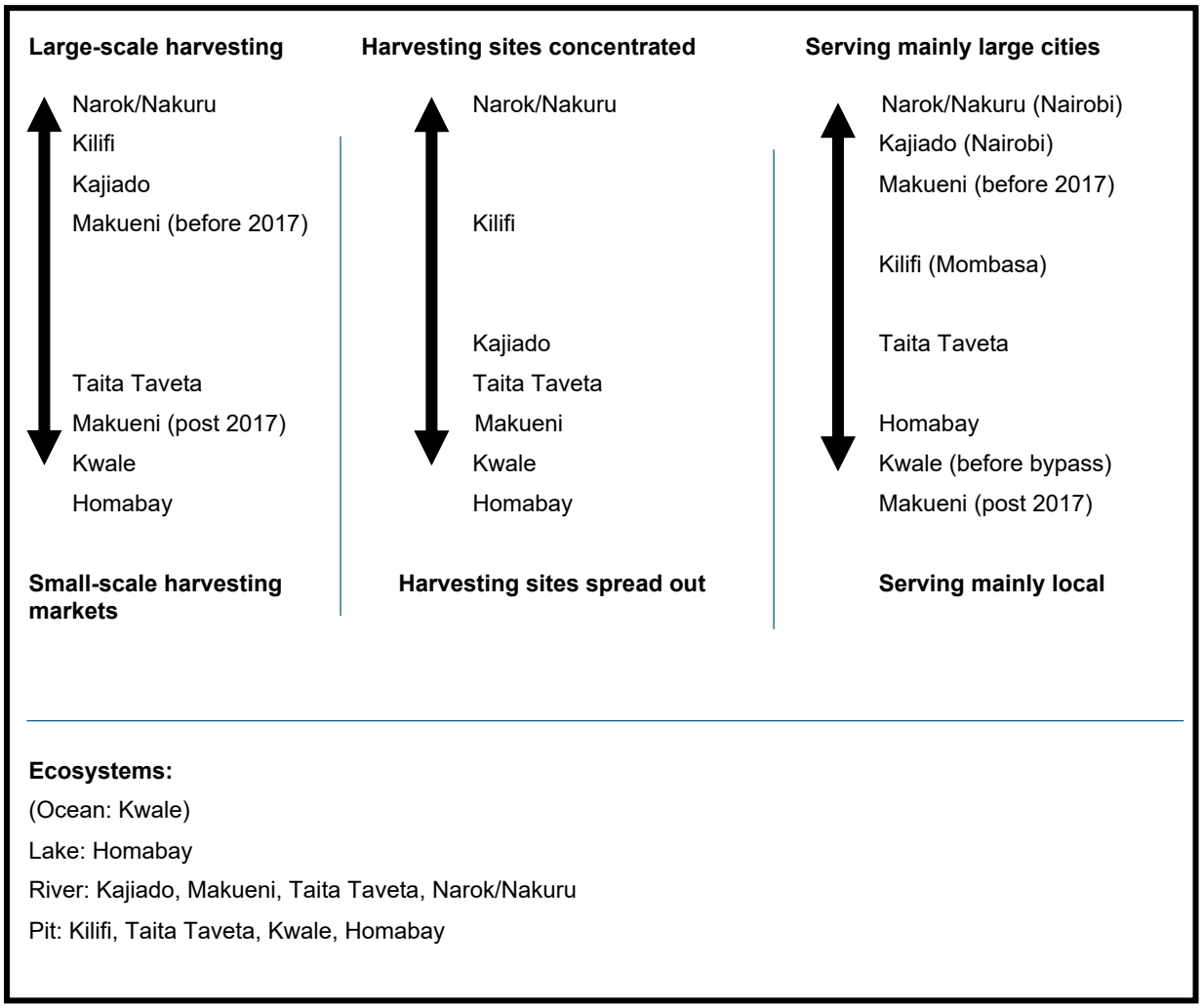

Table 1: Variations in geographical and market features of sand sites

2. SUMMARY OF KEY FINDINGS

Sand mining emerged as an important matter of concern in all counties in relation to a variety of aspects including environmental damage, depletion of sand resources, communal conflict, unfair distribution of income, market conditions and insufficient regulation.

2.1. SOCIO-ECONOMIC ASPECTS

- Across field sites, sand harvesting is an **important economic activity,** as it secures the livelihoods for thousands of people in all the counties under study. Engaging in sand trade helps people to cover expenses such as school fees, healthcare, land purchases, and even establishing businesses.
- However, **the income that rural communities can make from trading sand varies tremendously** due to the industry's volatility. **Livelihoods often are at the whims of external forces** as availability of sand can be seasonal or dwindling, demand unstable, and prices often dictated elsewhere. Mechanisation of harvesting (Homabay) is putting loaders out of work.
- **Cess [16] revenues from sand transportation contribute significantly to county budgets (Kilifi, Kajiado).** At the same time, a high reliance on sand cess as a primary revenue source without adequate oversight fosters overextraction (Kajiado).
- While **violent conflict may occur**, we did not observe it as a prominent feature in the Kenyan sand economy. We however observed non-violent contestation between different actor groups (e.g. between site owners, loaders and brokers) and violent contestation in one of the sites where the land is also contested (Narok/Nakuru). In addition, there were **inter-generational conflicts** where the younger generation accused the older of corruption and mismanagement, while the older generation blamed the youth for pursuing short-sighted gains at the cost of building up collective bargaining power (Kilifi).
- In some contexts of large-scale mining, we noticed **tendencies of centralisation and control, often known as cartels** (primarily in Kajiado, to an extent Kilifi), though these were not always present in large mining sites (Narok/Nakuru). In reverse, cartels existed at smaller decentralised sites (Makueni until 2017). In many areas, the sand trade is still a predominantly **decentralised business** with many players taking a share (Homabay, Taita Taveta, Kwale). Generally, more powerful stakeholders with access to capital and relevant networks, namely transport, construction and cement companies, have leveraged their influence and in many cases maintained value chains that operate independently, influencing market prices and overall conditions (Kajiado, Kilifi).
- While income for loaders at the mining sites often allows for a marginal subsistence, **the largest profits are made during transport and at urban markets** (this was observed in all counties where we conducted a commodity chain analysis, that is Narok/Nakuru, Kajiado, Kilifi). The greatest beneficiaries in the commodity chains are large truck owners as well as the construction industry (though we acknowledge that accessing credible data on expenses and profits along the various chains proved difficult). Differences in profit distribution are a source of uncertainty and generate tensions between stakeholders in the Kenyan sand economy**.**
- **Where individuals personalised land, profit is prioritised over community welfare, thus leading to limited economic gains for the wider community** (e.g. when site owners in Kajiado claim riparian land as theirs). In

[16] Cess is a local levy collected by county governments on products or resources produced in or transported through the county. Cess revenues are supposed to be reinvested to improve production or to rehabilitate the county's road infrastructure.

contrast, communal or inclusive ownership models have enhanced broader community benefits (e.g. Kilifi cooperatives,).

- **The sand trade is highly gendered**. It is dominated by men across all field sites and value chains. Women usually provide services such as food. Taita Taveta and Kajiado stand out where women emerge as brokers.

2.2. GOVERNANCE DYNAMICS

- In all counties, with the exception of Makueni, **county legislation on sand harvesting is either absent, still pending, or is not being enforced**. To an overwhelming extent, environmental regulatory mechanisms have not worked to date and licensing of mining sites is erratic and incomplete. As a consequence, much of **sand harvesting in Kenya is done outside existing regulations**.
- Despite the previous lack or non-enforcement of regulations, **sand harvesting is rarely done in a disorganised way**. On the contrary, harvesting is often governed by a **comprehensive set of informal and formalised rules and norms.** The bigger the mining site and the larger the number of actors involved, the higher the level of organisation and regulation (Narok/Nakuru, Kilifi, Kajiado). In turn, the smaller the number of miners and the more dispersed the sites, the lower the likelihood of efficient organisation and regulation (Kwale, Taita Taveta, Homabay).
- There is a **clear conflict of interest between the different levels of government**. While the national government is concerned with environmental protection and security, county governments oversee natural resources but depend on cess revenue from sand transport.
- **Local sand associations have a critical role in supporting community welfare** through revenue from access fees. These associations help fund essential services like school fees and medical care, and assist with representation, demonstrating the potential benefits of informal community-led regulation of sand harvesting.

2.3. ENVIRONMENTAL IMPLICATIONS

- **Ill-regulated sand harvesting** in Kenya facilitates excessive sand mining, **which puts multiple ecosystems at risk** (Taita Taveta, Kajiado, Homabay, Makueni before 2017).
- **Excessive sand mining threatens to deplete Kenya's rivers** (Taita Taveta, Kajiado). With river Voi, for example, where some sections are mined to the bedrock level, the process is likely to be accelerated by mechanisation of the industry (Homabay).
- **Removing unwarranted volumes of sand from rivers disturbs the natural ecosystem as it changes stream course, velocity and the water table**. The effects jeopardise farmers' access to water, negatively affect biodiversity, lead to flooding and increase the risk of erosion.
- **When sand is depleted from farmland, landowners lose a key source of income** and are left with land unsuitable for farming.
- **Large-scale pit sand mining transforms landscapes irrevocably** (Kilifi). The clearing of vegetation and removal of topsoil, coupled with the creation of deep pits, leads to severe land degradation and leaves barren land.
- **While we observed locally-driven small rehabilitation efforts**, these are often done in a haphazard way and without sustainable support.

3. RECOMMENDATIONS

Given the constraints in accessing reliable aggregate data on sand trade in Kenya, some of our findings are necessarily tentative. Accordingly, the recommendations are formulated as propositions for further conversations, rather than a confident "must-do-list." They draw inspiration from UNEP recommendations on sand and sustainability but are adapted to the Kenyan context.[17]

3.1 FOR THE NATIONAL GOVERNMENT

- **Acknowledge sand as a strategic resource**, given the resource's significance for the country's prosperity—both in terms of securing livelihoods and infrastructure construction—and given the wide-ranging consequences of insufficiently regulated sand harvesting for the environment and community relations.
- **Effectively support and resource NEMA in implementation** of the Environmental Management and Coordination (Sand Harvesting) Regulations 2024.
- **Harmonise the various laws** that relate to riparian zones (wildlife, forest, land, environment and agriculture). This will assist in coordinating effective management.
- **Research and consider developing alternatives to river sand** including crushed rock or recycled crushed concrete or glass.

3.2 FOR COUNTY GOVERNMENTS

- **Effectively work with NEMA on the implementation** of the Environmental Management and Coordination (Sand Harvesting) Regulations 2024, namely oversight of sand harvesting by the County Environment Committee and establishment of Ward Sand Harvesting Committees, which are inclusive and representative of local interests.
- **Consider developing county sand harvesting and utilisation legislation** that is harmonised with NEMA's new the Sand Harvesting regulations, 2024.
- **Create a sense of bottom-up ownership** of sand management. Work in partnership with local communities, utilise existing practices, rules and knowledge and integrate the latter into the work of Ward Sand Harvesting Committees.
- **Invest in education for sustainable sand use**. Disseminate knowledge about ecosystem services and rehabilitation, harm reduction, technological solutions such as sand dams, recycling of and alternatives to sand.

3.3 FOR LOCAL STAKEHOLDERS

- Be familiar with regulations, namely Environmental Management and Coordination (Sand Harvesting) Regulations 2024 and requirements for permits, licencing, etc.
- **Evaluate sand extraction practices along the harm they may create** for communities and the environment.
- **Deepen collaboration with local authorities and other stakeholders** towards positive transformation in the sand trade; claim your stake in formal institutions including Ward Sand Harvesting Committees.
- **Form constructive alliances for leveraging bargaining power** at sand extraction sites.

[17] See UNEP 2022. *Sand and sustainability. 10 recommendations to avert a crisis*. UMEP-GRID Geneva. United Nations Environment Programme.

- **Communities can be actively engaged in efforts to rehabilitate and reforest degraded areas** by planting vegetation in order to restore them and ensure long-term environmental health. Explore sources of donor funding for reforestation and rehabilitation of riparian zones (sand dams).
- **Local CBOs and environmental NGOs should support communities by raising awareness and providing training and resources that will facilitate the implementation of sustainable harvesting projects** and/or the establishment of income-generating activities. This will help reduce the dependency on sand as the primary resource.
- **Communities should play a critical role in enforcing policies by reporting illegal harvesting and participating in inspection activities**. This active participation in monitoring will help deter unsustainable practices.

4. CASE STUDIES

4.1 NAROK/NAKURU (K. Mkutu)

4.1.1. CONTEXT

Kedong is a 30,000 hectares area of land located on the Rift Valley floor near Mount Suswa and Mount Longonot volcanic craters, around 50km northwest of Nairobi (see figure 1). It is located mainly in Nakuru County (on the border with Narok County). It is one of the largest sand harvesting sites in the country and a major source of income for Nakuru County.[18] Sand extraction in Kedong began in 2004. The area has "black" volcanic sand, washed down in the gullies from Mount Longonot during the rains.

The area is also the site of various recent infrastructural developments such as the standard gauge railway (SGR), the inland container depot and an industrial park. The wider landscape, once Maasai ancestral rangelands, is now privately titled and owned by Maasai landowners, though many Maasai continue subsistence pastoralist livelihoods and live in traditional homesteads. Kedong Ranch, however, is a former colonial settlers' ranch, which passed hands after independence and is currently owned by a group that includes some of Kenya's political elites. 35,000 people (400 large families) of the Kitet Maasai community continue to occupy the land and use it for herding and sand harvesting, though their future is currently uncertain.

Thousands of local youths are involved in harvesting and loading of trucks in this area. They operate in groups of 50-400 members and are highly organised through their own committees, constitution, regulations, bank accounts, shares and branding. The groups include Maasai youths coming from Suswa in Narok County, and others from the more cosmopolitan town of Mahi Mahiu in Nakuru County. The groups divide the work of harvesting and loading equally between members and arrange loyalty deals with trucks or groups of trucks. Maasai elders control access to the rivers and charge a fee to every truck. Families and all community members in the area rely heavily upon the sand industry; widows come to the site daily, are given a portion of the proceeds by the elders, and are among the women who are given the opportunity to cook at the site.

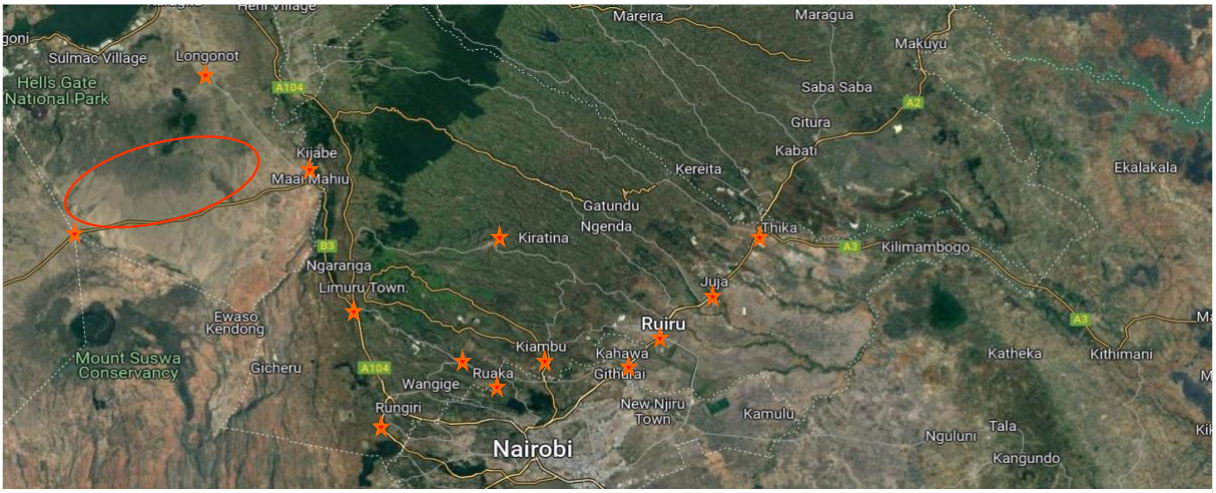

Figure 1: Map showing Kedong sand-harvesting site and sites for delivery

[18] Nakuru County (2023) County Integrated Development Plan. https://nakuru.go.ke/wp-content/uploads/2024/05/Nakuru-CIDP-2023-2027.pdf

4.1.2. REVENUE STREAMS

The sand value chain is quite informal and decentralised with many actors benefiting. An estimated 400 trucks per day access the site. They deliver sand mainly within the vicinity of Mahi Mahiu and Nairobi (see Table 2). Many of the actors are both transporters and vendors who sell to private individuals, yards or hardware stores, and to the construction businesses; they may also run their own yards or construction businesses. Chinese construction companies also subcontract transporters. Brokers assist and benefit from these processes at every point in the chain.

Drivers go through numerous challenges, including the lack of storage facilities for sand, which paralyses transporting until the current load is sold. Poor roads and muddy inaccessible conditions at the site make the journeys more time consuming and expensive. The weighbridge is another challenge, located close to the Kedong gate on the highway to Mahi Mahiu, and inflicts severe penalties for overloading at 10,000 KES or more. Transporters lament that although they can only estimate the quantities by sight, and that wet sand is heavier, even slight overloading is not forgiven. The commodity chain is illustrated in Figure 2.

	6-wheeler	10-wheeler	12-wheeler	18-wheeler	comment
Price of sand	1,000	1,500	1,500	3,000	
Loaders wage	3,000	6,000	6,000	15,000	
Gate fee	1,000	1,500	1,500	3,000	
Costs at site	**5,000**	**9,000**	**9,000**	**21,000**	
Cess	500 – 2,200				
Police stops	500-1,200				
Fuel	5000 -14,000				Lowest price is for 6-Wheeler truck to Mahi Mahiu
Driver wage	1000-1500				
Offloader fee	0-1,500				
Costs in transit	**7,000-20,400**				
Market price	**14,000-20,000**	**18,000-35,000**	**n/a**	**n/a**	

Table 2: Sand revenue streams for Kedong, amounts are given in Kenyan shilling (KES)

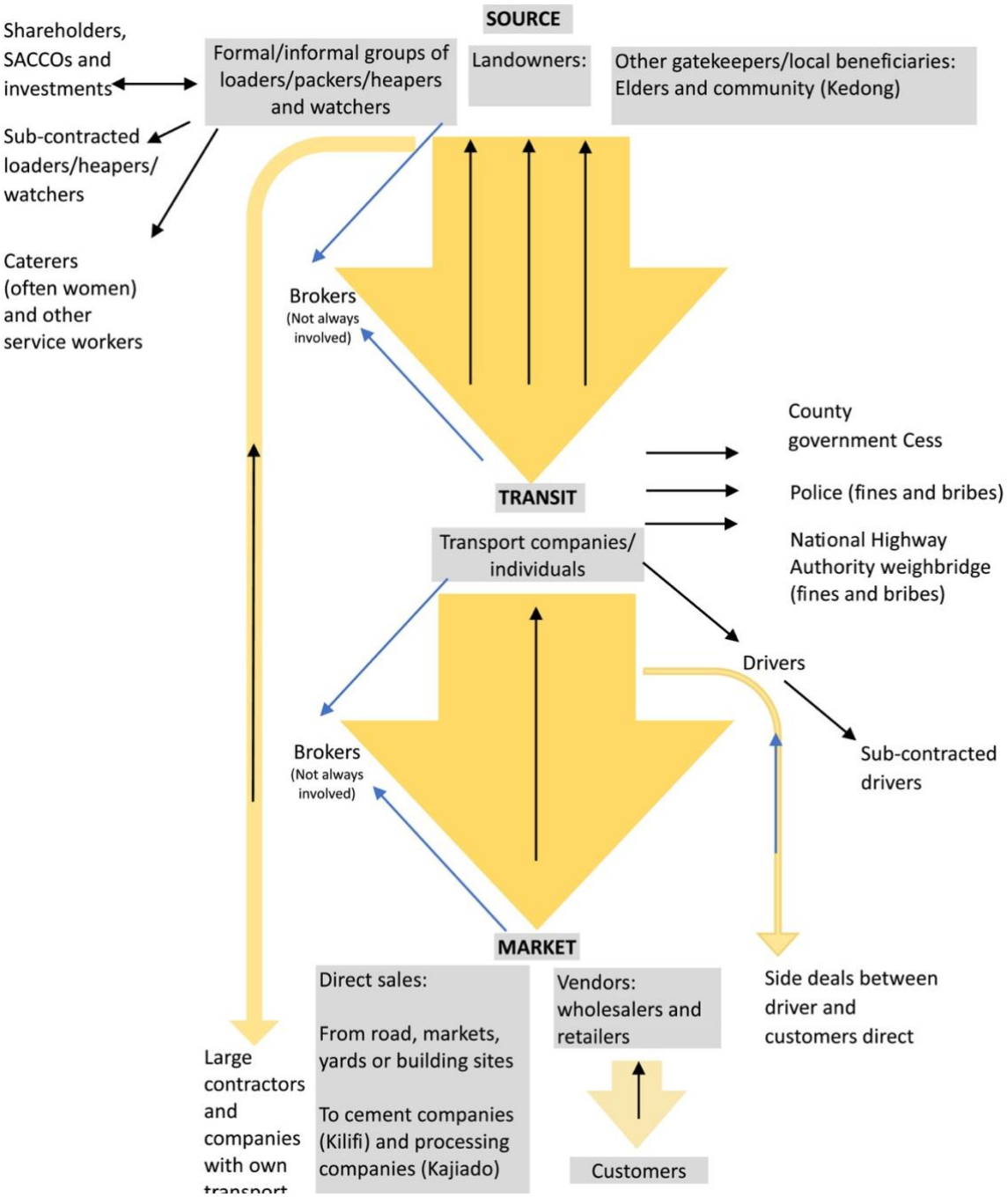

Figure 2: The sand value chain in Kedong

4.1.3. MAIN CHALLENGES

SOCIOECONOMIC AND COMMUNITY RELATIONS

An important contestation at Kedong is the issue of land, which is claimed by the Kitet Maasai. This is a decades-long issue, with some community members taking the matter to international courts.[19] Attempts to evict the local community intensified following the construction of the SGR and associated strategic developments at the ranch. In 2019 the land was fenced, preventing the usual movements of the community, and the gate fee imposed, which led some sand transporters to go elsewhere. Community members responded with protests, which led to deadly clashes with the police. [20] Around the same time, two excavators procured by the Kedong ranch owners were burned and destroyed by the loading community, who saw it as a likely threat to their livelihoods.[21]

There is sometimes contestation between different harvesting groups [22] in the form of territorial and boundary disputes. Sometimes trucks that have an agreement with one group may be hijacked by another group. This has occasionally led to conflicts.[23] At times groups try to undercut others,[24] and elders try to bribe trucks to come to their own particular rivers.[25] An umbrella organisation, known as M6, was created to bring together several harvesting groups in the same sub-county (Naivasha) and was able to mitigate conflicts over loading agreements. However, it is no longer operating for unclear reasons. Brokering at the site can also bring contestation as harvesting groups pay large sums to secure deals that are ultimately not honoured. One group explained that they had lost 70,000 KES to fraudulent brokers. Because these agreements are informal, it is impossible to report them to the police.[26]

ENVIRONMENT AND SUSTAINABILITY

Kedong's many gullies do not suffer quite the same level of degradation and adverse effects as river sites, though some gullies have been overexploited. Being at the foot of a dormant volcano gives a steady supply of black sand, but also makes the area highly vulnerable to floods. This is a problem for the nearby road and is made worse by the SGR, which interferes with drainage. The erosion of the flooded landscape is then exacerbated by trucks churning up the mud; when mud is carried by the floods, it blocks the main road.

GOVERNANCE AND REGULATION

At the loading and transporting stages, the organisation and governance provided by sand harvesting groups and SACCOs to a large extent standardises fees and, in so doing, protects members from exploitation. Groups self-regulate who can access the site, allowing in members of Maasai groups or groups from Mahi Mahiu, with whom they have a historical agreement. Maasai elders oversee the site and coordinate access for other community members.

County governments also provide some regulation but do little to restrict harvesting. The 2023-2027 County Integrated Development Plan notes the intention to introduce a county Mining Act and sand-harvesting regulations.[27] One disincentive is the large income from cess.

[19] Interview, official in the Kitet community-based organization in Suswa on 20th December 2022.
[20] Cherono, S. & E. Matara. (2020) "Kenya: Two dead after protests rock Maai-Mahiu Town" 10 November, 2020. https://allafrica.com/stories/202011110151.html
[21] Interview, retired civil servant and a sand elder in Kedong Ranch on 14th July 2021; Interview with senior national government administrator in Suswa on 11th May 2023.
[22] Group Interview with senior administrators in Narok on 19th December 2022.
[23] FGD with Neema Youth Group on 21st December 2022, and Puan Sand Harvest Youth Group on 21st December 2022.
[24] Interview local pastor in Suswa on 19th December 2022.
[25] Authors own experience.
[26] FDG with Neema Youth Group on 21st December 2022.
[27] Nakuru County Government (2023) County Integrated Development Plan https://nakuru.go.ke/wp-content/uploads/2024/05/Nakuru-CIDP-2023-2027.pdf pp 171.

An additional one is that sand harvesting groups, and even SACCOs for truckers, are large and powerful entities with political clout. Interestingly, Kedong ranch is currently not restricting harvesting, due possibly to the fact that some of the owners are themselves involved in sand transport.[28] It is also likely that the ranch is wielding minimal control to avoid further contestation.

Corruption is evident at levels familiar to Kenya. Police receive a small but steady income from the industry, while buyers sometimes collude with state officials to avoid the cess fee.[29]

[28] Interview, name withheld on 7th August 2024

[29] Interview local pastor in Suswa on 19th December 2022.

4.2. MAKUENI (O.A. Kasera)

4.2.1 CONTEXT

Sand is integral to both Makuen''s community life and local government revenue, transitioning from cartel-driven to community-led trade. [30] Nearly all local communities have licensed sites, although new sites continue to open and close (see Figure 3 below showing some of the sites visted as part of this study). This widespread licensing has enabled many residents to benefit from sand income, including youth employed as loaders, older citizens supported through community funds, and the county government. For instance, a substantial portion of Makuen''s 9.3% own-source revenue for Financial Year 2024/2025 is projected to come from sand-related activities.[31]

Makuen''s sand-bearing ecosystems, primarily seasonal riverbeds like Athi, Thwake and Kaiti, support both the local economy and environmental stability. These ecosystems are crucial not only for sand extraction but also for water conservation, agriculture, and biodiversity. However, uncontrolled sand harvesting has in the past led to environmental degradation, drying riverbeds, disrupted water flow, and soil erosion, ultimately harming farmlands and water tables.

The 2015 Makueni County Sand Conservation and Utilisation Act (Sand Act) introduced regulatory limits, including the provision that all sand harvested in Makueni County is to be utilised within the county, a formal designation of all sand harvesting sites, a maximum extraction depth of six feet at on-farm sites, and strict restrictions for riverside mining. [32] While enforcement remains challenging—especially at county borders—the Act has successfully curbed degradation and positioned Makueni as a model for sustainable sand management in Kenya.

Land governance is tightly linked to sand management in Makueni. Before the 2015 Act, weak land governance allowed powerful sand cartels to exploit resources, causing conflicts, environmental harm, and a loss of local control. The Act reshaped governance by empowering local communities to form sand harvesting committees that oversee site management. These committees collaborate with county authorities to enforce extraction limits and licensing, reducing conflicts and fostering equitable economic benefits.

The Sand Act has also addressed historical power imbalances favouring external actors. Community-led governance has become a model for local ownership and transparency, with other counties looking to replicate Makueni's approach. Nevertheless, consistent enforcement and non-compliance, especially in remote areas, remain challenges.

Makueni's sand sector transformation began in the mid-1980s with small-scale local usage, escalating in the early 2000s with rising urban demand. The county's experience with 'sand wars' from the 1990s through to 2017 underscored the need for reform, as violent conflicts emerged from illegal mining controlled by powerful cartels. This exploitation led to severe social and environmental impacts, including broken families and increased crime. A turning point came in 2011 with the murder of a police officer defending sand resources, sparking public outcry and marking the onset of a widespread community-driven and county-supported mobilisation for reform.[33]

Under the then Governor Kivutha Kibwana's leadership, the Sand Act established the Makueni County Sand Conservation and

[30] The findings if this section are based on the analysis and interpretations of a dense qualitative dataset collected from a total of 16 respondents composed of sand site owners, loaders, transporters, community members, sand SACCO officials and Makueni County Sand Conversation and Utilization Authority officials. The study was conducted in one round occurring between 8th October and 18th November 2023, primarily with site-based actors.

[31] Government of Makueni County (2024). The Makueni County Finance Act 2023. Retrieved from: www.https://makeuni.go.ke.

[32] See Makueni County Sand Conservation and Utilization Act. (2015).

[33] Key Informant Interview (KII) 1, 3 & 5, held between 8th and 13th October 2023.

Utilisation Authority, empowering communities to reclaim control over sand harvesting and protect their environment. Today, Makueni serves as a benchmark in sustainable sand management, with community-led governance replacing cartel dominance and other counties looking to Makueni's model for guidance.

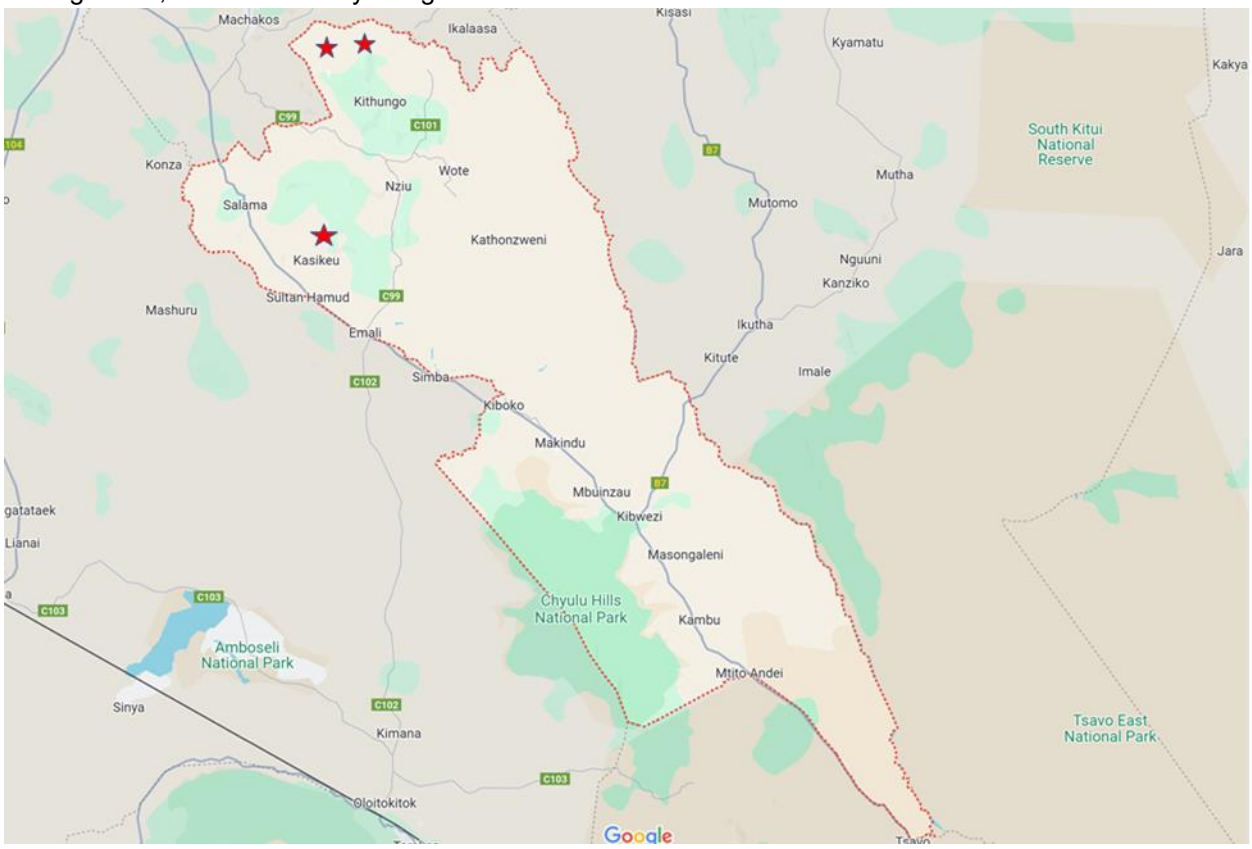

Figure 3: Sand sites visited during the study in Makueni County, excluding Tawa River

4.2.2 REVENUE STREAMS

The revenue structure within Makueni County's sand mining industry reveals a complex blend of formal and informal transactions across various actors in the sand value chain as well as formal and informal benefits sharing schemes (see Table 3). Although governed by the Sand Act of 2015, revenue distribution at sand sites is largely shaped by local negotiations, which bring transparency yet retain informal elements, especially at the extraction and transport levels. For example, the Sand Act leaves a window of opportunity to community members to decide how much to charge per truck collecting sand from their site(s), and consequently how to share this among themselves. In Kajiado, only those engaging their efforts directly (loading, for example) share the proceeds collected from transporters in terms of sale of sand. In Makueni, on the other hand, in addition to loaders, community members from villages adjacent to harvesting sites as well as organised sand dam management teams, gain a share from the sale of the sand. Moreover, there is widespread involvement of other actors who earn indirectly from the sand business. These include cooks, donkey cart operators, and wheelbarrow harvesters among others, all of whom cater to different market needs and maintain informal payment systems. For example, daily earnings range from 1,200 KES for cooks to 4,800 KES for donkey cart operators. Although there is dissatisfaction among locals on the actual implementation, the Sand Act spells out the modality for sharing the proceeds from sand sales (through cess) as follows: 50% are earmarked for the Conservation Fund, 25% are used for the Authority's operational costs, 20% go to the

County Government as revenue, and 5% remain with the local community.[34]

	6-wheeler	Comment
Price of sand	3,000 – 3,500	Across four sites visited only 6-wheelers were observed.
Loaders' wage	1,650-2,000 (100-250 per loader)	
Costs at site	**4,700-5,500**	
Cess	3,000	
Police stops	N/A	Decommercialisation removes a major source of illegal income for police.
Fuel	2,000-3,000	Suppliers are almost entirely local hence less costs on fuel.
Driver wage	1,000-7,000	Average, depending on terms of employment.
Costs in transit	**6,000-13,000**	**N/A**
Market price	**10,000 – 17, 000**	

Table 3: Sand revuenue stream in Makueni County

At the market level, resellers negotiate with buyers to earn between 2,400 KES and 6,400 KES daily, often transitioning to mPesa (mobile money) as a payment method, signifying a gradual move toward more formalised transactions within informal trade settings.

The county government collects formal cess fees of 3,000 KES per truck trip[35] via Mpesa, reflecting a structured revenue stream that supports environmental and community safeguards. Higher-tier actors, such as contractor suppliers and private house construction suppliers (who are mainly truck owners), generate monthly earnings of up to 120,000 KES and 306,000 KES respectively, under formal agreements, relying on mPesa for predictable payments. This layered revenue ecosystem, underpinned by regulatory oversight, underscores the mix of formalised and informal practices in Makueni's sand mining industry, showcasing both income regularity at site levels and disparities across different actors within the value chain (see Table 3 above).

4.2.3 MAIN CHALLENGES

SOCIOECONOMIC

Sand mining serves as the primary source of income for many community members in Makueni. Two explanations can suffice. First, is the very nature of the county: it is an arid/semi-arid land with few opportunities for agriculture. The second is the current regulatory environment that has fundamentally empowered community members to not only gain from governance of sand, but also from its economics: extraction and the trade of sand. The economic empowerment brought about by the post-2015 regulatory changes has been particularly beneficial for youth, women and older members of the community. For example, at the Kamarathan site, 16 loaders, who are mostly aged between 18 and 42, earn daily wages of about 1,850 KES each after loading around 18 6-wheeler trucks.

Interviews with loaders reveal that that this economic activity reduces their likelihood of

[34] See Makueni County Sand Conservation and Utilization Act. (2015), section 35.

[35] 6-wheeler is the most common and visible commercial truck and is charged at 3,000 KES per trip.

engaging in criminal activities,[36] as they are gainfully employed in sand mining. The economic benefits, however, are not equally shared, with loaders receiving lower pay compared to transporters and truck owners (suppliers).

COMMUNITY RELATIONS

From the fieldwork, most respondents shared the view that the regulation of sand mining has fostered positive community relations mainly by promoting equitable benefit-sharing between actors at the site. Revenues are spread among loaders/youths, women, older persons, and other actors, ensuring that various groups within the community benefit. Additionally, semi-formal mechanisms like chamas (small "merry-go-round" type of savings organisations) have been created to manage communal funds, enhancing social cohesion and collective decision-making. In Ngwania ya Mzumuo, a CBO responsible for managing sand harvesting has been operationalised. It operates as an autonomous entity that collects revenues from transporters and redistributes them to community members. Only registered CBO members are eligible to benefit from these proceeds. At the same time, the CBO acts as an extended appendage of the Makueni County Sub-County Sand Committee (MCSCSC). This is so because at least two members of its leadership sit at the MCSCSC and report conflicts, progress and challenges. Even more interestingly, the CBO is an inclusive platform with persons with disability and women in its core leadership, further enhancing community relations by averting potential identity conflicts due to non-inclusion of a given group, especially the marginalised.

ENVIRONMENT AND SUSTAINABILITY

The introduction of regulations limiting sand extraction to a depth of 2 feet is aimed at preserving the environment, particularly the county's critical water sources. While these regulations have had a positive impact, concerns about enforcement persist. Blocked bridges and over-accumulation of sand in certain areas are cited as unintended consequences of overregulation.[37] Additionally, community members express frustration with the county government's failure to implement key environmental initiatives such as tree planting and sand-dam maintenance.[38]

GOVERNANCE AND REGULATION

Self-regulation by community groups has been critical in maintaining order at sand mining sites. Groups of loaders, sand dam maintenance teams, and other community members adhere to established codes of conduct, such as abstaining from drug and alcohol use during work hours. Leadership within these groups ensures compliance with regulations, contributing to the smooth operation of sand extraction activities at sites. However, challenges such as limited enforcement capacity[39] and the perceived involvement of current county leadership in cartelistic practices have raised concerns about possibilities of re-emergence of pre-2017 era.

The Makueni County government has played a key role in shaping formalised sand governance post-2015. While regulations have been instrumental in bringing order to the industry, enforcement gaps persist. For instance, issues such as delayed site licensing, continued non-compliance with environmental standards, or lack of proper monitoring and countering of

[36] Key Informant Interviews 1 (community organizer – member of Kikundi), 3 (loader), 6 (cook); FGD 1 with loaders.

[37] This was major concern for respondents at Mbooni and Makueni respondents who asserted that the restriction that sand for mining must come from not just licensed sites but also from within the riverbeds was somehow dangerous and needed to be revised because sand was causing blockage of bridges and flooding at several people's homes.

[38] FGD 1 – Karamathani (9th October 2023); KII 13, Ngwania ya Mzumuo (25th October 2023).

[39] Key among these is the concern of just a few enforcement officers and sand clerks, 1 officer paired with a sand clerk are currently expected to cover 4 wards. This is challenging and so cases of over-time harvesting and loading, and extra-county trade all of which are illegal seems to happen albeit in much reduced rates.

extra-county trade of sand indicate the continuous vulnerability of the county's sand regulation.

An additional critical governance step for Makueni going forward is to re-evaluate the criteria for licensing and opening of sites. For example, the criteria seem to largely affect not only the communities (such as Kasikeu) who, due to previous negative experience related to 'sand wars', have unanimously refused to both licence and open their sand sites; but also neighbouring communities, especially when large sand deposits have caused extensive and at times fatal flooding. The Authority can, for example, solve this problem by limiting the extent to which communities concede to site licensing and opening in sand-rich areas. Another way may be to temporarily lift the ban on transporting sand out of Makueni county, for example during the months when sand deposits are largest and accessible.

4.3. KAJIADO (O.A. Kasera)

4.3.1 CONTEXT

Sand mining is a vital economic activity In Kajiado. It is deeply integrated into regional infrastructure projects, such as major infrastructure developments in Nairobi.[40] Key sites, such as Kasarani, Mile Sita and Kelewa, have sustained sand extraction for decades, with Kasarani being the largest, hosting over 26 specific sand harvesting locations (see Figure 4). Despite its size, uncontrolled overexploitation, changing seasons, and poor roads have reduced its capacity. For example, during our first round of investigation as few as 15 trucks were observed collecting sand at a time, compared to the hundreds previously accommodated.

Figure 4: Sand sites visited in Kajiado

The industry in Kajiado has experienced significant degradation due to overextraction, with major environmental impacts on sand rivers that once supplied water to local communities. For example, access to water is now a problem to locals residing around the river Kasarani, which once served as an endless source of water.[41] Sites like Mile Sita and Kelewa have seen reduced sand availability and a declining workforce, with fewer trucks and opportunities for loaders. The

[40] The study of sand harvesting in Kajiado County was conducted between 15th October 2023 and 27th June 2024. In total, 33 key informant interviews and 5 focus group discussions were conducted.

[41] FGD 1, Round 1 with loaders at Kerio 1, 18th October 2023.

degradation of sand rivers has disrupted agricultural activities and diminished water sources, exacerbating local food security issues in an arid/semi-arid region, where farming is a rare alternative for those with capacity to engage in technology-enabled agriculture.

Unlike Makueni, where sand is treated as a communal resource, sand in Kajiado County is largely perceived as private property. Landowners adjacent to sand dams benefit exclusively, earning 3,500 to 4,000 KES or at times up to 6,000 KES per truckload, while other community members have to pay for access.[42] This private ownership model has led to inequalities in benefit distribution and created a *tragedy of the commons* scenario, where overextraction and uncoordinated exploitation prevail due to the absence of effective formal regulations, presence of informal regulations that focus solely on personal gains, and formal county regulations that focus solely on revenues from sand collectors.

Sand mining in Kajiado has a long history, with sites like Kasarani operating for over 70 years. However, in recent years, overexploitation and the absence of self-regulation have led to significant environmental damage and a reduction in sand availability. Previously, the industry was controlled by cartels and brokers, but with the depletion of sand and the entry of County Government as a player (especially through its heavy taxation), their influence has waned. Today, loaders often double as brokers, further highlighting the shifting dynamics within the industry in terms of reduced demand for sand.[43]

4.3.2 REVENUE STREAMS

Revenue dynamics from Kajiado's sand value chain are complex. This is so because of new actors, brokers and police, higher monthly charges by the county, complex market dynamic and typology, the mix of formality and informality, and the entry of women at the town level as brokers. Table 4 below summarises the main expenses along the sand value chain for a trailer.

Before highlighting the value chain dynamics, it is important to underscore that unlike Makueni, where highly regularised and informal benefits sharing schemes are in place, in Kajiado, revenues earned from sand provide benefit to a much narrower section of the community, namely the so-called sand site owners, and the share received for loading is shared among loaders.

At the site level, local brokers operate as intermediaries between site owners [44] and transporters (and even contractors buying directly from river sites). Typically, they earn between 2,000 KES and 4,000 KES per trip. Town-based brokers serve similar roles but between different actors and with a spatial difference. They are based in towns or city centres such as Kitengela and mostly connect contractors with transporters. This means that the driver collecting the sand from the site has to go through another layer of brokering, namely a town-based broker, who not only points the driver to the market for his sand, but also collects pay for sand from the buying contractor and pays the transporter. Town-based brokers collect even higher fees for their work ranging from 3,000 to 14,000 KES, depending on distance and negotiation. Interestingly, with the entry of women brokers at the town level, gender dynamics in Kajiado are changing. As female brokers claim a lower fee, namely between 1,000–3,000 KES, their male counterparts are forced to diversify their brokerage trades, including brokering for other building items such as rocks, iron materials and timber, among others.[45] However, it is notable that the informality here is balanced with predictability, as these transactions are regularised despite lacking formal oversight. For example, even without signing of contracts

[42] KII 12, Round 2 with sand site owner held on 19th June 2024.
[43] Which also shows not only changing seasons but also unavailability of mega projects to which sand should be supplied but also emergence of sand substitutes such the so-called quarry dust (Round 2 KII 2, 5, 9, 16 & 17).
[44] Especially those lower in the social strata. Those with some sense of economic empowerment sell directly and try to disrupt brokers.
[45] KII 16, held in Kitengela on 4th July 2024.

(except for larger town-based brokers), every player seems to be comfortable with their roles and pay. Loaders do not seem to have an interest in the actual amount paid to brokers, as is the case with site owners who do not ask questions around the possibility of exploitative brokers.

Loaders, responsible for preparing trucks, receive 8,000 KES per truck from brokers, suggesting a relatively consistent payment pattern but one that remains governed informally. Meanwhile, site owners experience disparities based on location; owners near tarmac roads, in particular, command 6,000 KES per truck or trailer from drivers or direct negotiation with truck owners. In contrast, site owners farther from major roads receive 3,500 KES paid in cash by brokers, because they are prevented by these brokers from reaching directly to drivers or truck owners to negotiate prices. This distinction underscores how geographical access influences bargaining strength and revenue potential, but also also shows that economic status of a site owner determines their negotiation power.

Additional actors at the site include food sellers, earning 2,300–3,000 KES daily, usually paid in cash by individuals consuming meals. Sand heapers and road repairers, essential for site operations, also receive a total of 800 KES per truck trip in cash, paid by brokers in a largely informal but steady process.

	10-wheeler	12-wheeler	Comment
Price of sand	3,500 – 6,000		Dominated by 10- and 12-wheel trucks
Loaders' wage	8,000 (1,000 per loader).		
Costs at site	**11,500-14,000**		
Cess	ca 1,000		Kajiado County charges a monthly cess fee per truck (25,000 KES for a 6-wheeler and 50,000 KES for 10- and 12 wheelers). The estimate per trip provided here is on the basis of two trips per day
Police stops	2,000 – 10,000		Truck reaching the Nairobi estates incur the highest bribes.
Fuel	10, 000 – 15, 000		
Driver wage	1,000 – 3,000		Note that the amount is an average driver's daily wage. However, drivers employed under formal market arrangements can earn between 30,000 KES – 45, 000 KES.
Costs in transit	**14,000-30,000**		
Market price	**35,000-78,000**		Trucks that supply the vicinities of the harvesting sites sell sand for 35,000 KES. Those supplying formal markets sell at 42,000 KES and those supplying contractors far off Kajiado make up to 78,000 KES

Table 4: Sand revenue stream in Kajiado County

The role of temporary drivers, who earn 1,000–3,000 KES per trip, and semi-permanent drivers on monthly contracts with companies (earning between 33,000 KES and 55,000 KES, typically paid via bank or mobile money transactions), reflects a blend of transient and formalised labour. Additionally, the owners of pathways granting access to sand sites charge 300–500 KES per truck, creating a layered payment structure that addresses even micro-access levels within the site itself.

In the transport segment, informal costs emerge prominently, particularly in the form of bribes. Police bribes cost drivers 3,000 KES per trip,

while weighbridge officials fine 6,000–10,000 KES for overloading, illustrating governance gaps and the informal costs that impact long-distance transport. More formalised interactions also exist: for example, transport actors make annual SACCO/KeNHA payments of 12,000 KES to operate under structured agreements, primarily among established transport companies. However, drivers face additional reloading and offloading fees, which are informally negotiated and often contested, particularly in cases of local, short-distance supplies.

The market level is stratified according to the destination and nature of the market. In local open markets near sand sites, customers pay about 33,000 KES per truck. Pail and wheelbarrow resellers in Kajiado Town, however, deal in much smaller transactions, with pales [46] buyers paying 200 KES and wheelbarrow buyers paying 200–300 KES, emphasising the range of sand volumes and customer types. Markets farther afield, like Kiserian, witness slightly higher prices, where demand from urban builders and developers increases costs. Closed markets, particularly sand-based enterprises in regions beyond Kajiado, reflect a more structured and formalised environment. In these cases, prices per truck reach 42,000 to 64,000 KES, while pick-up buyers incur smaller costs ranging from 1,200 to 1,600 KES per trip. The mobile markets situated at high-traffic intersections, such as Kitengela, fetch premium prices between 45,000 KES and 78,000 KES per full truck, showcasing how proximity to urban centres can dramatically affect revenue.

Finally, instead of paying cess fees for every journey, Kajiado County operates a system of formalised monthly fees, with six-wheeler truck owners paying 25,000 KES and twelve-wheeler owners paying 50,000 KES.

4.3.3 MAIN CHALLENGES

SOCIOECONOMIC AND COMMUNITY RELATIONS

The socio-economic landscape of sand harvesting in Kajiado County is shaped by significant challenges, particularly as sand mining remains a primary livelihood for many, especially young people and older residents with limited alternative income sources. However, the growing competition for work in this sector is marked by rising wait times and fewer opportunities, leading some workers to spend days waiting without a guaranteed income.

Additionally, gender dynamics add complexity to Kajiado's sand mining sector. Women brokers, primarily operating in town areas, have entered the trade with competitive rates, often charging less than their male counterparts and, in some cases, threatening to replace them. Male brokers, who previously profited from mega-projects like the Thika Superhighway and the Nairobi Expressway, are now facing reduced prospects as fewer large construction initiatives arise in the county.

The working conditions within the sand mining industry also reflect socio-economic and labour exploitation issues, particularly for loaders who earn between 800 KES and 1,400 KES per trip at the Kasarani site. Loaders face ongoing exploitation, especially from sand-processing companies operating in the area. As they control the commodity chains, they directly affect loaders' employment opportunities. Collectively, these dynamics highlight the socio-economic vulnerabilities and inequalities entrenched within Kajiado's sand mining industry, requiring attention to labour rights, equitable resource distribution, and supportive policies to foster a more inclusive local economy. Unfortunately, the county government has not worked on harmonising these grounds for conflict and is mostly interested in the collection of revenues.

[46] This is one of the many local carrier tools used to measure and sell sand from local sand markets to small scale buyers.

ENVIRONMENT AND SUSTAINABILITY

Overexploitation of sand in Kajiado has led to severe environmental degradation, particularly in rivers, where water sources have dried up, negatively impacting agriculture and food security. Unregulated sand extraction has also led to the destruction of roads due to overloading, with transporters routinely exceeding weighbridge limits. This environmental damage, coupled with prolonged droughts, has exacerbated the already fragile ecosystems of this arid and semi-arid lands (ASAL) region, further straining local resources.

GOVERNANCE AND REGULATION

The governance and regulatory framework for sand mining in Kajiado County reflects a blend of formal and informal mechanisms that significantly shape the industry's operations. However, these mechanisms fall short in both oversight and sustainability. Kajiado lacks a comprehensive local regulatory structure that encourages sustainability and equitable distribution of resources. While SACCOs are present to organise loaders, their role is largely limited to financial management rather than regulatory oversight, leaving many loaders exposed to exploitative practices by larger transport firms and brokers. This dynamic creates an environment where resource extraction is pursued with little coordination, fostering overexploitation and depletion of sand resources. The absence of community-led initiatives has thus left Kajiado reliant on loosely enforced county regulations and sporadic intervention, which has proven insufficient for sustainable governance.

Moreover, the informal networks among sand brokers, transporters, and site owners underscore a governance framework where informal practices often circumvent formal regulations. For instance, informal negotiations at sites allow for variability in sand pricing, depending on factors such as location, proximity to major transport routes, and the number of available brokers. This informality is further compounded by sporadic bribes to police and weighbridge officials, facilitating unregulated transport across county lines and exacerbating resource depletion issues. Together, these layers reveal a fragmented regulatory landscape where informal networks prevail, leaving the industry susceptible to exploitation and unsustainable practices.

Kajiado's sand regulation is centred around financial transactions, particularly the sand cess. Truck and trailer owners pay 25,000–50,000 KES per month as a subscription to continue sand mining. Political interference further complicates enforcement, as some politicians who own transport companies bypass these payments, undermining the regulatory framework.

A critical component of county regulations is the ongoing discussion about the sand policy in Kajiado County. It reveals significant concerns among respondents, who oppose the proposed regulation largely due to fears of an impending shift towards a new SACCO model, which would centralise control over the sand business under county management. Respondents worry that such a model might not only limit individual and private sector participation, but also shift control and benefits away from local operators, concentrating power and profits within county administration.[47] This centralisation could also exacerbate issues of accountability and transparency, entrenching existing inequalities and reduce opportunities for equitable distribution of benefits.

[47] A perspective that emerged strongly from my Key Informant Interviews with SACCO leadership and empowered sand site owners (KII 4, 8, 12 held on 11th, 16, 23rd June 2024 respectively).

4.4. TAITA TAVETA (W. Mbuguiru)

4.4.1 CONTEXT

Taita Taveta is a dry county in southeastern Kenya, approximately halfway between Nairobi and Mombasa. Over 60% of the county's over 17,000 km^2 of land is set aside as Tsavo East and West National Parks respectively.[48] The population projection stands at around 360,000, which is made up of majority Taita and several other groups. Livelihoods include livestock keeping, small-scale subsistence farming and small business ventures together with small- and large-scale mining of the rich mineral deposits in the area.[49]

Sand from the area has specialised uses and is in high demand.[50] Harvesting is mainly carried out by artisanal miners and is widespread throughout the county at river and pit site.[51] Although there are numerous river sites, these are declining, and sand harvesters have increasingly turned to pit sand extraction. Sand harvesting sites visited along the river Voi were Kasarani, Ore, Bridge, Tanzania and Mto Mwagodi, while pit harvesting sites visited were Kasarani and Gimba (see Figure 5 and 6). There is also a distinction between highland (Taita hills) and lowland sites; sand is abundant and readily available in highland sites as compared to the lowlands. Although the industry is male-dominated, several women are also working as sand loaders and brokers.

Most land in Taita Taveta has historically been Trust land (now known as Community land under the Land Act of 2012), with some having been converted to private land. In the areas visited, residents have semi-formal rights to the land, with some residents having individual title deeds and others still waiting to receive them.

Figure 5: Pit sand harvesting at Kasarani, Voi sub-county

[48] Taita Taveta County 2023. County Integrated Development Plan 2023-2027.

[49] Anyona, S. and B. Rop 2015. The Character and Profile of Artisanal and Small-Scale Gemstone Mining Community in Taita Taveta County, Kenya, Proceedings of the Sustainable Research and Innovation (SRI) Conference 6 - 8 May 2015.

[50] Interview, Transporter in Voi on 12th July 2023

[51] Funder, M., & Marani, M. 2013. "Case study: the EMCA And NEMA In Taita Taveta County. In Implementing National Environmental Frameworks at the Local Level: A Case Study from Taita Taveta County, Kenya (pp. 32–47). Danish Institute for International Studies.

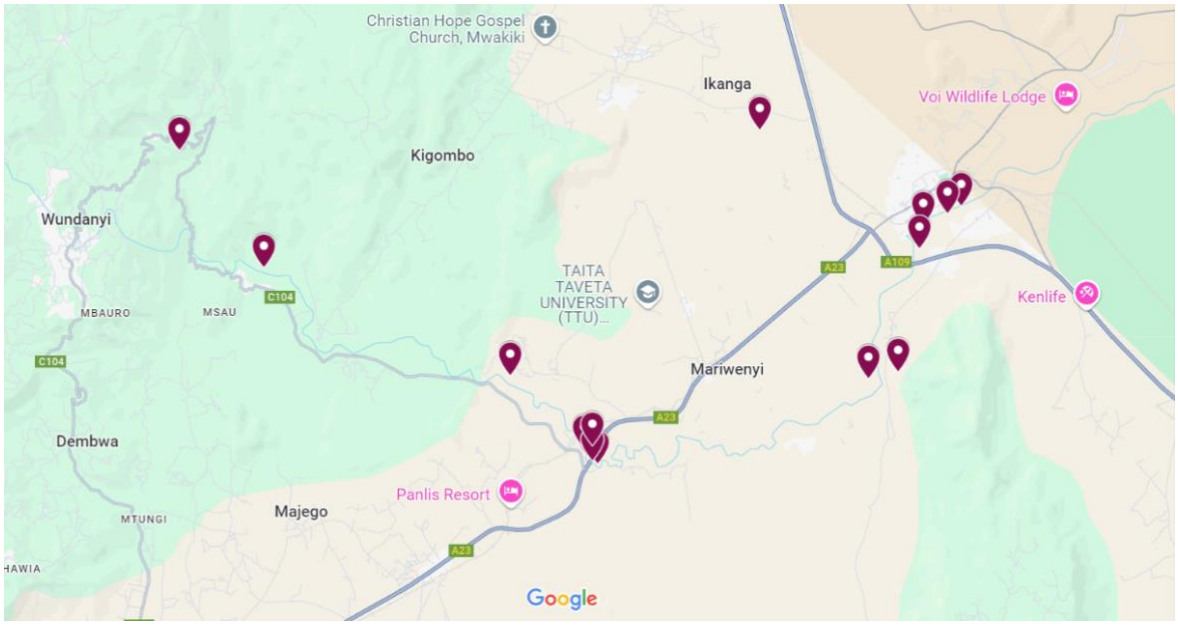

Figure 6: Map of sand harvesting sites visited in Taita Taveta County

4.4.2 REVENUE STREAMS

Sand harvesting in Taita Taveta County is weakly organised. Few areas have sand harvesting groups while others undertake sand harvesting activities individually. Transporters visit the sites with 6- or 10-wheeler trucks and trailers. Prices, as shown in Table 5, may be almost three times higher in lowland sites compared to the highlands where sand is readily available. The fee to loaders is included in the price and the remainder goes to the landowner. It is then sold at a cost of 12,000-26,000 KES, depending on the market destination. Sand is mainly transported to Mombasa County and sold to contractors and construction companies.

Most of transporters supply other construction materials as well as sand. Given the position of the sites near the main Nairobi-Mombasa highway, some drivers make the most of a journey to Mombasa by collecting some sand to sell,[52] sometimes for personal profit and not necessarily with the knowledge of the truck owner.

	6-wheeler	10-wheeler	12-wheeler
Price of sand	1,500-4,000	3,500-6,000	7,000-12,000
Loaders' wage	450-750 (150 per loader)	1,500 (300 per loader)	2,500 (500 per loader)
Costs at site	**1,950-4,750**	**5,000-7,500**	**9,500-14,500**
Cess	1,000	3,000	5,000
Market price in Voi	**12,000**	**20,000**	**30,000**

[52] Interview, Driver in Mzukeni site on 5th May 2023.

Market price in Mombasa	13,000-26,000	30,000-45,000	50,000-75,000

Table 5: Sand Revenue Stream for Taita Taveta County

4.4.3 MAIN CHALLENGES

SOCIOECONOMIC AND COMMUNITY RELATIONS

Sand extraction activities are a vital source of livelihood for youths with few other livelihood options, and who have only completed primary education. And while many of those who have attended primary school do not proceed to secondary due primarily to a lack of finances, sand harvesting activities have also been identified as a further reason for school dropout. Furthermore, sand harvesting activities have attracted economic migrants to the county from neighbouring counties of Kwale and Kilifi and as far as western Kenya, thus straining the local resources and exacerbating issues of unemployment.

The industry attracts some crime and conflict dynamics such as theft of domestic animals by trespassing truckers, burglary and defilement. Drug peddlers may camouflage themselves as sand harvesters to infiltrate the loaders' networks. Some residents oppose the activities of sand harvesters, as noted by this interviewee:

> *There is heightened community relation between me and community members who accuse me of interfering with their source of livelihood because I blocked the pathways to the sand extraction sites near the river. Community members also blame me when NEMA officials impound on them. They claim "You alert NEMA to come and arrest us."* [53]

Conflict is rampant between landowners and brokers over shares of the profits. For example, in the Mbololo area, landowners still lack legal documents to claim ownership of their land whilst the brokers are accused of harvesting sand and failing to share profits. Sometimes harvesting takes place on land belonging to absentee landlords who have not given consent (e.g. at Ore and Kasarani).

ENVIRONMENT AND SUSTAINABILITY

Visitors to Voi town will observe severe degradation of the Voi river as a result of sand harvesting. There are several dimensions of environmental degradation. In pit-sand harvesting, fertile topsoil is the first to be removed and is then sold to landscapers or brick-makers, which makes it more difficult for vegetation to regrow. Excavated pits have become pools of stagnant water and breeding sites for mosquitoes. Bed rock is the last material to be exploited, blasting it for removal and sale for construction purposes. Dust, air and water pollution are a major challenge especially at sand harvesting sites that are near homesteads and roads. Those depending on the Voi river for domestic use express concerns over dry riverbeds and silty and contaminated waters.

GOVERNANCE AND REGULATION

The Taita Taveta Sand Harvesting and Conservation Amendment Act 2020 has borrowed several notions from the National Environmental Management and Conservation Act of 1999 (EMCA). However, the former Act is not operational, as validation is yet to be done by the public. Sand regulation in the county is also minimal, due to overlap of mandate between the Ministry of Mining and the Ministry of Water, Environment and Natural Resources, which has led to a lapse in sand harvesting regulation. Additionally, the Ministry of Mining has not yet tapped fully into sand extraction as expected, as more attention is directed to the county's lucrative gemstones industry.

[53] Interview, community member in Gimba, on 9th May 2023.

Multiple toll stations on major roads exist, operated by the Directorate of Revenue to collect cess on vehicles transporting sand. However, there are no weighbridges and officers rely on the visual scale to indicate tonnes, on the side of the truck. As observed by another interviewee:

> *Challenges affecting them are lack of monitoring tools, the department had proposed for a weighbridge, items were even procured but because of bad politics the project never went through. This was in 2019-2021.*[54]

County government plans are underway for value addition of the sand, through sieving and packaging into 50kg and 100kg bags, to ensure standardisation of prices. As in other places, transporters complain of harassment and coercion by police officers to offer bribes.

[54] Interview, senior County official in Voi on 19th July 2023

4.5. KILIFI (B.M. Kilaka)

4.5.1 CONTEXT

Sand harvesting plays a significant role in Kilifi County, particularly in Magarini Division, where it is the primary source of livelihood for thousands of residents and a critical revenue source for the county government. Despite its importance, the industry remains largely decentralised. In addition, the sand extraction process has remained predominantly manual over the years, with loaders relying on spades to harvest sand. Attempts in the 1990s to automate the process were met with resistance from loaders, who feared job losses due to technological advancements. [55] The sand available in Kilifi is categorised into three differenttypes, namely: scope, thick particles, and building sand. Each type serves different construction needs and is priced differently. In Kilifi, sand harvesting is concentrated in three main areas, namely, Mjanaheri, Kibokoni and Moi areas (see Figure 7 below). In all three areas, sand harvesting supports the livelihoods of thousands of locals, particularly loaders, brokers, and landowners.

Due to the large number of dispersed sites and high-quality sand, Mjanaheri has a higher truck traffic volume compared to the other areas. While Moi sees around 25 trucks per day[56] and Kibokoni between 60 to 70 trucks,[57] Mjanaheri experiences even more traffic due to the large reserves of sand, which is also considered as the best in the market. The decentralised nature of the sand harvesting industry in Mjanaheri makes it difficult to determine the exact number of trucks transporting sand daily. However, with sand harvesting occurring 24 hours a day across numerous quarries, a rough estimate suggests that over 300 trucks may be transporting sand daily from the area.

HISTORY OF SAND HARVESTING

Sand harvesting in Kilifi began in the 1960s as a small-scale activity to meet local needs. Community elders[58] from Mjanaheri recall that sand was initially used to support the cotton

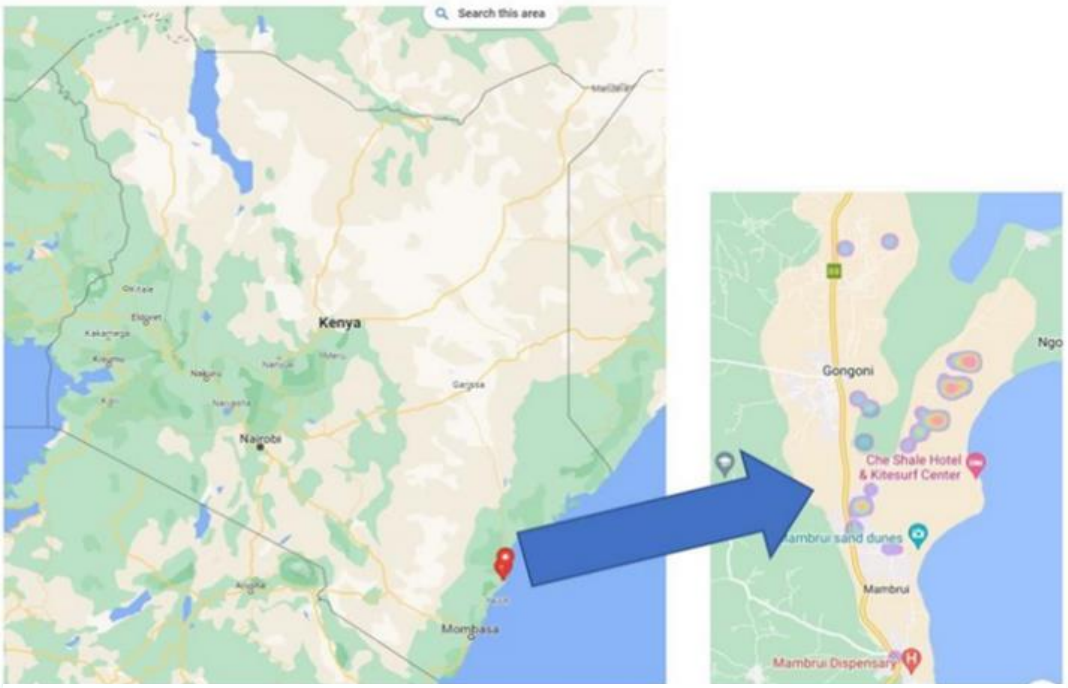

Figure 7: Research Areas in Kilifi County

[55] Interview, former employee of the Magarini Sand Cooperative in Mjanaheri on 21st April 2023
[56] Interview, official local sand association in Moi on 14th March 2024.
[57] Interview, official local sand association in Kibokoni on 14th March 2024.
[58] Interview, founding member Magarini Sand Cooperative in Mjanaheri on 10th October 2023 and FGD with three elders in Mjanaheri on 9th October 2023.

industry by providing a clean surface for drying cotton, which was a major cash crop at the time. Sand was also in demand for local construction needs. Over time, sand harvesting expanded, particularly in the Magarini Division, between Ngomeni and Mjanaheri, where sand was abundant. By the 1990s, the activity had grown into a large-scale industry, driven by increasing demand from Mombasa and other parts of Kilifi and the coastal region. As demand surged, the local community, transporters, and traders recognised the potential to profit, leading to the commercialisation of sand harvesting.[59]

As the industry grew, local communities recognised the need to exert control over the trade and maximise their benefits. This led to the formation of the Kilifi Multipurpose Cooperative Society in 1992,[60] which aimed to regulate the trade and negotiate for communal interests. However, internal conflicts led to its collapse shortly thereafter. In 1997, a renewed effort to place sand harvesting under community control led to the establishment of the Magarini Sand Cooperative.[61] Unlike its predecessor, this cooperative was exclusive to sand harvesters within the Magarini Division. Its primary goal was to bolster the local economy, as the demand for sand had surged, particularly from Mombasa. The cooperative played a pivotal role in advocating for the interests of sand harvesters, promoting community welfare and environmental conservation.[62]

The SACCO's influence over sand prices led to an increase in sand prices. With the price of sand rising, outsiders—mainly transporters from Mombasa—began infiltrating the SACCO and offering separate deals to its members.[63] This undermined the cooperative's unity, and some community members started opposing the SACCO, arguing that its involvement was driving up sand prices. The resulting splinter groups weakened the cooperative, contributing to its eventual collapse.

Despite setbacks, there were multiple attempts to revive the SACCO in 2013. Despite notable achievements, internal conflicts and external interference led to its collapse in 2016. Since then, sand harvesting in Magarini has been left to market forces. Efforts to revive the SACCO are ongoing, led by community elders and the county governor,[64] but face significant challenges from both internal and external factors.

SAND-BEARING ECOSYSTEMS

In Kilifi, sand harvesting primarily occurs through pit extraction across the three main sand belt areas of Mjanaheri, Kibokoni and Moi. Of the three sites, Mjanaheri stands out as the most active and productive as it is known for its high-quality sand that fuels much of the sand trade in Kilifi County. Kibokoni, covering about 400 acres, is the second-largest,[65] while Moi, established in 2004,[66] is the smallest and the most recent site.

Of the three locations, Mjanaheri operates a decentralised system, where quarries are scattered across the landscape. These quarries shift based on landowners' willingness to sell sand. In contrast, Kibokoni and Moi feature centralised operations, with single, large quarries that have designated entry and exit points. These quarries are managed by local associations made up of community members. This has greatly contributed to better control and coordination of sand harvesting activities in the two areas.

LAND GOVERNANCE AND SAND HARVESTING REGULATIONS

A significant portion of sand harvesting takes place on privately owned land. This gives landowners considerable autonomy in deciding whether or not to sell their sand. For this reason,

[59] Interview, founding member of the Magarini Sand Cooperative in Mjanaheri on 10th October 2023.
[60] Ibid.
[61] Ibid.
[62] Interview, former employee of the Magarini Sand Cooperative in Mjanaheri on 21st April 2023.
[63] Ibid.
[64] Interview, founding member of the Magarini Sand Cooperative in Mjanaheri on 10th October 2023 and FGD with three elders in Mjanaheri on 9th October 2023.
[65] Interview, local leader at Kibokoni on 13th March 2024.
[66] Interview, loader at Moi on 14th March 2024.

it is common to find homesteads surrounded by quarries as some owners choose not to sell their land. In contrast, sand harvesting in Moi is conducted on community land, [67] which presents a different dynamic in terms of land use and decision-making authority.

Despite the importance of sand harvesting to the local economy, Kilifi County lacks specific regulations governing the industry. The sector is primarily regulated by the National Environmental Management Authority (NEMA) guidelines on sand harvesting. This absence of formal county regulations further complicates efforts to manage and oversee sand harvesting activities, particularly in addressing environmental and social concerns. According to NEMA regulations, landowners are required to conduct Environmental Impact Assessments (EIA) before beginning sand harvesting. However, this regulation is often disregarded, with many landowners proceeding without the required assessments.[68]

4.5.2 REVENUE STREAMS

Revenue in the sand value chain flows through several actors, including loaders, landowners, brokers, and transporters. At the extraction sites, loaders and landowners are typically paid by brokers or transporters. Loading costs often exceed the cost of sand. For instance, loading an FH truck costs around 2,000 KES, while the sand goes for only 1,000 KES or below. Similarly, a 10-wheeler truck pays approximately 3,000 KES to loaders and 2,000 KES to the landowner. Transporters are also required to pay cess fees to the county government. In 2024, cess was charged at 120 KES per tonne.[69]

Additionally, for sand quarries in remote areas, where trucks have to pass through private farms, sand site owners or brokers must pay an access fee to the farm owners, often on a monthly basis.[70]

As shown in Table 6 below, once the sand reaches markets such as Mtwapa or Mombasa, its price rises significantly. For example, a 10-wheeler truck that pays 5,000 KES at the source may see the price jump to 25,000 KES[71] by the time it reaches Mombasa. Semi-trailers face an even greater price increase, with market prices in Mombasa rising to between 45,000 KES and 55,000 KES.[72]

Although transporters seem to benefit the most from these price escalations, they often argue that their profit margins are squeezed by high operational costs. These include cess fee imposed by the Kilifi County government, bribes of around 800 KES at each police roadblocks, and the rising cost of fuel.[73]

[67] Interview, official of the local sand association in Moi on 14th March 2024.
[68] Interview, major quarry owner in Mjanaheri on 8th October 2023
[69] Interview, revenue officer, Kilifi County Government on 9th October 2023.
[70] Interview, broker in Mjanaheri on 7th October 2023.
[71] Interview, truck driver in Mjanaheri on 10th October 2023.
[72] Ibid.
[73] Ibid

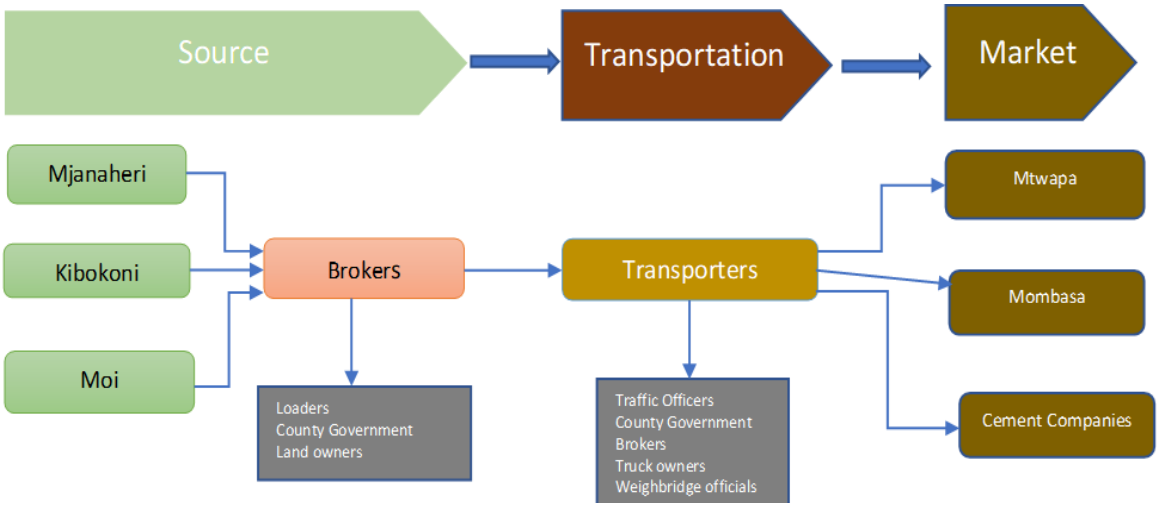

Figure 8: A typical sand value chain

As shown in Figure 8, the sand market operates through three interconnected value chains. The first revolves around the Mzambarauni market in Mtwapa, Kilifi. The second and third chain targets the Mombasa market, with one serving large cement factories and the other serving the general public. The Mombasa market is dominated by few large transport companies handling high volumes of sand, leaving little space for smaller operators. Larger companies, due to their financial power, influence prices at the source, contributing to unsustainably low prices and undermining efforts to revive a SACCO that once stabilised the market.[74]

At the market, especially in Mtwapa, vendors experience instability due to brokers and transporters manipulating prices. [75] Some transporters, who engage in sand business as a side job, often sell sand at lower rates to gain a competitive edge, leading to unfair advantages and market volatility.

	6-wheeler (FH)	10-wheeler	24-wheeler (trailer)	Comment
Price of sand	1,000	2,000	4,000	
Loading	2,000 (4 loaders, 500 each)	3,000 (6 loaders)	6,000 (10 loaders)	Per load
Costs at site	**3,000**	**5,000**	**10,000**	
Cess	1440	4560	5760	120 ksh per tonne
Bribes	500	800	800	Per trip
Fuel	7500 (45 litres)	9000 (55 litres)	11000 (65 litres)	Per trip
Driver	1000	3500	3500	Per trip
Costs in transit	**10,400**	**17,860**	**21,060**	

[74] Interview with a founding member of the Magarini Sand Cooperative in Mjanaheri, 10th October 2023.

[75] Interview with a vendor in Mtwapa, 14th June 2024.

Market price Mtwapa	**18,000-25,000**	**25,000-27,000**	**45,000-55,000**	**Per load**
Market price Mombasa	**24,000-31000**	**31,000-33,000**	**51,000- 61,000**	**Per load**

Table 6: Sand revenue stream for Kilifi County

4.5.3 MAIN CHALLENGES

SOCIOECONOMIC

Sand harvesting in Kilifi has profound socio-economic effects, particularly concerning livelihoods and inter-community relations.

Sand harvesting is a major source of livelihood in Kilifi as it provides jobs for loaders, brokers, transporters, local businesses, and landowners. The trade helps cover expenses such as school fees, healthcare, land purchases, and capital for establishing businesses.[76] However, the trade has its downsides. When sand is depleted from farmland, landowners lose a key source of income and are left with land that is unsuitable for farming. Transporters face challenges from vehicle breakdowns due to poor infrastructure, and many are burdened by loans taken to purchase trucks, making any income loss a significant financial risk.[77] The growing number of actors in the sand business has also led to stiff competition, reducing daily earnings across the value chain. The result is a "race to the bottom", where landowners lower sand prices to stay competitive.

COMMUNITY RELATIONS

The collapse of the Magarini SACCO has profoundly affected community cohesion in Kilifi. Initially intended to unify the community and enhance collective benefits from the sand trade, the SACCO's repeated failures have instead created significant rifts. The younger generation accuses the older members of mismanaging the SACCO.[78] Conversely, the older generation blames the younger members for undervaluing sand and failing to rejuvenate the SACCO, thus deepening generational conflict.[79]

Tensions have also emerged, particularly between Mjanaheri and Kibokoni sand operators. Kibokoni residents feel that Mjanaheri disproportionately reaped the benefits of the SACCO, leading to a sense of inequity and discussions about forming a separate SACCO in Kibokoni.[80] Efforts to revive the SACCO have introduced further conflict. Current landowners, who still possess sand reserves, advocate for leadership roles within the SACCO, excluding older members whose reserves have been depleted.[81] This has led to disputes between those advocating for new leadership and those insisting on maintaining roles based on past contributions.

ENVIRONMENT AND SUSTAINABILITY

The environmental impacts of pit sand extraction in Magarini are significant (see Figure 9). The clearing of vegetation and removal of topsoil, coupled with the creation of deep pits, leads to severe land degradation. The abandoned quarries pose dangers to both people and livestock, particularly during the rainy season when they fill with water. Moreover, the extensive extraction disrupts local ecosystems, leaving the land barren and prone to further environmental degradation.

[76] FGD with loaders in Mjanaheri, 8th October 2023.
[77] Interview with a truck owner in Mtwapa, 14th October 2023.
[78] Interview, broker in Kibokoni, 8th October 2023.
[79] Interview, two elders in Mjanaheri, 9th October 2023.
[80] Interview, a leader of the local association in Kibokoni, 3rd March 2024.
[81] Interview, two elders in Mjanaheri, 9th October 2023.

Figure 9: Environmental impact of the trade in Mjanaheri, Kilifi County

GOVERNANCE AND REGULATION

In the absence of a formal regulatory framework, an informal structure has emerged within Kilifi's sand harvesting industry that brings stability and social cohesion to the trade. Local communities and stakeholders have created unwritten norms and agreements that manage sand access, extraction, and prices. These informal mechanisms allow various actors to balance competing interests and maintain a cooperative atmosphere, which is crucial given the social, economic, and political complexities involved in sand harvesting. For instance, each sand harvesting site in Kilifi operates through its own informal structures and rules, which help maintain order and address issues like loader payments, stakeholder roles and conflict resolution.[82]

Kilifi's sand harvesting activities remain largely unregulated. A Quarrying Control Bill of 2021 is yet to be assented to and primarily addresses quarrying. Community calls for robust regulation continue to grow, and while NEMA sporadically enforces area rehabilitation, limited site visits have affected compliance and environmental protection efforts.

[82] FGD, loaders in Mjanaheri, 8th October 2023.

4.6. KWALE (N. Omwoyo)

4.6.1 CONTEXT

Kwale County, located along Kenya's coastline, covers an area of over 8,000 km^2 with a population of around 900,000.[83] The county has 255 km of coastline with some stunning coral beaches which host many international tourism resorts, but by contrast the historically marginalised indigenous Mijikenda peoples suffer high levels of multidimensional poverty. Within the tourist industry, indigenous people usually occupy menial roles with up-country immigrants taking up the better-paid skilled work.[84] The main economic activity carried out by 85% of the population is agriculture.

The county is well endowed with natural resources, including sand, a key component in the local construction industry (see Figure 10).

The industry became prominent in the early 2000s due to infrastructural development within Kwale and Mombasa counties, which continues to grow, particularly in the Dongo-Kundu bypass and special economic zone around southern Mombasa. Artisanal sand harvesting is now a significant industry and supports many households with hundreds of people directly involved in extraction, transport and intermediary services. At least 25 sites for river and pit sand extraction have been identified by NEMA around the county and the ocean itself. The rapid, unregulated extraction of sand has led to severe environmental degradation in some parts of the county, particularly in Matuga and Kinondo.[85]

Land governance in Kwale is complex due to history, with waves of colonisation by the Portuguese, Arabs and British, which left coastal people as squatters on the land, held

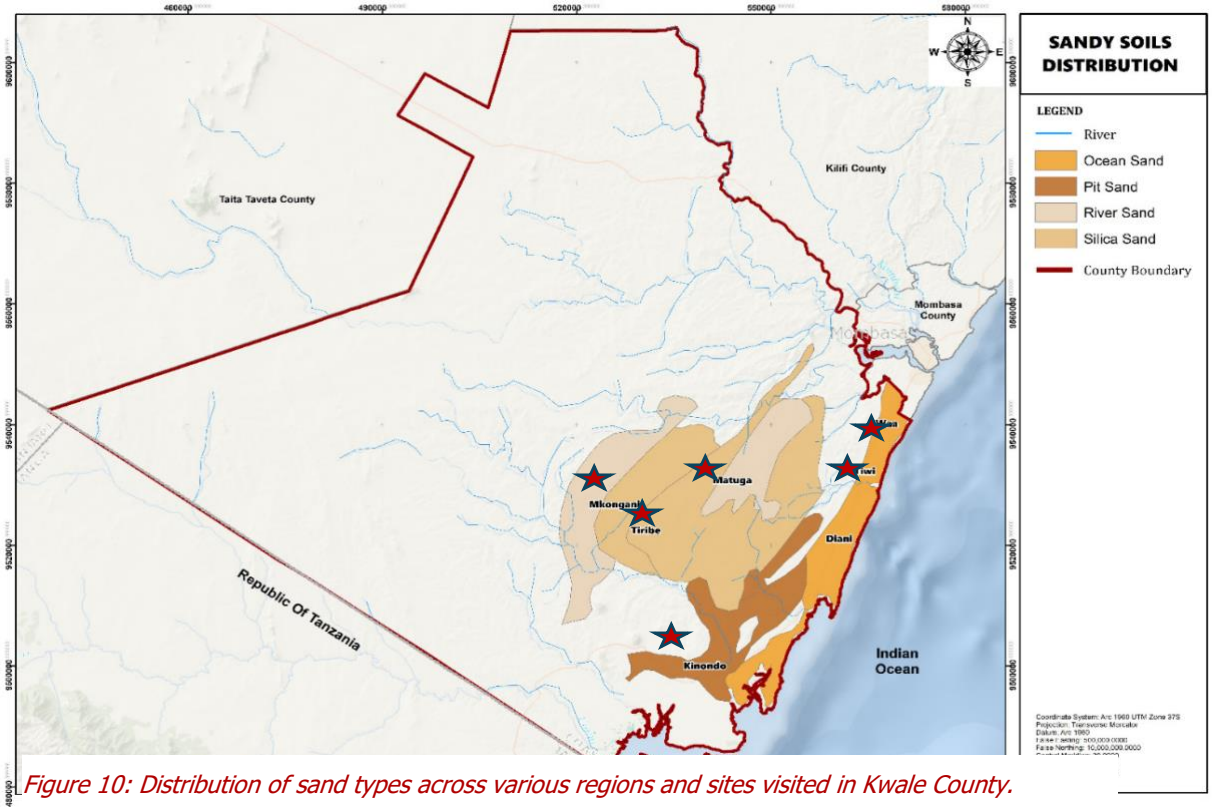

Figure 10: Distribution of sand types across various regions and sites visited in Kwale County.

either

[83] Kwale County 2023. County Integrated Development Plan 2023-2027. https://www.kwaleassembly.go.ke/wp-content/uploads/2023/11/Assembly-CIDP-2023-2027_045606.pdf

[84] Mkutu, K and Opondo, V. 2019. "The complexity of radicalization and recruitment in Kwale, Kenya" Journal of Terrorism and Political Violence https://doi.org/10.1080/09546553.2018.1520700

[85] Omar, S. 2023. "Nema alarmed as illegal sand harvesting increases in Kwale." *The Star*, 14 August. https://www.the-star.co.ke/counties/2023-08-14-nema-alarmed-as-illegal-sand-harvesting-increases-in-kwale Accessed 4 November 2024

by the government or absentee Arabs landowners.[86] In the post-colonial era, reforms took place in the form of settler schemes for local people, but were complicated by elite grabs, exploitative sales and the ongoing ownership by absentee landlords. Sand harvesting occurs both on private land and government-owned riparian zones. However, governance challenges persist, particularly around the issuance of title deeds, land conflicts, and the lack of clear regulations for sand extraction.

4.6.2. REVENUE STREAMS

Sand is harvested by individuals, who in some areas are organised into self-help groups. It is sold according to truck size. Harvesting provides income to loaders, transporters, landowners, and intermediaries (see Table 7). Most workers are young people, especially in areas where formal job opportunities are scarce. Sand is sold based on lorry capacity, with different rates applied for various roles in the process (fuel prices have not been included); it is evident that locals receive very little income in comparison to the profits at the end of the value chain.

4.6.3. MAIN CHALLENGES

SOCIOECONOMIC

With formal employment opportunities dwindling, even for educated individuals, the sand industry has emerged as a critical economic pillar. However, this reliance has exposed many workers to economic vulnerabilities due to unregulated working conditions, hazardous environments and limited job security. A landowner and harvester in Matuga explained:

> *This is my sole source of livelihood and if you block me from harvesting it is like asking me to starve to death. From sand harvesting I have made my family a home, furnished my house, provided education for my kids and other basic needs including ensuring my house is well lightened with electricity every day. Sand harvesting has positively transformed my life.*[87]

Risks of injury, school dropout and exposure to soft drugs that are often sold at sites are other socioeconomic problems associated with the industry.

Group membership enhances livelihoods, welfare and organisation of the industry. In Kinondo, organised groups such as the Mwanduria Self-Help Group have fostered social cohesion, improved bargaining power, and created a sense of collective responsibility. They are also able to collectively invest in small business ideas like slab-making, and invest their profits in SACCOs. However, in Matuga and Mkongani, sand loaders are less organised; this limits their ability to negotiate fair prices, access resources and reinvest their small profits. Group members explained that they feel let down by the government because funds for youths such as the Youth Enterprise Development Fund, amongst others, do not seem to be accessible; they described visiting offices only to be told that funds have not been disbursed, or applying and following up only to be informed that their application had never been received.[88]

The state is also a harvester as was revealed in Waa and Tiwi in 2020. Contestation emerged between the government and local stakeholders, including tourism and fishing communities, due to sand dredging and topsoil dumping by the China Road and Bridge Company. This consists of waste materials from the project that aimed to expand Mombasa's

[86] Mkutu, K and Opondo, V. 2019. "The complexity of radicalization and recruitment in Kwale, Kenya" Journal of Terrorism and Political Violence https://doi.org/10.1080/09546553.2018.1520700.

[87] Interview with a land owner and sand harvester in Matuga, 1st May 2023

[88] Focus Group Discussion with members of Mwanduria self- help group in Kinondo location Kwale county, 4th May 2023

second container terminal, a move that was authorised by NEMA but later halted.[89] The activities were seen as a threat to fishing and tourism and therefore to the local economy. Insufficient consultation left coastal residents feeling betrayed, as they saw the port expansion as a risk to their livelihoods rather than a direct benefit.

	6-wheeler	10-wheeler	12-wheeler	Comments
Price of sand (incl. Landowner dues)	800-1,500	1,500-3,000	3,000-5,000	
Loaders' wage	400-1,000	750-1,000	1,000-1,500	
Costs at site	**1,200-2,700**	**2,250-4,000**	**4,000-6,500**	
Cess	500	700	1,500	
Police stops	n/a	n/a	n/a	
Fuel	n/a	n/a	n/a	
Driver wage	1,000- 3,000	1,500-3,000	1,500-3,000	Dependent on mileage covered
Offloader wages	300	600	2,000	
Estimated costs in transit	**3,000-5,000**	**5,000**	**≥ 5,000**	
Market price	**8,000**	**14,000**	**18,000**	

Table 7: Sand revenue stream for Kwale County

ENVIRONMENTAL AND SUSTAINABILITY

The areas from which sand is harvested are part of a delicate ecosystem where sand plays an essential role in maintaining river flow, preserving habitats and preventing erosion. Unregulated sand harvesting has caused severe ecological damage, including the widening and deepening of river channels,[90] flood risks, interruptions in water supply, reduced water quality for downstream communities impacting upon livelihoods and public health. There is also habitat destruction leading to a decline in aquatic life and bird populations.

Mwandaruya self-help group noted that they carry out some restoration activities with support from Hekima University College, an established faith-based venture based in Nairobi (see Figure 11). However, for many, pressing livelihood needs tend to overshadow long-term environmental sustainability initiatives.

Figure 11: Sign board illustrating efforts to rehabilitate former sand harvesting sites in Ukunda, Kwale County

[89] Business Daily (2020) Tribunal halts Kwale sand harvesting, 23 December. https://www.businessdailyafrica.com/bd/economy/tribunal-halts-kwale-sand-harvesting-2091296 Aceessed 4 November 2024.

[90] Observations by the research team.

GOVERNANCE AND REGULATION

Self-regulation is present in some places through the formation of groups, as noted, and provides loaders and harvesters with collective bargaining power and other benefits. For example, the Mwandurya group was formed around 2012–2013 in Kinondo, when, as a member explained, "there were misunderstandings on the pricing of sand leading to the intervention of the area assistant chief." The group works as follows:

> *We are guided by our constitution. The main aim of the group is to protect members and more so landowners from exploitation by buyers of the sand. This group plays a big role in deciding the price of sand. We know the market price of the sand; we also know the cost of transport of the lorries to different sites. This knowledge enables us to determine the price of sand. We also know that there are brokers involved in the business.*[91]

However, the majority of loaders and harvesters remain independent and face increased challenges from limited access to capital, market fluctuations, unregulated working conditions, crime and exploitation by intermediaries.

There is some overlap in governance of sand-harvesting between the county and national government. However, though NEMA officials are active in the county, enforcement is weak. Kwale county has a Quarrying Act 2016 that covers "common minerals" including sand. It stipulates various environmental restrictions: that loaders should be organised into self-regulated groups; that groups shall be overseen by Resource Management Associations, which shall carry out ESIAs prior to any harvesting activities; and that all harvesters or landowners and dealers shall be licensed. Interestingly though, the issue of sand harvesting is entirely absent from the main county planning document, the County Integrated Development Plan for 2023-2027 (Kwale County). A county official noted that the county was hoping for better legal provisions at the national level to guide them.[92]

[91] FGD, members of Mwandurya self- help group, Kinondo location Kwale county, 4th May 2023.

[92] Interview with a CEC of Kwale County.

4.7. HOMABAY (B. Nyambedha)

4.7.1 CONTEXT

Sand mining in Homabay County is an economic activity that evolved in last three decades.[93] Initially, sand was harvested at Lake Victoria where boats were used to ferry sand scooped from the lake to the landing sites. Increasingly, communities started mining sand from their farmlands. For instance, in Rakwaro Kamwala location, sand mining was done manually using spades and a locally made tool known as *kichowe*. During this time, there was division of labour where men dug the sand and women ferried the same using buckets to a central place, ready to load onto trucks. Loading was then done by two to three people. Most sand harvesting sites across Homabay are privately owned (see Figure 12 for sand sites visited in Homabay).

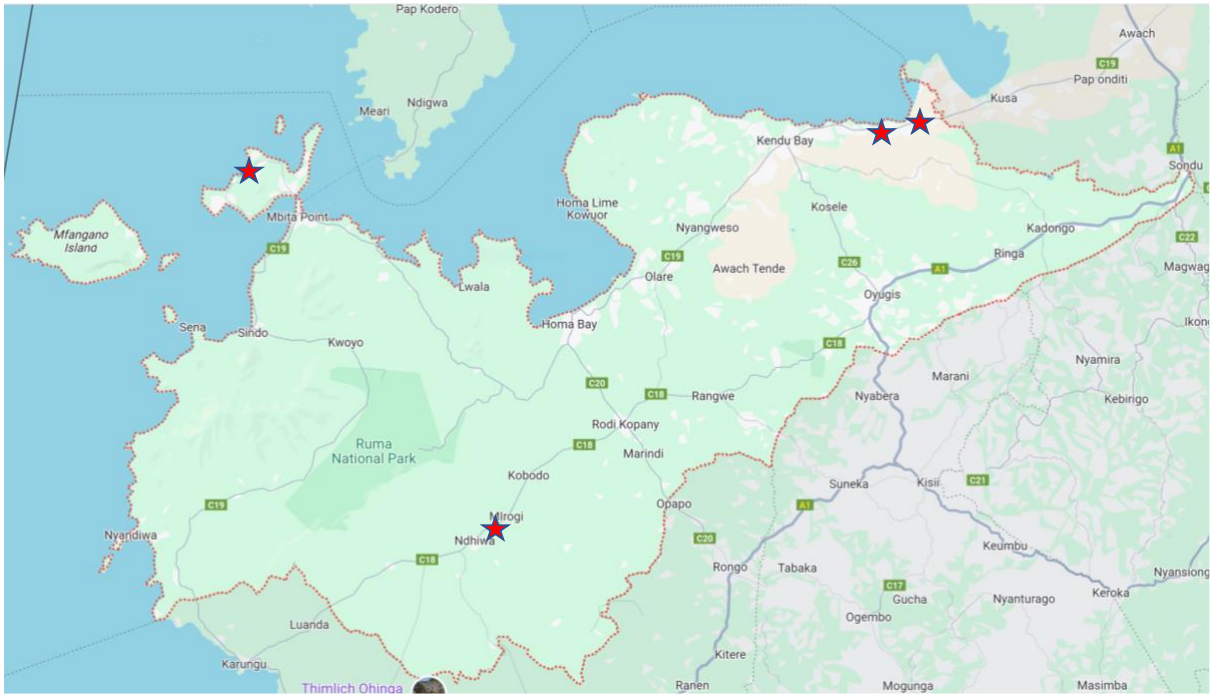

Figure 12: Sand sites visited in Homabay County

Recently, the advancement in technology has seen the introduction of machines such as excavators at sand mining sites. The excavators have made sand mining easier and several trucks can now be loaded within a day. At the same time, the machines have replaced manpower and impacted negatively on the local loaders' income. The excavators are present at all the sites visited except Kaswanga, where the trucks are loaded manually. Initially, the loaders received 300 KES each per truck loaded, but now they are paid 150 KES for removing the soil debris and stones from the truck as well as levelling sand on the loaded truck.

4.7.2. REVENUE STREAMS

The various sand mining sites in Homabay County have similar prices of sand depending on the size of the trucks: these are classified as FH, ten-wheeler and semi-trailer (see Table 8). However, there is a shift in the price when the sand gets to the market. While a six-wheeler truck pays an amount of 4,000 KES at the harvesting site, the load is sold at the market in Homabay town for 15,000 KES and for up to 25,000 KES in Kisii town.

[93] The study of sand mining was conducted at various sites in Homabay county including Rakwaro Kamwala, Kobuya West, Kaswanga and Sori/Ndhiwa in Homabay County.

	6-wheeler	10-wheeler	12-wheeler	Comments
Price of sand at site	2,000	2,000	2,000	**Correct**
Loaders' wage	150 (per loader) **3 loaders per truck (150 x 3) = 450**	150 (per loader) **3 loaders per truck (150 x 3) = 450**	150 (per loader) **3 loaders per truck (150 x 3) = 450**	**150 per loader and 3 loaders per truck maximum**
Excavator operator	1,500	1,500	1,500	
Costs at site	**Ca.3,950** (2,000 + 450 + 1,500) = 3,950	**Ca, 3,950** (2,000 + 450 + 1,500) = 3,950	**Ca 3,950** (2,000 + 450 + 1,500) = 3,950	**The price is constant whether 6-wheeler or 12-wheeler**
Cess	1,000	1,000	1,000	
Market price Homabay	**15,000**	**25,000**	**35,000**	
Market price Kisii town	**25,000**	**35,000**	**45,000**	

Table 8: Sand revenue stream in Homa Bay County

4.7.3. MAIN CHALLENGES

SOCIOECONOMIC

Community members acknowledged that sand harvesting has lifted livelihoods in various areas. These range from the opportunity to pay school fees to building houses. These observations, expressed during multiple focus-group discussions, are shared by all communities. At Kobuya site, people have bought livestock from revenues made from sand harvesting.

Informal and more formalised rules exist at the mining sites. For example, brokers have a decisive role in mediating between customers and loaders, and they do not allow customers to interact with site owners and loaders directly. Important to note is that the site owners do not allow learners or students to work at the sites. They argue that this helps to avoid safety incidents as well as "rubbing shoulders" with the authorities. They further add that learners and students are still young and do not have the requisite expertise regarding operations at the sand mining sites. The loaders have a register in which they record the names of loaders who work in cycles each time a truck comes to the site. This is to assure a fair distribution of work.

It is indicative of the advanced level of planning in Homabay, where SACCOs and other welfare organisations are operational at most sites. An example of such organising is the Kobuya West Sand Harvesters. Here, the members contribute 150 KES per month each as shares, 100 KES for sickness and 200 KES towards the loss of a member. There were certain unique findings that included the aspect of giving back to the society such as contributing free sand towards constructions of schools and churches. In several places, the activity of sand harvesting has strengthened community cohesion through the collaborative work the community is doing at the mining sites. This initiative has enabled the local community members to participate in decision making process; it has also enabled community members to give out food to sand harvesters at a lower cost and provide security to late night sand harvesters.

ENVIRONMENTAL AND SUSTAINABILITY

Sand harvesting in Homabay, as in the other counties studied, has far reaching effects for

environment. Sand harvesting farmlands interferes with vegetation cover and leads to degradation and soil erosion. Sand removal leaves behind huge valleys that are hazardous to residents. The resulting valleys and holes provide breeding grounds for mosquitoes, thus exposing communities to health hazards. Informants cite the example of Chuoye area that is prone to floods that severely affect vulnerable communities. Likewise, public infrastructure such as rural roads and electricity poles have suffered from unregulated sand harvesting.

People who own lands bordering the lake tend to claim the riparian areas and insist that sand loaders cannot operate there without their consent. In other cases, mining sites are utilised by investors who engage with landowners on lease terms. One example is at Sori, where a company called Mapere is active in sand harvesting.

For sustainability issues, the community argues that they plant trees at the mining sites in a bid to reclaim the land that could later present an opportunity for a reoccurrence of sand mining.

GOVERNANCE AND REGULATION

Since 2020, the County has a bill on sand harvesting that would allow county officers to regulate the industry. However, up until today this has not been assented to. It is also governed by NEMA's guidelines on sand harvesting. Therefore, the authority requires the site owners to secure a permit that will allow smooth operations of the sand harvesting activity. In practice, however, several site owners are reluctant to secure the permits, arguing that the costs are too high. They further add that upon securing the permit, they will be subjected to a renewal on a regular basis, even when they may experience a reduction in sand production at the site. As a result, sand harvesters work at night to avoid encounters with the authorities. Failure to secure the permits has resulted in some of the sites being closed by NEMA. An example of this is the site at Kaswanga by the lake. There is also indication that sand industry is being politicised: on occasions, MCAs protected sand harvesting activities in a bid to secure their electorate.

Figure 13: Sand removal using excavators in Homabay County

5. DISCUSSION AND LESSONS LEARNT ACROSS CASES

As shown in the cases above, sand harvesting has become a vital yet contentious industry across several Kenyan counties. The findings of this project reflect broader issues in resource management, governance and the sustainability of local livelihoods. A closer examination of the cases reveals recurring themes of economic dependence, environmental degradation, weak administration and the urgent need for sustainable sand harvesting practices. To offer a clear understanding of these dynamics, this discussion is organised around four key themes that touch on different aspects of the Kenyan sand trade, namely, economic dynamics, environmental impacts, governance challenges and the wider social impact of the industry on people's livelihoods.

5.1 ECONOMIC DYNAMICS

Across the cases in this study, sand harvesting has become a vital source of income both for county governments and for communities. In many areas, such as Taita Taveta and Kwale, Kilifi, Kajiado and Kedong, sand mining has become an economic mainstay, filling a gap for communities with few employment opportunities. As data from the counties shows, sand harvesting is the primary source of income for 82% of respondents,[94] which underlines its critical importance to household livelihoods. This reliance illustrates the sector's integral role in sustaining local economies, particularly in areas where alternative employment opportunities are scarce. The data also shows that around 70% of respondents have worked at these sites for more than four years,[95] further emphasising the sector's stability as a long-term employment avenue for many. These figures position sand harvesting not as a transient activity but as a primary occupation for a significant portion of the workforce.

The demographic composition of sand harvesting workers also offers deep insights into the socio-economic characteristics of those engaged in this labor-intensive industry across all the sites. The data reveals a predominantly youthful workforce, with 36% of respondents aged between 26-34 years, and another 26% within the 35-45 age range.[96] This highlights that sand harvesting attracts individuals in their prime working years, likely due to limited alternative employment opportunities in their regions. Such age dynamics underscore the sector's role as a critical economic activity for those seeking stable livelihoods.

Although the youth and artisanal miners in these areas are drawn to the sector by the immediate income it provides, they often receive disproportionately low wages compared to transporters and middlemen, who control much of the profit. This creates a structural disparity where the primary financial benefits of sand harvesting remain concentrated among external actors, leaving workers at the extraction sites regularly with minimal compensation for their efforts. Some loaders are also facing the challenge of mechanisation of the industry.

A notable exception is Makueni County where, after the introduction of a robust and inclusive legal framework, communities benefit from predictable incomes realised through licensed sand harvesting.

In contrast, Kilifi, like Kwale, Homabay and Taita Taveta, illustrates how sand harvesting remains a fragile lifeline for local communities. Despite their integral role in the industry, youth groups often lack essential protections, including social security or health benefits. The absence of formal labour structures deprives them of the means to negotiate fair wages, further entrenching their vulnerability.

While the high demand for sand and the stark contrast between its price at the source and that at the market may suggest substantial profits for transporters and brokers, transport costs and

[94] Kobotool data, last accessed on 17th January 2025
[95] Kobotool data, last accessed on 17th January 2025
[96] Kobotool data, last accessed on 17th January 2025

hidden expenses consume a significant portion of their earnings.

Fuel prices and cess payments imposed by local authorities cause rapid decrease in earnings. Additionally, unofficial costs such as police bribes at checkpoints, which have become an almost institutionalised part of the journey, further strain their finances. Though illegal, these payments are often unavoidable for those seeking to prevent delays, fines, or even confiscation of their goods. In addition to these, driver wages, vehicle maintenance, and the relentless wear and tear on trucks further diminish any remaining profits. These hidden costs not only threaten the financial viability of transporters, but also expose deep-seated inefficiencies and systemic corruption within the sand supply chain.

Land ownership has also emerged as a pivotal determinant in shaping access, control and impacts within the sand harvesting sector. With a majority (67%) of operations taking place on privately owned land, followed by government-owned land (27%), the dominance of private ownership underscores potential inequities in resource governance. [97] Private landowners often hold disproportionate power over pricing and site management. This has created a dynamic where economic benefits flow to a few, while environmental and social costs ripple across entire communities.

Despite the absence of formal governance structures, informal organisations play a pivotal role in creating a semblance of order within the industry. Approximately 76% of respondents reported being organised in some form, primarily through SACCOs or welfare groups.[98] These organisations provide critical support in terms of financial services, collective bargaining and social cohesion. For instance, loaders in counties like Kilifi, Narok/Nakuru and Kajiado have managed to establish control over certain aspects of their work, such as setting standardised prices for loading services and even determining the number of loaders allowed to work on each truck. This level of self-organising has given loaders a degree of protection against exploitation by transporters and landowners, who would otherwise have more control over pricing and wages.

In contrast, landowners in Kilifi and Kajiado often face greater income instability. Many landowners negotiate prices separately with different buyers, leading to inconsistent earnings and making it challenging to secure fair compensation. Competition among landowners to sell sand keeps prices low, and in some cases, the fees loaders charge for their services can exceed the actual price of the resource itself. This disparity highlights how localised organising within the sand industry can create stability for certain groups while leaving others in more precarious financial situations.

In addition, the financial ecosystem of sand harvesting presents both opportunities and challenges. As illustrated in Figure 14 below, income levels vary significantly between loaders and brokers. According to the loaders we interviewed as part of this study, 69% earn less than 1,000 KES per day, while 31% earn between 1,000 and 4,000 KES per day. In contrast, 33% of brokers we interviewed earn less than 1,000 KES per day, whereas 67% earn more than 1,000 KES daily. These figures highlight substantial income disparities within the workforce and underscore systemic inequities in the distribution of economic benefits. Loaders, who perform much of the physically demanding labor, often receive disproportionately lower earnings compared to brokers and site owners, reflecting broader structural imbalances in the sector.

At the same time, cess collected for sand transportation constitutes a viable chunk of the counties' overall revenue. Most of the counties under study have mechanisms in place that assure a more or less efficient cess collection. Such reliance on revenue from what often is excessive sand removal creates trade-offs that may delay or undermine establishing pathways for sustainable sand harvesting and trade.

From the experiences across the counties, the economic landscape of sand harvesting

[97] Kobotool data, accessed on 17th January 2025
[98] Kobotool data, last accessed on 17th January 2025

underscores the unrealised potential of this industry. Sand mining serves as a crucial economic pillar for many communities but remains often plagued by systemic inequality and exploitative practices due to the lack of formalised structures and fair and clear regulations. Addressing these disparities through policy reforms, formalising labour practices, and ensuring equitable distribution of profits is an essential step in creating a more just sand harvesting industry, ultimately empowering the communities that rely on it.

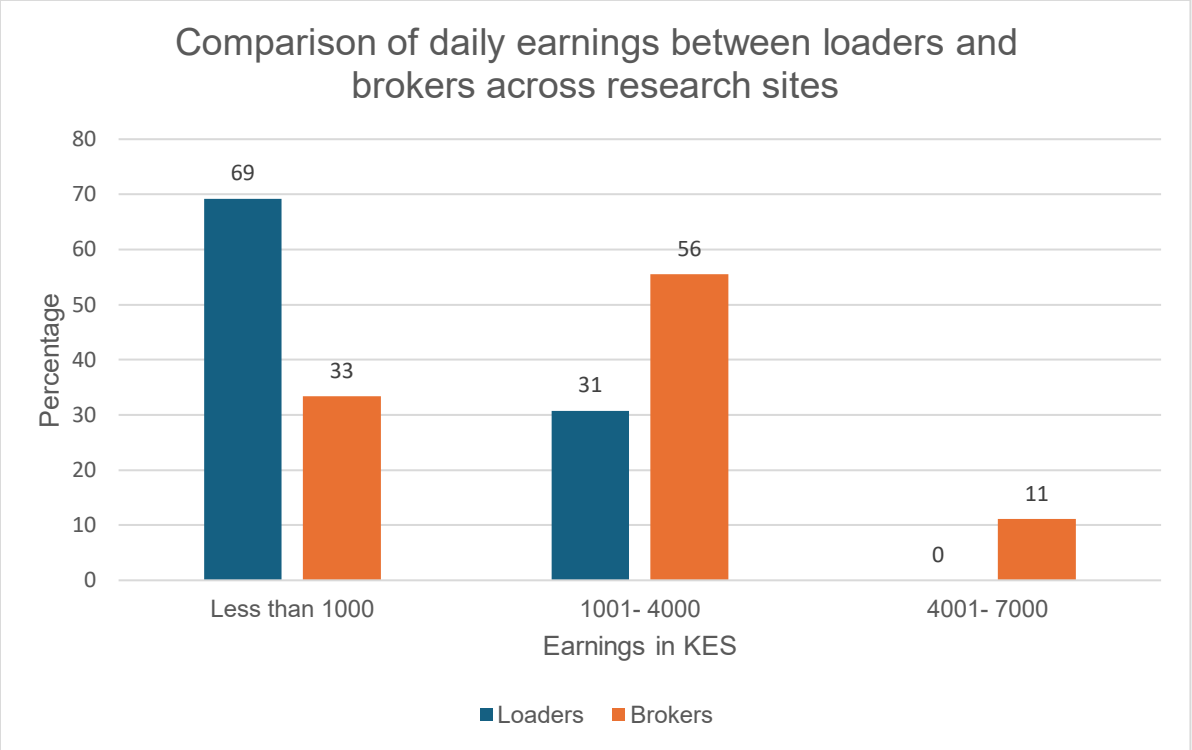

Figure 14: Daily earnings between loaders and brokers at sand sites across research sites

5.2 ENVIRONMENTAL IMPACTS

Across the counties under study, underregulated sand extraction has led to severe and sometimes irreversible environmental damage. The ecological impact of sand harvesting reveals patterns of widespread environmental degradation that threaten local ecosystems, water resources and community livelihoods. Among other factors, this has compromised the stability of riverbeds, soil fertility and water quality, which are essential to local agriculture and biodiversity.

One significant impact is the destabilisation of riverbanks and waterways, which is common in several counties. Sand, a crucial stabiliser of riverbeds, is essential in controlling erosion, yet its extraction has disrupted river flows and sediment balance, thus resulting in widened and deepened channels. In Taita Taveta, for example, sand harvesting has led to an increased risk of flooding, which disrupts downstream agriculture and threatens settlements. Similarly, Kwale has seen its riverbeds widened, erosion exacerbated and riparian habitats destroyed, conditions that endanger local agriculture. These riverbank instabilities are not confined to these counties but are observed widely, with ripple effects that include a decrease in soil, loss of arable land, and increased siltation downstream.

Water scarcity and altered water dynamics due to sand mining have also emerged as critical issues in the counties studied. In semi-arid areas like Makueni, prior to the new sand legislation introduced in 2015 (see Section 4.2.1), heavy sand extraction lowered water tables and altered natural water flow, a development that further intensified existing pressing water shortages. The reduction in sediment flow affected downstream ecosystems dependent on consistent water levels, and placed additional strain on agricultural and drinking water resources. A

similar pattern is seen in Kajiado, where declining water availability is linked to disrupted river dynamics and damaged riparian vegetation. The cumulative effect of these changes has a profound impact on water access for local communities and reduces the natural resilience of these regions to withstand drought.

In some areas, sand mining activities have left post-mining landscapes with unique hazards. In Kilifi, decades of large-scale sand harvesting have left behind barren, rugged landscapes. Moreover, abandoned sand pits, left unfilled after extraction, accumulate rainwater that creates breeding grounds for mosquitoes and increases the risk of disease outbreaks. These pits also degrade local vegetation and are often turned into waste disposal sites. Similar issues arise in Homabay, where shoreline sand extraction along Lake Victoria has eroded lakefront areas, harmed water quality and destroyed fish habitats. This degradation poses risks to the fishing-based economy by reducing fish populations and diminishing catches.

Moreover, the loss of biodiversity and habitat fragmentation is an alarming result of sand harvesting. Across areas like Kedong and Kajiado, unchecked erosion and destruction of riparian vegetation have severely impacted the stability of local ecosystems. The removal of sand disrupts sedimentation, which plays a vital role in nutrient cycling and water filtration, leading to long-term damage that is difficult to reverse. In Kwale, for instance, altered river flows impact coastal sedimentation, creating cascading effects on biodiversity and heightening the region's vulnerability to future environmental pressures.

As noted previously, a majority of operations take place on private land: this means that private owners benefit while environmental costs are felt widely. The long-standing operations of many sand harvesting sites further compound these challenges. Data reveals that 45.68% of sites have been active for more than seven years, thus reflecting the deeply entrenched nature of this industry. While this longevity may signal economic resilience, it also serves as a stark reminder of the environmental toll associated with prolonged sand extraction. Over time, unchecked operations have accelerated resource depletion, destabilised ecosystems and greatly contributed to land degradation, with cascading effects on soil fertility, water flow and biodiversity.

On the whole, insights from the counties in this study illustrate a common pattern of degradation that transcends county boundaries and point to the urgent need for sustainable practices and effective regulatory oversight. Unregulated sand extraction has eroded the very ecosystems that support agriculture, clean water and biodiversity. Addressing these ecological concerns through sustainable sand management and enforcement of regulations is crucial to mitigate further harm and protect both the environment and the livelihoods of affected populations.

5.3 GOVERNANCE AND REGULATION CHALLENGES

The governance and regulatory landscape for sand harvesting across Kenyan counties reveals systemic challenges, including weak policy frameworks, enforcement limitations and conflicting jurisdictions, which together foster unregulated practices and exploitation of local communities.

A major issue affecting most counties is the lack of specific natural resource governance legislation or weak enforcement of existing regulations, stemming from poor coordination between county and national authorities, political interference and limited resources. For instance, while Taita Taveta approved the Taita Taveta Sand Harvesting (Amendment) Act (2020) to control sand mining, the lack of collaboration between county and national authorities, alongside political pressures, has rendered the Act largely ineffective. Similarly, in Kwale, despite the Kwale County Quarrying Act (2016), jurisdictional conflicts and limited enforcement capabilities hinder regulatory efforts (see Table 9 below). This has further been compounded by a lack of community representation in policymaking.

In contrast, Makueni County showcases the potential of more cohesive governance. In 2015, the county enacted the Sand Conservation and Utilisation Act and also established a sand harvesting authority to manage extraction activities in the county. Makueni's journey reflects the impact of political will, good leadership and community-focused regulations. Before the enactment of the Sand Act in 2015, sand mining in Makueni was characterised by uncontrolled extraction and cartel-driven conflicts. The Act reshaped this dynamic, fostering greater transparency and community-centred governance. Although challenges remain, Makueni's regulatory model has led to improved income transparency and community involvement. This has positioned the county as a benchmark for sustainable sand management in Kenya. However, while the regulations have empowered communities, they have also sparked debates on overregulation, with certain rules occasionally seen as obstructive to community needs.

In other counties like Kilifi, Narok and Nakuru, regulatory frameworks are nearly absent. Although Kilifi County collects cess from trucks transporting sand, there are no specific regulations governing sand mining practices. Homabay County presents a distinct regulatory challenge due to its reliance on lake and river ecosystems, which face degradation from unmonitored and often mechanised sand harvesting. Despite national environmental laws governing water resources, inadequate enforcement capacity and limited resources have allowed unsustainable practices along the Lake Victoria shoreline. This highlights the need for stronger frameworks to prevent environmental harm and ensure sustainable sand harvesting practices across regions dependent on sensitive ecosystems.

In the absence of formal regulation, informal governance mechanisms have emerged in some counties to bring stability to the industry. In larger-scale extraction areas like Kedong in Narok/Nakuru, Kilifi and Kajiado, informal regulations managed by community associations and SACCOs help maintain order. These groups set rules on loading service prices, establish guidelines for industry roles and impose penalties for rule violations. This is especially evident in Narok/Nakuru, where groups are well organised and loaders work according to a rota that is strictly adhered to.

Loader groups make semi-permanent agreements with trucks, furnishing them with labels and guiding them to the designated loading site. While informal structures can promote social cohesion and empower local communities, they lack the comprehensive authority required to enforce sustainable practices on a larger scale, thus leaving artisanal miners vulnerable.

5.4 SOCIAL IMPACTS

The social impacts of sand harvesting across the different cases are far-reaching as they affect local livelihoods, crime rates and health outcomes. While sand harvesting has created essential income opportunities, especially in regions where formal employment is scarce, the industry has also introduced a series of social challenges that vary across the cases.

One of the most prominent social impacts of sand harvesting is its role in shaping livelihoods in communities like Kwale, Taita Taveta, Kedong in Narok/Nakuru, Kilifi and Homabay. In these counties, sand harvesting has become a primary source of employment for young people, many of whom face limited options for stable income due to high unemployment rates. In Kwale, for instance, youth groups engaged in sand extraction gain a crucial source of income but are also subject to poor working conditions that lack basic health protections. This precarious work environment leaves young workers exposed to health risks without access to health insurance. This reflects a broader issue of inadequate social safety nets for informal workers. Furthermore, some of the sand extraction sites have become hubs for substance abuse and drug trafficking.

In addition to these issues, dependency on sand harvesting as the main source of livelihood also exposes vulnerabilities to key stakeholders in the industry. Any disruptions in the sand harvesting industry - whether due to regulatory changes, environmental degradation, or market dynamics - often leads to severe socio-

economic implications for the communities involved. Diversification of income sources remains limited, and while some respondents mentioned alternative activities like farming or small businesses, these are exceptions rather than the norm.

The social landscape of Kedong, Kilifi and Homabay reveals a similar pattern of youth involvement in sand harvesting, largely due to a lack of formal education and skills training. The absence of such programs means that many young people are vulnerable to the inherent risks associated with informal sand extraction.

For example, in Homabay, the prevalence of school dropouts is rising as youth forego education in favour of working in sand extraction, sacrificing long-term economic stability for short-term earnings (though some students pay their school fees through loading). This shift from education to manual labour leaves many young people with limited prospects.

Across the cases, the industry is rife with tensions, largely fuelled by disparities in profit distribution, power dynamics and community-specific conflicts over sand resource

management. As sand harvesting becomes increasingly critical for local economies, these unresolved inequalities and competing interests have transformed the industry into a hotspot of economic and social friction. For instance, a major point of contention stems from differences in revenue allocation across the sand value chain. While the standardisation of loading fees and transportation costs has introduced some predictability and fairness, they have not fully bridged the gap between the lower and upper echelons: loaders perform the most labour-intensive work but often earn considerably less than transporters and truck owners.

Therefore, a cross-cutting issue in all counties involved in sand harvesting is the lack of social security or health services for sand workers. In Kajiado, for instance, the absence of formal healthcare services or social protections leaves workers with limited options if they are injured on the job. This lack of social infrastructure is mirrored in other counties like Kilifi and Homabay, where sand workers similarly face the double burden of unsafe working conditions and a lack of access to formal healthcare. As a result, injuries and health issues related to sand extraction often go untreated. This exacerbates the precarious nature of employment in the sand sector and highlights the systemic gaps in social protections for informal workers.

Its also important to note that a significant gender disparity exists within the sector, with almost 90% of respondents in this study being male. This imbalance is reflective of the physically demanding nature of sand harvesting. However, women's role in the sector, though less visible, is crucial. Some are brokers while many are engaged in selling food and providing other services to workers at sand harvesting sites: this makes them indispensable contributors to the broader sand harvesting ecosystems.

Figure 15: River Voi depleted of sand, Voi

County	Sand Harvesting Legislation	Status
Narok/ Nakuru		Absent
Kajiado	Kajiado Sand Harvesting and Quarry Bill 2020	Absent- ongoing process
Taita Taveta	Taita Taveta Sand Harvesting (Amendment) Act (2020)	Absent- ongoing process
Makueni	Makueni County Sand Conservation and Utilization Act (2015)	Active
Kilifi	Quarrying Cintrol Bill (2021)	Absent- Stalled (Limited relevance for sand harvesting
Kwale	Kwale Quarrying Act (2016)	Active Limited relevance for sand harvesting
Homabay	Homabay County Sand Harvesting and Sale Bill (2020)	Absent- ongoing process

Table 9: Status of sand harvesting legislations across the seven counties in Kenya

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