

Value Chains Analysis for Minerals in Kisii County, Kenya

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Submitted: 2024 Oct 01; Accepted: 2024 Nov 12; Published: 2024 Nov 20

Citation: Mukofu, L., Cheloti, M., Mburu, A., Onyuka, A., Omamo, J., et al. (2024). Value Chains Analysis for Minerals in Kisii County, Kenya. *Earth Envi Scie Res & Rev*, 7(3), 01-10.

Abstract

Mineral value chain entails a full range of activities involving different people that deliver products to final consumer after passing through the different phases of production, processing and marketing. The aim of the mapping exercise was to establish the status, gaps and technology needs by the enterprises involved in the minerals extraction value chain with the aim of promoting innovation, enhancing productivity of the SMEs, improving managerial and technical skills, strengthening local supply chains and reducing gender gaps. The main value chains that were identified in the County were: Kisii soapstone, construction clay bricks and shale minerals. The activities and actors involved were also analyzed. The study was conducted through administering of well-structured questionnaires and interviews to map different stages of the value chains, the main activities and actors. Findings from the value chain analysis revealed the range of activities involved from mining, product development, and marketing and associated waste value addition. Technological challenges/gaps, product development options, environmental and social sustainability challenges were highlighted while value addition to waste was also explored. While Kisii and the neighboring Nyamira County has an abundance of minerals, it is recommended that the County government, in collaboration with relevant stakeholders should take stock of all minerals. It is also imperative for the enterprises involved with the three value chains adopt use of appropriate modern technologies during their operations to ensure productivity and business competitiveness.

Keywords: Minerals, Value Chains Analysis, Technology Needs, Entrepreneurs

1. Introduction

A Survey on Mapping of the Minerals value chains and Technological Need Assessments in Kisii County was conducted by the Kenya Industrial Research and Development Institute (KIRDI) under the Kenya Industry and Entrepreneurship Project (KIEP) on behalf of the Ministry of Investment, Trade and Industry (MITI). The survey was funded through grants provided by the World Bank Group (IBRD-IDA and Word Bank). The purpose of this mineral value chain analysis approach is aimed at strengthening local value chains by determining strengths, weaknesses, commercial viability, constraints, environmental, technology and social sustainability aspects.

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chain products and byproducts and technology needs assessment in Kisii County by studying the full range of activities undertaken by different actors. This comprises of all the different intermediary phases of production, processing, storage, marketing and distribution (wholesaling/retailing). Technological needs were assessed in mining and value addition of the minerals to establish the existence, challenges and gaps in the application of modern technologies in the value chains

Kisii County is endowed with various natural resources that include fertile agricultural soils; mineral deposits (like soapstone, granite and ballast); rivers and forests. While some of these natural resources have been exploited optimally, others have either been under-exploited or over-exploited. Mineral resources for instance have not been fully exploited due to inadequate technology and exploration infrastructure. In addition, water from springs in the County remains untapped. There could be a need for the

County Government, together with other stakeholders, to develop regulations to control the exploitation of natural resources to spur economic development while ensuring sustainability. Kisii County has two main minerals; soapstone and granite. The mining of soapstone at Tabaka is an important economic activity that provides over 7,000 people with incomes. This mineral is mainly used in the making of carvings that are sold in the local and international markets. It could also be used locally for the production of other products such as chalk, talc powder, ceramics, tiles and paint. The stone is also exported for value addition. Granite is found in Bonchari, Sub-County. It is an important component for processing of tiles, carving of monuments, countertops and stair case arcs. Despite, its potential this mineral however remains unexploited. The findings presented herein are from the field visits and data collection from Kisii County in Kenya.

2. Methodology

Based on the objectives of the project to increase productivity, innovation and competitiveness of the Kenyan SMEs through strengthened and increased uptake of innovation, technology and improved managerial and technical skill, a value chain approach was chosen to identify the existing gaps within the minerals value chain in Kisii County. Value chain analysis seeks a pro-poor approach to improve efficiency, improve quality and inclusion in economic activities. It seeks to analyze all activities and actors right from the input level through to distribution and transformation up to when goods are accessed by the final consumer. The value chain approach results to enhanced competitiveness, increased market access, improved livelihoods, inclusivity and overall poverty reduction. This resonates with the aim of the study.

The main minerals that were identified were Kisii soapstone, shale and clay. For each mineral, the key stages were identified and mapped along with the key actor's right from the input up to the consumer levels. Tools were developed for conducting the study to allow for data collection on the following issues:

- Enterprise ownership and management structures
- Actors involved
- Technology used and technology needed
- Value addition

- Quality management
- Supporting services
- Marketing and distribution
- Skills levels and gaps
- Risks and challenges
- Recommended interventions

Waste management and possible symbiotic relationships among chain actors

Literature review was conducted and information gathered was corroborated by information from Key stakeholders and informants interviewed. Visits were done to the mines and production facilities. Interviews were conducted along with observations on the production processes and sites. The survey was conducted in the month of March 2024.

3. Findings

3.1. Soapstone Value Chain Analysis

The main activities involved in soapstone value chain in Kisii County is mining from the quarries, transportation to different production sites for curving into products of different features and sizes by artistic sculptors. The stone can also be crushed and sold to distributors or to manufacturers of other products such as ceramics, tiles, terrazzo and paints.

Soapstone mines in Tabaka sub-County are owned by individuals who have formed a miners' association known as Tabaka Miners association. The primary activities in the value chain are dominated by artisans who do both the mining and carving of the soapstone products. The artisans mostly use hand held tools to undertake the productions. The procedures in place at the various stages of the value chain include;

3.2 Soapstone Extraction

Mining of soap stone is done by miners hired by sculptures producers, distributors and brokers. Mining is mostly done by hand-held excavation tools. Most of the exhausted mining sites are left open posing environmental and safety hazards.

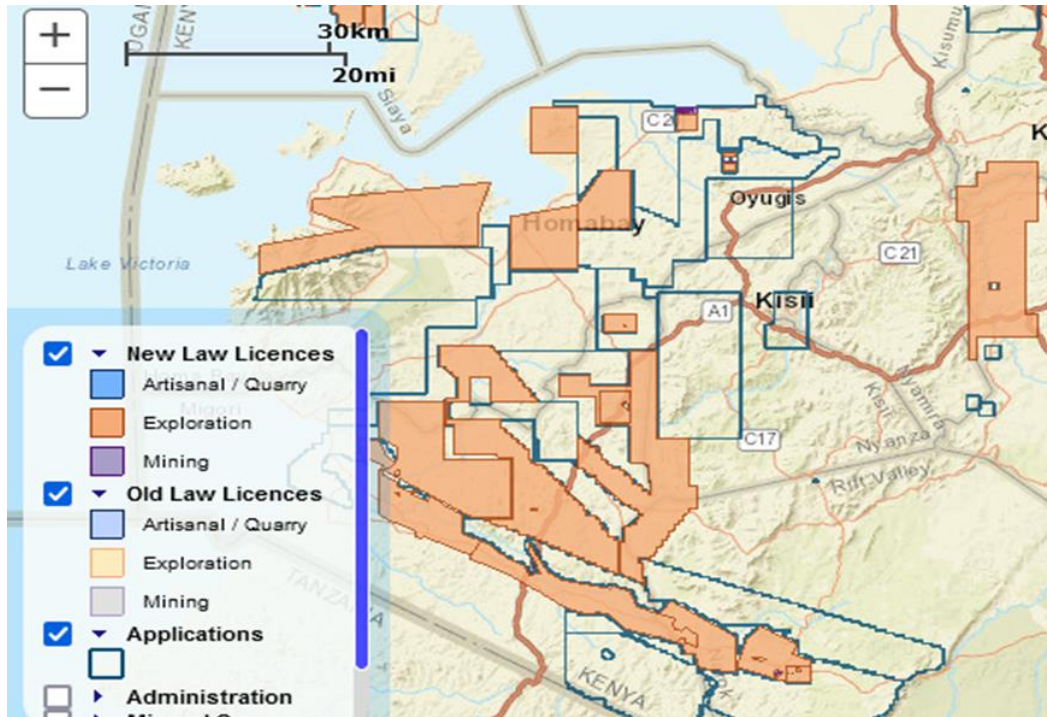


Figure 1: Cadastral Map of Mining Licenses in Kisii and Neighboring Counties

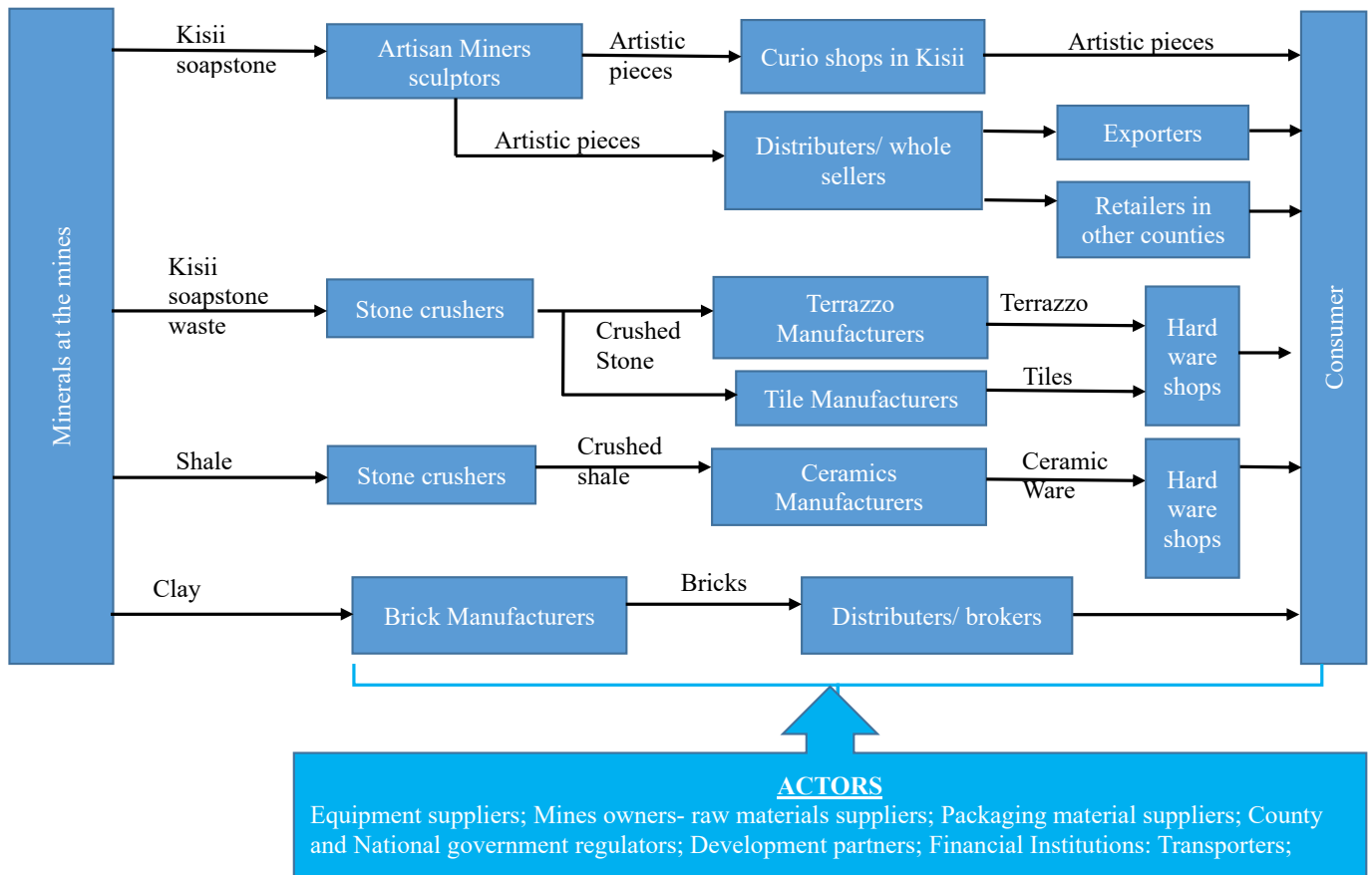


Figure 2: Mineral Value Chain for Soapstone, Shale and Clay



Figure 3: Soap Stone Mining Sites

- **Quality Assurance:** the process of quality assurance is done by experienced artisans through visual inspection of soap stones to check for their suitability in producing quality artistic products. This is done during excavation of the stones. The suitability is assessed on the basis of hardness, color and texture. The stones used for terrazzo production are obtained from the reject and/or waste soap stone pieces.

- **Artistic Pieces Carving:** Large sculptures are either being made at the quarry site or transported to the production facilities. The process involved the artist first coming up with a sketch to be actualized onto the stone piece followed by the curving process

using hand-held tools to create the actual piece. The pieces are then sanded to have a smooth finish which is followed by painting the piece as required. The paints are mostly sourced from Nairobi. Sculptures meant for export to Europe are required to adhere to international regulations on lead content limits in the paint. The last step is waxing to add sheen to the stone and help in preserving the product from moisture effect. The pieces are then packed in boxes ready for dispatch or displayed and sold in shops within the production facility. Carving is mainly done by men while women are mostly involved in the sanding, polishing and painting activities.



Figure 4: Soapstone Art Work Production



Figure 5: Soapstone Art Work Production

• Plant Layout

Production and retail outlets are mostly integrated within the same facility/or compound.

• Waste Management

The waste generated is in the form of powder and chippings that is piled and disposed of. The waste generated at the curving site is in high amounts.

• Process Optimization

Most of the staff supervising production have been trained by the experienced artists through mentorship.

• Management

All enterprises that were interviewed, have their business registered and with management structures already in place. The enterprises ensures compliance in terms of business licensing by the County government.

• Terrazzo Manufacture

The waste pieces in the mines are used for production of terrazzo. The stones are usually crushed using a stone crusher then sieved to obtain the right size for terrazzo. The terrazzo is then packed in bags and loaded in trucks to be transported to ceramics and paint manufacturers.



Figure 6: Soap Stone Waste and Crusher for Terrazzo

Value Chain Actors

• Mines Owners

Provide source of raw materials

• Miners/Artisans

Excavates the raw material and carve them

• Waste Crushers

Prepares the soap stone waste for terrazzo manufacture

• Paint/ Ceramics Manufacturers

Utilizes terrazzo produced in manufacture of ceramics and paints

• Transporters

Transport raw materials and finished goods

• Distributer/Exporters

Link producers and retailers with costumers

• Curio Shops/Retailers

Sells soap stone sculpture to consumers

• County and National Government

regulation of mining and curving activities and Curio shops registration.

The following gaps were identified as shown in table 1 below.

Technology Gaps	Business management Gaps
<ul style="list-style-type: none"> • Lack of modern equipment for soap stone mining • Lack of modern equipment for soap stone design and product development • Lack of adequate technologies for soap stone waste value addition • Lack of appropriate equipment for soap stone waste preparation for terrazzo • Lack of quality standards • No quantification and value addition of wastes • No effort to optimize process or minimize waste 	<ul style="list-style-type: none"> • Poor record keeping • No documented strategies or policies • Risk of designs duplication by competitors • No planned programs on skills upgrade • Lack of finance to acquire appropriate equipment • Lack of finance management • Lack knowledge on Intellectual Property (IP) matters • Lack of digital marketing knowledge
Environment Management Gaps	Social Challenges
<ul style="list-style-type: none"> • Abandoned excavated open sites • Lack excavated sites rehabilitation/ reforestation efforts • Lack of adequate initiatives to add value to high volumes of wastes at the excavation sites 	<ul style="list-style-type: none"> • Lack of Personal Protection Equipment (PPEs) • Lack of structures at the mining sites • Lack of appropriate mining and curving tools/equipment • Non-secured exaction sites • Lack of professional association

Table 1: Soapstone Gaps

3.2 Shale Value Chain

The activities involved in Kaolin value chain are: excavation from the quarries, transportation to manufactures of ceramic items, tiles and paints where it is blended with other materials to produce products. The mines are located in Kepera region. The mines are owned by the community and managed by the young women miners. The minerals are mined using excavators and hand tools. It is then loaded into trucks and transported to different industries in Kisumu and Nairobi for various products making.

• Quality assurance

The process of quality assurance is done through visual inspection. Miners sample excavated stones and assess their suitability on the basis of hardness, color and texture.

• Process Optimization

Most of the staff supervising production have undergone on the job training and apprenticeship from experienced staff.

• The Technology

The technology used for excavation is an excavator, drilling machines, hand tools and sieves. The shale is crushed using jaw crushers and other mills.

• Utilities

Utilities needed include electricity and water

• Waste and Waste Management

There were no waste management procedures after the excavation process. The mines are left open once the mineral is exhausted.



Figure 7: Shale Mines

Value chain Actors

• **Mines Owners**

Provide source of raw materials

• **Miners/Artisans**

Excavates the raw material and carves them

• **Paint/ Ceramics Manufacturers**

Utilizes Kaolin produced in manufacture of ceramics and paints

• **Transporters**

Transport raw materials and finished goods

Some of the gaps identified are highlighted in Table 2 below

Technology gaps	Business management gaps
<ul style="list-style-type: none"> • Lack of modern equipment for mining • Lack of modern equipment for shale value addition • Lack of technology for shale waste value addition • Lack of quality standards 	<ul style="list-style-type: none"> • Low level skills • Poor record keeping • No documented strategies or policies • No planned program on skills upgrade • Lack of finance to acquire modern mining equipment • Lack of finance management and technical skills • Lack digital marketing
Environmental gaps	Social Challenges
<ul style="list-style-type: none"> • Abandoned excavated open sites • Lack excavated sites rehabilitation/ reforestation efforts • Lack of adequate initiatives to add value to high volumes of wastes at the excavation sites 	<ul style="list-style-type: none"> • Lack of PPEs • Lack of structures at the mining sites • Lack of appropriate mining and curving tools/equipment • Non-secured exaction sites • Lack of professional association

Table 2: Showing Gaps Identified in Shale Mining

3.3 Brick Making Value Chain

The activities involved in the brick making value chain in Kisii County (as shown in fig. 9 below) include; clay harvesting and preparation, green brick moulding, drying, brick firing, selling to distributors/ brokers who then sell to customers for building and construction. The sites for clay production are located in interior areas with limited access by road and only accessible by foot. The clay pits are owned by individual farmers. The tools used in brick production are hand tools and in the dry season production drops due to water scarcity and cost of production increases as water is bought for clay production. The green bricks are produced at the source of clay but the bricks are fired at a different site in close proximity to the road in order to sell to the brokers and distributors.

• Quality Assurance

There exists a Kenyan standard for making bricks, KS-02-300. It describes the properties and test methods for standard brick

used in building. However, most brick makers were not aware of the standard and only relied on physical inspection to assess the quality of bricks. The bricks are inspected for cracks, deformities and the colour. They are then sampled and a drop test is done to determine if they are strong enough.

• Process Optimization

Clay harvesting and molding are done near the source. Firing is supervised in order to ensure maximum utility of fuel and is done near the road in order to ease transportation cost of fuel to kiln and of bricks to market.

• Technology

The technology used in brick making is hand held wooden molds that make one or two bricks at a go. The kiln used for firing utilize wood as source of fuel.



Figure 8: Showing the Brick Making Process

• Utilities

The utilities that are used in brick production are water and wood as fuel.

• Waste and Waste Management

Waste bricks are either recycled into the production of new bricks or used to make insulation for the kiln during firing.

Value Chain Actors

• Land owners

Provide raw materials (clay) for brick production

• Brick makers

Produce bricks

• Distributors/Brokers

Link brick makers to the market

• Contractors/Consumers

Use bricks in construction

• Firewood Sellers

Provide fuel for bisque firing

• Transporters

Transport fuel to brick makers and bricks from brokers to consumers

Some of the gaps identified are highlighted as highlighted in table 3 below.

Technology Gaps	Business management Gaps
<ul style="list-style-type: none"> • Lack of modern production technology for molding and firing. • Lack of standard quality testing technology • Lack of branding technology 	<ul style="list-style-type: none"> • Low level skills • Poor record keeping • No documented strategies or policies • No planned programs on skills upgrade • Lack of finance management and technical skills • Lack of marketing skills • Lack of finance to acquire appropriate skills

Table 3: Showing Gaps Identified in Clay bricks-Making Process

4. Challenges and Recommendations Summary

Value Chain	Challenges / Risk	Recommendations / Opportunities
Kisii soapstone	Lack of appropriate modern technologies for mining, design, curving and waste value addition	Adopt/adapt appropriate technologies for soap stone mining, product development and waste value addition
	Lack of finance management, IP, marketing, documentation and record keeping skills	Capacity building of soap stone enterprise management on the lacking skills
	Open mines posing environment and safety risks	Reforestation of exhausted mine sites
	Lack of PPEs for use during soap stone mining and products development	Acquire/use PPEs during soap stone mining and product development
Shale	Lack of appropriate modern technologies for shale mining and associated waste value addition	Adopt/adapt appropriate technologies for Shale mining, and waste value addition
	Lack of finance management, documentation and record keeping skills	Capacity building of shale mines owners on the lacking skills
	Open mines posing environment and safety risks	Reforestation of exhausted mine sites
	Lack of PPEs for use during Shale mining	Acquire/use PPEs during Shale mining

Brick making	Lack of appropriate modern technologies for clay harvesting, bricks molding and firing	Adopt/adapt appropriate technologies for clay harvesting, bricks molding and firing
	Lack of finance management, marketing skills	Capacity building of enterprises management on the lacking skills
	Lack of PPEs for use during clay harvesting, bricks molding and firing	Acquire/use PPEs during clay harvesting, bricks molding and firing

Table 4: Showing A Summary of Challenges Encountered and Their Recommendations

5. Conclusion and Recommendations

The value chain analysis on the Kisii soap stone, Shale and Clay minerals in Kisii County revealed the series of activities involved from mining, product development, and marketing and associated waste value addition. The study found the technological challenges/gaps that affect the respective minerals mining, product development and waste value addition. The study also highlighted the environmental and social sustainability challenges that affect each of the three mineral value chains. It was able to identify the abundance of minerals in Kisii and the neighboring Nyamira County that in spite of not being part of the scope the team was able to gain some information on some of its mineral potential and visit site for clay and shale minerals. It is therefore recommended that the County government, in collaboration with relevant stakeholders should take the stock of the remaining soap stone, Shale, Clay and other minerals. It is imperative for the enterprises involved with the three value chains adopt use of appropriate modern technologies during their operations to ensure productivity and business competitiveness. It is recommended that the workers involved with the minerals mining, product development waste value addition should always use the appropriate PPEs to ensure their safety. There is need to ensure that the exhausted mines are rehabilitated/reforested to ensure environment sustainability and safety. The enterprises should also be trained on finance management, Intellectual Property (IP), marketing and use of quality standards during products development [1-8].

Acknowledgement

We express our gratitude to the World Bank Group for supporting this mineral value chain mapping exercise through a research

grant to the Kenya Industrial Research and Development Institute (KIRDI). We are indebted to the Ministry of Investment, Trade and Industry (MITI) for enabling KIRDI to carry out this work, as well as the County Government of Kisii for granting us the approval and an enabling environment for the mapping exercise. We appreciate the enterprises such as Kisii Soapstone Art Center, Tabaka Chigware and Nyamira young women miners for availing the information to the KIRDI team.

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