



Research article

Mining impact on communities' livelihoods: A case study of Taita Taveta County, Kenya

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Abstract: Mining has been blamed globally for harmful and impoverishing effects. Most countries are rich sources of gemstone, yet there is very little development, since miners, and those around mining sites, still live in abject poverty. This study sought answers on: “how mining activities have affected communities' livelihoods?”. Data was gathered from, Mwatate Sub-county, Taita Taveta County, Kenya. Structured questionnaires were administered through mobile technology, to randomly selected respondents from 173 out of 990 households, followed by a one-on-one focused discussions with Key Informants. Both groups were purposively selected. Data was analysed using Statistical Package for Social Sciences (SPSS) Version 21.0 after it was examined for accuracy by arranging it into manageable units and identifying patterns among variables. The findings were presented on tables for clear understanding. The study found that there is no proper mining regulatory system in Kenya. There is also no control of the intrusive influx of migrants from other counties into the mining areas of Taita or regulations for best mining practices. Mining did not help some of the households, to acquire assets, even though its enhanced ability to meet their day to day needs., Mining pits, poor rehabilitation and large-scale mining have caused a loss of agricultural land resulting in reduced crop yields and poor living standards. Some established mining companies in the area did not compensate, or share their accrued revenues nor did they support development projects as was expected. Therefore, the improvement brought about by mining was not sustainable to communities' livelihood. The study recommends diversification of economic activities for livelihood improvement. To reduce poverty, equitable distribution of benefits and costs needs to be considered as essential. Environmental and social impact assessment, as a legal framework to regulate the mining operations, should be enforced in Africa and in Kenya.

Keywords: impact; livelihoods; mining; poverty; wealth

1. Introduction

Mining is a major economic activity in Taita Taveta County (TTC) [1]. According to Mghanga M' [2] research done on mining in TTC, concentrated on the political economy of the mining area, associated with conflicts over land and mineral resources. There is scanty information on the impact of mining on livelihoods of communities living in the mining environs of the Taita Taveta County. Most of the previous research work done in TTC has not been documented nor published with the exception of a few which address the natural science and geological issues since they are driven by prospector, investor and trade interests. This new study therefore, focusses on how the extensive mining activities affect the livelihoods of local communities with a hope for some legislative solution being applied by the government in Kenya, Africa and other countries. These solutions which have remained elusive for a long time will be for the benefit of communities in the mining areas and the local economy. Mining operations, whether on a large or small scale have potential impacts on the people's livelihoods as it employs people in the proximity where minerals are being exploited [3]. It is a driver to development as it contributes to per capita income through job creation resulting in improved livelihoods. It boosts the economy of the country through the generation of revenue, an example, being through infrastructure development [4]. The mining sector creates a pool of opportunities that can be relied on by the county government for socio-economic development and the creation of wealth. Artisanal Small-Scale Mining (ASM) has got a major potential in reducing poverty and contributing to sustainable development. ASM is when miners not officially employed by mining companies work independently by hand, using their own resources. ASM provides vocational jobs across the globe which represents the livelihood of the poor communities. Income generated by ASM tends to be spread and spent mainly in the local economy and has a significant impact economically and developmentally at the local level, in contrast to large-scale mining which directs much of its income to overseas shareholders or banks [5]. In Kenya, most of the small-holder farmers engage in artisanal mining during dry seasons to gain income for their agriculturally based livelihood [6]. In Tanzania, ASM has been the solution to growing unemployment among youth and provides income-earning opportunities for both men and women in a variety of occupations [7]. During the civil war of Cote d'Ivoire (2002–2007) when labour migration was difficult, ASM offered a viable livelihood for many inhabitants [8]. ASM may, at the same time, negatively affect the development and livelihood of local communities environmentally, socially, and economically [9]. Extraction processes rarely consider social and environmental sustainability for the benefit of future generations [10]. Mining has been blamed globally for harmful and impoverishing effects. The governments are expected to regulate mining in a manner likely to attract investors and at the same time protect the interests of local communities [11].

In Kenya, various types of minerals are found but only a few are being exploited [12]. Taita Taveta County is rich in industrial minerals and gemstones (Tsavorite, red garnets, green garnets, yellow garnets, ruby, green tourmalines, yellow tourmalines, change colour blue sapphire, pink sapphire, amethyst, peridot, iolite, spinel, rhodolites, and kyanites) that have potential to generate considerable wealth for the prospectors, investors and local community members [13]. This has been challenged by Abuya W and Abuya O [14,15] who have stated that there has been much debate on

whether mining is a curse or a blessing as little consideration is given to the owners and their attachment to the land and the assets therein, all because of inadequate mining regulations. They have documented a scenario where 3000 residents in Kwale, Kenya, were displaced to make way for the mining of titanium. The result of this human rights abuse action invited conflicts over control of resources such as ownership of land between the mining communities and the government of Kenya who allowed extractive companies to operate. Displaced communities in Kenya have lost homes, livelihoods, food insecurity, poor health and illness, psychological trauma, and social and cultural risks, and they have been marginalized without any compensation. There has been no sharing of profits emanating from the mining ventures.

Africa owns the land and is a rich source of gemstone yet there is very little development in many African countries, since miners still live in poverty. Colonial mining Acts are still enforced in African countries like Kenya, Malawi, and Nigeria's petroleum industry. South Africa's legislation allows communities to own and control minerals but does not allow them ownership and development [16,17]. Major gemstone producing countries in Africa like Botswana, Namibia, and South Africa are under pressure to gain further economic benefits from the gemstone value chain through seeking investments in the cutting, polishing and jewellery industry. Kenya, Tanzania, and Uganda won a Fairtrade gold award through a project supported by the United Kingdom (UK) and the Netherlands for their development progress on gemstones which was aimed at improving livelihood and working conditions for Artisanal and Small-Scale gold miners (ASGM) through productions and sale of gold [18]. African coloured gemstones are largely mined by Small-Scale operators including women together with some large international operators. In Africa, many women are actively engaged in Small-Scale mining. These women work in coloured gemstone deposits, reworking tailings, and trading in small stones across Madagascar, Zambia, Mozambique, Malawi, Tanzania, and Kenya. Success stories have been documented, concerning women dealers who own their mines and work internationally in coloured gemstone [19].

Other minerals that exist in the Taita Taveta mineral ore belt are titanium, barites, coral rock, salt, iron ore, and gypsum [20]. In Taita Taveta, mining is often carried with little government regulation or control [21] there being few rules on sharing of royalties and benefits among the investors, the communities, the county, and national government. The extraction freedom has attracted people from all over Kenya and East Africa to Taita, but only a few locals participate, largely benefiting only brokers, middlemen, and other players along the supply chain. Unverified claims of exploitation of the environment and the local communities by miners have been made. Exploitative systems are unlikely to be sustainable [22]. In many mining sectors, sustainable development is considered as "the combination of enhanced socio-economic growth and development, improved environmental protection and pollution prevention" [23].

The socioeconomic impact on national and county economy at large have a significant proportion towards the national mining production generated from artisanal and small-scale mining. Studies of exploitation in the area have been inconclusive, presenting variable findings on the effects it has on various actors in the mining activities [24]. It is difficult to obtain accurate information on the number of artisanal and small-scale miners in the county as the practice is considered illegal and informal. The study sought to determine and analyze the severity of the Taita Taveta County mining industry concerning the surrounding communities' livelihood. The study was based upon the hypothesis that mining activities have a significant contribution to poverty on the local communities.

2. Materials and method

2.1. Study area

This study was carried out in two mining fields, Kamtonga and Mkuki in Mwatate sub-county, Taita Taveta County, Kenya, between January 2016 and April 2019. Geographically, the county lies at Latitude: 3°48' S and Longitude: 38°24' E. It is located in the southwestern part of Kenya, with a distance of 360km from Nairobi, the capital city of Kenya and 200 km from Mombasa to the southeast and northwest respectively. Other counties bordering Taita Taveta are to the North, Kitui, Makueni, and Tana River; to the East are Kwale and Kilifi; to the Northwest is Kajiado. The county covers an area of 17,083.9 km² of which a bulk 62% or 11,100 km² is within Tsavo East and Tsavo West National Parks. The remaining 5876 km² is occupied by ranches, sisal estates, water bodies such as Lakes Chala and Jipe in Taveta and Mzima springs, and the Hilltop forests which occupy less than 100 km². The Republic of Tanzania is found in the Southwest. It has an altitude of 500–2300m above sea level. It receives rainfall to an average of between 440–1900mm. Taita Taveta is divided into three major topographical zones. The upper zone, suitable for horticultural farming comprises of Taita, Mwambirwa and Sagalla hills region with altitudes ranging between 304 meters and 2208 meters above sea level. The lower zone consists of plains where there is ranching, national parks, and mining.

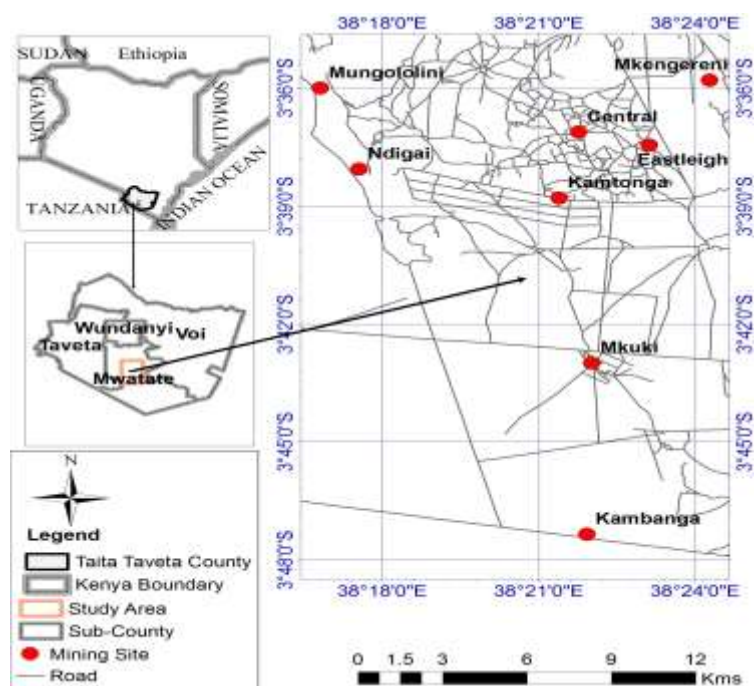


Figure 1. Map of the study area.

2.2. Scope of the study area

Kamtonga and Mkuki areas are in Taita Taveta County, in Coastal Region of Kenya. These minefields were easily accessible and treated as legitimate samples of the minefields scattered far and wide in Taita Taveta. The logistics of reaching the two areas were much easier than for the less

accessible Kasighau or Kuranze. The two sampled mining fields are surrounded by ranches including Kutima, Choke, and Kabanga that keep livestock herded by Maasai and Somali employees who roam the vast land parcel. Kamtonga and Mkuki townships are fast growing into vibrant commercial centres and dwellings that accommodate the cosmopolitan gemstone miners and dealers. Itinerant dealers move in, twice a week from as far away as Tanzania for the gem auctions that take place at the Chawia Mining Community Based Organization (CBO).

2.2.1. Geology of the study area

The geology of the County falls in two categories namely the Mozambique belt and the Tertiary Volcanic belt. The Mozambique belt covers Taita Hills, Mwatate, Kasigau and Kuranze areas, among others, while the Tertiary Volcanic belt covers the Taveta region. Most gemstones and industrial minerals are found in the Mozambique belt. The County is the main source of Tsavorite and ruby minerals worldwide.

2.3. Population and sampling

2.3.1. Study population

According to the Kenya National Bureau of Statistics [25] census, the population in Taita Taveta County is 340,671, with Mwatate population being 81659. Kamtonga and Mkuki which were the selected research areas had 990 households. The population in the nine villages of Kamtonga and Mkuki comprise of local indigenes, non-local Kenyans and non-Kenyans forming a pool of cultural diversity. Most of the people have lived in these areas for over 20 years having come from Taita Taveta, Makueni, Murangá Nakuru, Tharaka-Nithi, Kilifi, Nandi, Siaya, Kiambu, Tanzania, Burundi, Kitui, Mombasa, Machakos, Tana river, Kisumu, Meru, and Nyeri counties.

2.3.2. Sample size

The formula below was used to calculate the sample size of each village bringing it to a total of 173 households (Table 1).

$$n = \frac{(z^2 \times p \times q \times N)}{e^2}$$

$(N - 1) + (z^2 \times p \times q)$, where:

n = Sample size (being determined)

N = Population size (known)

p = Sample proportion (assumed to be 0.02, if not given)

$q = 1 - p$

$e = 0.02$ (since the acceptable error should be 2%)

z = Standard deviation at a given CI ($z = 1.96$ at 95% CI)

Within the 173 households visited, the researcher was able to identify formal miners, mineral brokers, small traders, transporters, and food vendors with the assistance of the village elder. These were treated as sampling frame strata. Within each stratum, respondents were selected randomly from a list generated from participatory community household mapping, with a bias to include both gender, age, and education level (none, primary, secondary and tertiary) within represented ethnic groups. The people-based livelihood study targeted nine villages (Table 1). Most respondents in the mining areas especially Kamtonga and Mkuki are farmers, teachers, vendors, shop/kiosk traders,

retailers, business people, transporters, cattle herders, church and women associations miners, small scale and artisanal miners. There is a registered Community-Based Organization (CBO) that oversees and supports interested multicultural groups in mining.

Table 1. Households from nine villages in Mwatate Sub-county.

No	Villages (Strata)	Number of households	Sample households
1.	Eastleigh A	85	15
2.	Eastleigh B	75	13
3.	Central	80	14
4.	Ndigai	120	21
5.	Mungololini	200	35
6.	Mukengereni B	80	14
7.	Mukengereni C	110	19
8.	Mkuki	200	35
9.	Kambanga	40	7
	TOTAL	990	173

2.3.3. Sampling design

Purposive Sampling technique was employed to select two mining fields that is Kamtonga and Mkuki in Mwatate Sub County as they were easily accessible. The two mining fields were reflective of artisanal and small scale mining and selected as clusters in the study. Random sampling was used to select households around the two mining fields to ensure respondents randomization for the interviews. Respondent included a household member from the age of 18 years and above mainly the father, or mother and in case of their absence, daughter or son. A household is considered to be ‘a group of people, who live, cook and eat’ together, and they may not necessarily be related but have one person regarded as the head of the house.

2.4. Data collection

2.4.1 Survey instruments

The source of data was mainly from primary and secondary sources such as questionnaires, Key Informants interviews and discussions. The main survey instruments for the primary data collection was face to face respondent interviews, using a discussion guide, structured and semi-structured in-depth questionnaires. A guide for the discussion was developed for the nine key informants who comprised of Manager of Classic Mines, an official of Chawia Mining Community Based Organization (CBO), an individual manual artisanal miner, a retired senior Warden of Kenya Wildlife Service (KWS), the Kenya Forest Service Manager, A gemologist from the Taita Taveta County, the Chief of Mwachabo ward in Mwatate, and the NEMA County Director. The Survey instruments were used as inquiry documents to provide insight into the nature of the problem under study.

A pilot study was conducted prior to the main study to assist in testing the validity and reliability of the tool. This helped to establish the consistency of the set questionnaire in terms of the time and location, and, to identify areas in the questionnaire that needed clarity for the respondent to

understand and answer appropriately. The researcher used mobile technology for this pilot study. The literature review formed part of the secondary data, gave the theoretical base for the research, and helped determine the nature of this study. It helped to identify what was already known about the area of this study. Mobile technology was then used to collect the data in the form of structured questionnaires for all the sampled groups.

2.5. Data analysis

The raw data was examined and organized into manageable units for analysis to establish the accuracy of the research study. Obtained data was analysed using Statistical Package for the Social Sciences (SPSS) Version 21.0. The data was displayed in the form of frequency table proportion (percentages) and use of measures of central tendencies for example means to give a clear understanding of the findings.

3. Results and discussion

3.1. Gender proportion of respondents

The majority of the respondents were male engaged in mining activities (62.79%) compared to the female respondents who were least involved as miners (37.21%). Table 2 shows the proportion of men and women and their income sources as interviewed during the survey. Both genders were equally involved in the business within the area. In terms of farming activities, women were the most involved (60%) compared to male (50%). Also, information from the key informants showed that, men were the majority in the mining sector.

Men, being chief providers in the family are forced to work tirelessly to ensure that they fulfil their obligations. In mining sectors, men are preferred due to their masculinity. It is reported that men do hard work to increase the level of production. Women find it difficult to operate heavy machinery and equipment [26]. There is a higher demand for men compared to women in mining even though this activity is gender-oriented [27]. This contradicts what is seen on the ground in the sense that as much as mining is perceived as the male activity, women also have been involved in mining [28].

Table 2. Gender proportions of respondents.

Income source	Gender		Grand total
	Female	Male	
Business	50.00%	50.00%	100.00%
Farming	60.00%	40.00%	100.00%
Miner	37.21%	62.79%	100.00%
Others	100.00%	0.00%	100.00%
Grand total	43.86%	56.14%	100.00%

From the study, it was also realized that more women were operating shops while men did the actual mining. This could be because the business mentality between the two genders has transformed to favour women. According to Stevenson L, et al [29], most of the women have dismissed the mentality that business and especially shops are for men only. More men are miners

because mining activities require more masculine gender. Olayide B, et al [30] argued that differences in biological composition between male and female predetermined capabilities and dispositions for various activities that they did.

3.1.2. Proportion of respondents' source of income, gender, and marital status

Part of the profile question was to indicate the marital status of the respondents from each category of occupation. There were more married male compared to the female. This is probably because most males in mines came from the other parts of Taita leaving behind their families while in search of livelihood. Within the study areas, the respondents reported being involved in diverse economic activities including mining, farming, and business activities (Table 3). To identify the key occupations of the residents in Kamtonga and Mkuki, the respondents were asked to list the skills they possessed. Listed skills included Farming (livestock, Poultry, land tilling), Mining (labourers, brokerage), business (shop keeping, kiosks, selling of clothes, food vending, sand selling, and transportation). Other activities are brick making, house construction, teaching, and community health workers. These are the activities that most respondents engage in to support their household livelihoods. The results are similar to that of Aragón F, et al [31] who reported that most local communities engage themselves in many different activities like business and farming to enable them to support their families.

Among the respondents, 85.3% of the male respondents and 64.0% of the female respondents were involved in mining activities as a source of income. Female respondents are more engaged in farming 24.0% compared to 12.50% of male respondents while a few engaged in business (Table 3). This could be because men, especially, in Africa are said to be the breadwinners and so they find themselves working harder [32]. Despite more men engaging in mining, 12.5% of the men respondents also engaged in farming. This means that some of the farmers are also engaged in mining for more economic gains which resonate with some of the communities studied in Ghana where Adjei E [33] indicates that mining has contributed to economic and financial gains to some farmers.

Table 3. Proportions of respondents' source of income, gender, and marital status.

Income source	Marital status	Gender		Grand total
		Female	Male	
Business	Married	8.0%	2.9%	5.0%
Farming	Divorced	0.0%	2.9%	1.7%
	Married	24.0%	8.8%	15.3%
Miner	Married	52.0%	82.4%	69.5%
	Single	4.0%	2.9%	3.4%
	Widowed	8.0%	0.0%	3.4%
Others	Single	4.0%	0.0%	1.7%
Grand total		100.00%	100.00%	100.00%

3.1.3. Estimated average monthly income for different categories of respondents

On account of female/male gender categories of respondents, they were requested to indicate

their monthly incomes from business activities, farming, mining, shop-keeping, and other engagements. The results in Table 4, indicate that most of the male respondents tended to earn more in business activities and mining compared to the female. Similar findings were reported by Spiegel J [34] who found out that women in the mining sector have minimal participation in the activity as a leading source of income. In this case, women are unable to engage in the mining sector adequately and tend to do farming and other activities such as food vending in the mining areas.

Table 4. Estimated average monthly income for different categories of respondents (in Kenya shillings).

Income Source	Gender		Grand Total
	Female	Male	
Business	8000.00	10000.00	18000.00
Farming	5333.33	6000.00	11333.33
Miner	6250.00	6666.67	6511.63
Others	10000.00	0	10000.00

3.1.4. Average monthly income made by respondents from different counties and locations within Taita

Observations from different counties and locations living within Taita and around the mining areas revealed that respondents from these counties also got involved in the three key activities namely, business, farming, and mining. The average actual monthly income varied considerably, showing communities from Makueni as leading in business activities with a monthly income of Ksh. 110000. The Taita community and the locals led in mining with a monthly income of Ksh. 46468.42 followed by communities that came from Machakos County (Table 5).

Table 5. Average monthly income made by respondents from different counties and locations within Taita.

Counties	Income Source			Grand Total
	Business	Farming	Miner	
Taita	-	-	46,468.42	46,468.42
Machakos	-	-	18,500	18,500
Makueni	110000	500	11,157.14	121,657.1
Kilifi	-	-	9000	9000
Kitui	-	-	2500	2500
Tana River	-	-	800	800

According to Machakos County [35], people from Makueni County led in business activities in Taita Taveta County because, in their County of origin, the development of market centres is limited by low economic activities. This is mainly because of over-reliance on agricultural activities, which often perform poorly due to recurring droughts, forcing them to shift to other income-generating activities such as businesses in cereal retailing, livestock, building materials, and household products. Taita people, on the other hand, being the majority in their County of origin and having more mining skills compared to the immigrants led in income generation from the mining activities.

3.2. Influence of mining on livelihood opportunities

On a scale of 1-4 the respondents were then asked to rate the extent of various variables on influence of mining on livelihood opportunities. The respondents agreed that mining activities assisted in creation of new business opportunities such as food vending, enlarged transportation and increased food security and created wealth (Table 6). Mining did not help them in acquisition of properties like land, cars and houses. This means that mining enhanced ability to meet day to day needs but fell short of creating wealth in form of assets that generate income to the people.

Table 6. Influence of mining on livelihood opportunities.

Livelihood opportunities	Females	Males
Created new business opportunities	3	3.1
Created wealth	3	3
Created opportunities for women	3	3
Enhanced food vending	3	3
Enlarge transportation	3	3
Increased food security	3	2.9
Creation of jobs	2.9	3
Created markets for agricultural produce	2.9	2.9
Enhanced security	2.9	2.8
Increased urban centres developments	2.7	2.9
Enabled buying of houses	2.7	2.8
Increased infrastructural developments	2.6	2.4
Increased incomes	2.5	2.7
Increased livestock ownership	2.4	2.6
Enabled buying of mining tools	2.4	2.7
Enabled buying of farming tools	2.4	2.6
Enabled buying of land	2.4	2.5
Enable build a good house	2.3	2.4
Improved farming	0.7	0.7
Improved standard of living	0.1	0.3

Note: Scale 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree.

Table 7 shows results that disapprove loss of assets contrary to the study in Ghana where mining operation brought negative outcomes to the livelihoods of some of the rural households.

According to Hilson G [36], mining has got a potential in poverty reduction and can also have adverse impact on communities based on close proximity to operations, besides environment, society and cultural heritage and the health and safety of mine workers. In Peru, mining adversely affected livelihood primarily through its impact on land and water resources reducing access to piped water and contaminating major rivers [37]. Mining activities affected livelihood assets of cultural identity like land rights reserved for future use. It led to increased insecurity such as loss of livestock because of reduced grazing lands occupied by mining activities. Mining has led to displacement of local people from their ancestral lands resulting in marginalization and oppression of lower income classes of people. For instance, in Zimbabwe the indigenous people were displaced to pave way for platinum

mining operations. Local communities bore the brunt of environmental and social impacts of extractions [38]. Mining was used to fund illicit activities in Colombia. These activities displaced indigenous people from their customary land and territories leading indigenous authorities to ban mining and regain control of their land. Globally issues of mining, land and displacement remains synonymous. In India, disrespect of indigenous tribal people's rights caused eviction and dispossession of Adivasi communities of their tribal lands for a large-scale coal mining. Another phenomenon is that of Large-Scale Mining (LSM) displacing Artisanal Small-Scale Miners (ASM) who would be the indigenes of an area, like in Guiana Shield of Northeast South America. Artisanal gold miners were displaced from their lands and territories by an industrial-scale mining complex and they had to move to an alternative artisanal mining location which was not as prospective as the original mine-site [39].

Table 7. Mining maligned for negative effects disapproved.

Negative mining impacts	Females	Males
Caused me to lose land and home	2.2	2.2
Low economic gain	2.5	2.4
Lost land	2.3	2.3
Lost trees	2.3	2.3
Lost Livestock	2.3	2.3
Reduced farming skills and activities	0.1	0.2
Reduced herding skills and activities	0.1	0.2
Reduced poultry rearing skills and activities	0.1	0.1
Reduced Bee keeping skills and activities	0	0

Note: Scale 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree.

Mining induced displacement is another way that endangers the livelihood of local communities and causes them to undergo livelihood dispossession. Mining projects affect local communities with regard to ecosystems and land use. Emissions from mining and mineral processing such as dust, noise, waste water and heavy metals have significantly decreased the quality of the ecosystem and led to public health issues. Other disruptions involve land and water use which reduces the viability of other industries such as agriculture, aquaculture and tourism [40]. When a mine moves in, transformation of space is immediately triggered. In order to extract, land must be cleared of property, people and their habitation. Displacement in mining areas always involves land. In Australia, the subject of Mining-Induced Displacement and Resettlement (MIDR) was in play. Coal mining in Australia's Hunter Valley and Mid-Western Region of New South Wales (NSW) between 1970 and 1980, altered the relationship between mines, governments and local communities. More land acquisition was required to extend coal operations and this involved workforce mobility and intensified migration whose effect was depletion of local communities at the coal area [41].

The picture on mining activities appear so negative, but there is still a light at the end of the tunnel in that mining industry can have positive effects as well on local communities. Added value is when mining firms construct health facilities and offer services in remote areas, resulting in significant improvements in infant mortality and life expectancy. In China, the coal mining industry is regarded as a driving force of the economy, providing employment and alleviating rural poverty. This is despite the fact that displacement of millions of people in China has taken place with severe

consequences causing tension between the industries and peasants. According to Jabareen Y [42], about 70% of population in Africa depends directly on environmental resources, which is land for their livelihoods. Other economic activities include; farming, subsistent business activities, unlike in the past when traditionally, local people made their living from crop and livestock farming only. With the diversified population in the study area, other skills were introduced including mining, which were not the major economic activity to the people of Kamtonga and Mkuki. Mining became an additional source of income by creating income opportunities for local farmers who obtained a closer market for their products.

Currently, people in Kamtonga and Mkuki are mainly involved in farming and trading. Mining activities create market opportunities for local farmers because of increased demand for food by people working in the mining areas. At the time of this study, the area had received a lot of rain and the Kenya Wildlife Service had just constructed an electric fence around these farms so that elephants are not able to invade them. The study revealed that as a result of the electric fence, residents in those mining areas harvested a lot of food and were able to sell their produce, at the developed market centers, and increase their income. According to one of the key informants this was a windfall for people who had suffered for a long time from wild animals invading the farms. Some findings showed that some made reasonable earnings in good months while some still lived from hand to mouth. From the study done by Makindi M, et al[43] most of the countries in Africa such as Kenya, for example, much of the wildlife lives outside protected areas and when humans encroach their habitat, human-wildlife conflict results. Because of new opportunities occasioned by mining, some people abandoned farming for business, thus enhancing community wellbeing.

This study revealed that the households that engaged in mining and food vending seemed to have benefitted the most, because they combined selling of food to the miners with farming. This study is supported by other researchers who explained that local communities and especially women around the mining areas abandoned farming activities and moved to business occupation around the mining places. The study revealed that most of the households had at least one member of the family actively employed in mining, alleviating poverty which is the first goal in Sustainable Development Goals (SDGs) [44].

Many respondents agreed that mining had greatly improved infrastructure in form of roads, schools, health centers and market centers. This was probably due to the increase in income levels as well as the living standards of the community around the area. Aragón F, et al [45] noted a positive effect of mine operations on access to better and improved health care due to increased number of health centers in areas nearing the mining areas. In Mali, mining increased length of good roads and numbers of health centers.

Respondents admitted that mining enabled improved housing quality. An increased share of household expenditure on housing and energy has been contributed greatly by increased mining activities in the areas [46] as wages for those working in mining are higher than average for the same population.

Some people lost their lands due to increased number and size of mining pits and especially in the areas that were poorly rehabilitated. As observed by Jonsson B, et al [47], impact of mining included losing agricultural land to large-scale mining resulting in reduced crop yields and increased poverty. On the other hand, mining has multiple effects on development, since it creates job opportunities both directly and indirectly [48], increasing purchasing power, although some respondents disputed the fact that, through mining activities, they had bought land, houses, cars and

livestock. There are those who consented that mining activities helped them buy other livelihood items like farming and working tools.

Respondents contended that mining companies neither shared their accrued revenues nor supported development projects as expected. This challenge for mining development has been documented elsewhere, as equitable distribution of mineral resource revenues to all stakeholders is a difficult thing for extractive industries [49]. Impartial benefits distribution is related to fairness or justness especially in distribution of mineral resources as well as the costs in accordance to the various sector's needs, aligning with Brundtland Commission, which explains the concept of meeting the needs of both the present and future generations in sustainable development [50]. In order to reduce poverty, equitable distribution of benefits and costs needs to be considered as essential.

The findings of this study show that mining improved the well-being of communities through employment at the mines, accessing healthcare, education and the skill transfer as well as better housing. Livelihood costs were eased, but still poverty prevailed, in that they still solely depend on farming. Having risen from such low levels of poverty, it was clear that more could be done to raise the living standards of the people living in mining areas. One such thing is the electric fence erected by KWS. It was a big win for the community's livelihood.

Mining activities should be conducted in a way which is perceived as fair by the present and future generation while contributing to poverty reduction and economic development in the mining areas. Because of inequality in consumption and distribution of mined minerals, for instance in Peru where mining intensified in 2000s, it was realized that mining locations had higher benefits than those which were not under mining thus contributing to poverty in such regions [51]. Governments need to balance the needs of local communities with creation of an appropriate environment that attracts investors and demonstrates mineral potential and viability for mineral extraction as done in Zambia.

4. Limitation of the Study

This study had limitations. First limitation was the sparsity of the homes since the area is sparsely populated. Poor road networks in the area of study was a challenge experienced by the researcher and assistants, resulting in walking long distances in the semi-arid area, to get to the targeted homes and centers to collect data from respondents. This took a lot of time coupled with the fact that respondents were also slow when answering the questionnaires. Confidentiality was a limitation as local communities would become suspicious of researcher's intentions, and this would interfere with information flow. The project was self-sponsored and this too was a strain to the researcher who had to hire four wheel vehicles to reach the area and also facilitate data collecting assistants.

5. Conclusion

In conclusion, this study about the impact of mining on communities' livelihoods in the selected areas of Kamtonga and Mkuki has shown that:

The mining sector has attracted people from different counties into Taita Taveta County. Diverse economic activities have grown as a result of the mining industry in the area. Both genders are equally engaged in agriculture and diversification of economic activities for their household sustainability. Most men work mainly in the mining sector and have had greater economic and

financial gains than women. Respondents agreed that mining activities assisted in creation of new business opportunities such as food vending, done mainly by women, improved transportation, food security and wealth creation. Every household has at least one family member actively working in the mining operations and this has been a great contribution to poverty alleviation within the household. Mining operation within the study area has brought about improvements of infrastructure such as roads, schools, health and market center as well as improved quality of houses. Mining helped some communities to purchase livelihood items such as farming and working tools.

There are nonetheless some negative outcomes owing to the mining operations which have affected the communities within the study areas of Kamtonga and Mkuki. For some of the households, mining did not help them in acquisition of properties like land, cars and houses. This meant that even though mining enhanced ability to meet their day to day needs, it fell short of creating wealth in form of assets. Some communities lost their land due to increased number and sizes of mining pits especially where the same were poorly rehabilitated. Open mining pits and large-scale mining have caused a loss of agricultural land resulting in reduced crop yields and poor living standards. On the issue of compensation, some established mining companies in the area did not share their accrued revenues nor did they support development projects as was expected. Also lack of proper mining regulations has rendered the indigenes powerless when migrants invade their land for mining.

Conflict of interest

The authors declare no conflicts of interest, financial or otherwise.

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