



Research paper

Socio-economic and environmental impact of mining on women in Kasigau mining zone in Taita Taveta County

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ABSTRACT

The Kasigau ward is home to many gemstones with their mining contributing to the county's economic development. The mining sector is dominated by artisanal and small scale mining with 3–5% of women employed. A Participatory Action Research (PAR) approach was used to involve women with the aim of establishing home-grown interventions. Seven villages and forty nine households participated in household interviews, Focus Group Discussions (FGDs) and female feedback reflection meetings to generate and analyze data. Women worked as *zururas* (workers) or employees, in deplorable environmental conditions, and were heavily impacted by mining activities. Women developed actionable strategies on productive engagement in the artisanal mining sector.

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1. Introduction

Kenya's mining industry is dominated by non-metallic minerals such as soda ash, fluorspar, kaolin and some gemstones. These minerals represent a small percentage of the Gross Domestic Product (GoK, 2015). Kenya has proven deposits of titanium, gold and coal, and is estimated to hold significant deposits of copper, niobium, manganese and rare earth minerals. The local share of mining revenue helps to diversify and expand the economy (Oxford Business Group, 2014). However, Kenya needs to attract investors from the mining industry to boost economic development. The country has enacted mining law which is envisioned to protect the environment, ensure compliance with regulations and standards in the sector and lead to the equitable benefit sharing of proceeds from mining resources in order to improve the welfare of the people living in mining areas (GoK, 2016). The constitution of Kenya 2010 (GoK, 2010) declares that every person is entitled to a clean and healthy environment and the current legal framework established a robust institutional framework to manage and protect the environment and the welfare of each person. Sectoral growth has been stunted by low levels of compliance with regulations and

policies and this has decreased the socio-economic and environmental benefits of the sector in the country. There is little regard for improved health and safety, environmental sustainability and the social wellbeing of workers. Abandoned mining sites and inadequate rehabilitation of the sites have consequently created degraded physical environments with the potential for adverse effects on the welfare of workers, especially women.

Women are directly or indirectly engaged in mining activities in many countries in the world despite the plethora of challenges facing them in the sector (Hinton, Viega, & Beinhof, 2003). Mining is the weakest driver of development in the coastal region, contributing only 2% (GoK, 1999) to the economic development, with the main economic activities being tourism, ports and shipping, fisheries and agriculture. Various types of minerals are found close to the Kenyan coast, some of which in significant economic quantities and only a few of these are being exploited (GoK, 2015). Salt, coral rock, titanium, manganese, barites, gypsum, iron ore and gemstones are some of the extractive mineral deposits that exist in economic quantities in the mineral ore belt of Taita Taveta County with the potential to boost economic development (Taita Taveta County Government, 2013). The mining industry in the county is a significant driver of development as it contributes to the per capita income of the population through the creation of job opportunities and livelihoods, as well as infrastructure development. The industry creates a wealth of opportunities that the county's government can rely on for wealth creation and socio-economic development.

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The mining sector is dominated by artisanal and small scale mines, with 3–5 percent of women constituting the total mining workforce in Taita Taveta County (Taita Taveta County Government, 2013; Rop, 2014; Anyona & Rop, 2015). Artisanal mining relies on physical menial labour, which can be too strenuous for many women. The violation of the rights of women and environmental degradation associated with mining activities create an unfavourable environment (International Institute for Environment and Development & WBCSD, 2003) for the active participation of women in the mining industry. This study aims to establish what the socio-economic implications of the mining sector on women are and create awareness of environmental integrity and female participation in the mining sector in the Kasugai mining area in Taita Taveta County through a Participatory Action Research (PAR) approach. This study empowered women to understand the challenges of artisanal mining and to develop home-grown interventions to enhance women's participation to the improvement of the welfare of women and the integrity of the environment in mining areas.

2. Materials and methods

2.1. Study area

The study was conducted in the rural artisanal mining communities of Kasigau Ward. Seven villages around Kasigau Hill, namely; Buguta, Kiteghe, Makwasinyi, Bungule, Jora, Rukanga and Kisimenyi (Fig. 1) with an estimated population of about 8000 (GoK, 1999) were selected for the study. The Kasigau community draws its livelihood from peasant farming, the keeping of livestock and artisanal mining. The location lies on a lower physiological zone lying slightly over 500 m above sea level with a mean annual rainfall of about 440 mm rainfall and an average temperature of about 23 °C (Taita Taveta County Government, 2013). It lies on the Mozambique belt which is dominated by the remnants of the Eastern Arc Mountains where most of the gemstones and industrial minerals are found (Rop & Anyona, 2015; Rop, 2014). Such gemstones include Tsavorite, red garnets, green garnets, yellow garnets, rubies, green tourmalines, yellow tourmalines, blue sapphires, pink sapphires, amethysts, peridots, iolites, spinels, rhodolites and kyanites (Keller, 1992; Rop, 2014).

2.2. The Participatory Action Research (PAR) approach

The PAR approach was adapted to ensure participation and empowerment of the stakeholders throughout the bottom-up research process and also that the participants 'owned' and implemented the action strategies to resolve the challenges they face. Unlike conventional research that generates knowledge and solutions to research problems, PAR engages the respondents further and challenges them to own the research problems and the solutions. Participatory research is a paradigm shift from conventional research, which involves engaging stakeholders in the research process and allocates equal participation of the researcher and the participants in pursuit of solutions to challenges (Krishnaswamy, 2004). In participatory research the people directly affected by the challenges are allowed to own them and find sustainable solutions. Methodologically, however, participatory research does not include the stakeholders in the process of providing strategic actions to resolve the challenges or achieve the solutions. Action research is another participatory research process in which the research findings are used to reveal action strategies to resolve the challenges without necessarily engaging the participant. Research methodologies are dynamic and methodological approaches that involve the stakeholders in attaining sustainable

societal solutions are desirable. Therefore, being a combination of participatory research and action research, Participatory Action Research (PAR) is an ideal research process that is engaged in finding sustainable solutions to societal challenges. PAR gives direction and involves stakeholders throughout the research process right up to the point of developing actionable strategies and implementing them. Guijt (2014) argues that PAR improves the relevance and accuracy of research, establishes causality of the challenges, and improves the understanding of the interventions and adaptive implementation of action strategies.

PAR was convenient in this case as it collaboratively and reflectively involved women in the research process, which allowed them to understand the challenges they face and to directly develop socioeconomic and environmental sustainability strategies to address these challenges. PAR is methodologically convenient, particularly when engaging in research with populations marginalized from power and decision-making (Khan & Chovanec, 2010; Lykes, Hershberg, & Brabeck, 2011), such as women in artisanal mining. The approach involved women and other stakeholders in a learning process to establish home-grown interventions to the challenges and to take action in order to empower the community and to improve environmental conditions in the mining areas. Bergold and Thomas (2012) contend that Participatory Action Research (PAR) ensures all the perspectives and voices of the participants are granted equal rights of expression and it shares the vision of the research process. This, in turn, empowered women to engage in productive mining activities in order to realize their potential. PAR is a participatory and democratic process concerned with developing practical knowledge in pursuit of a worthwhile cause that brings about action and reflection, theory and practice (Morales, 2016).

Stakeholder analysis was conducted in consultation with women. This analysis identified women's groups, local NGOs in the mining sector, government agencies at the national and county levels as well as local leadership. The stakeholders were engaged in the conceptualization of the research problem and identification of the challenges facing women throughout the participatory process. The process involved designing research procedures, undertaking the research, the analysis of the results, making recommendations and the formulation of actionable strategies. The underpinning principle was that the mining sector has the potential to alleviate the socio-economic challenges facing women and to eliminate social and environmental barriers.

The PAR process involved making courtesy calls and visits to relevant government agencies and reconnaissance visits to the study area. This was done to familiarize the researchers with the governance system, identify other stakeholders and to select women's groups to participate in the study. Despite the fact that women are traditionally considered as the backbone of families, their involvement in the mining sector, in general, is insignificant. While they dominate the artisanal and small scale mining (ASM) sector, this has not transformed their standard of life. The study process therefore empowered women to actively engage in the ASM sector to enhance the socio-economic wellbeing of the family. Seven women's groups from the seven villages in the Kasigau ward were selected based on the assumption that 75% of each group's members were involved in artisanal mining. A ten member team was selected, which comprised of seven women, one from each of the selected villages and one person from the County government, Civil Society Organizations (CSOs) and the local leadership, for training as Trainers of Facilitators (ToFs) to lead the process through the mobilization of women's groups, organizing inception meetings, developing research tools, conducting data collection and analysis, and developing action strategies. The ToFs trained and engaged women from all the groups in the research process.

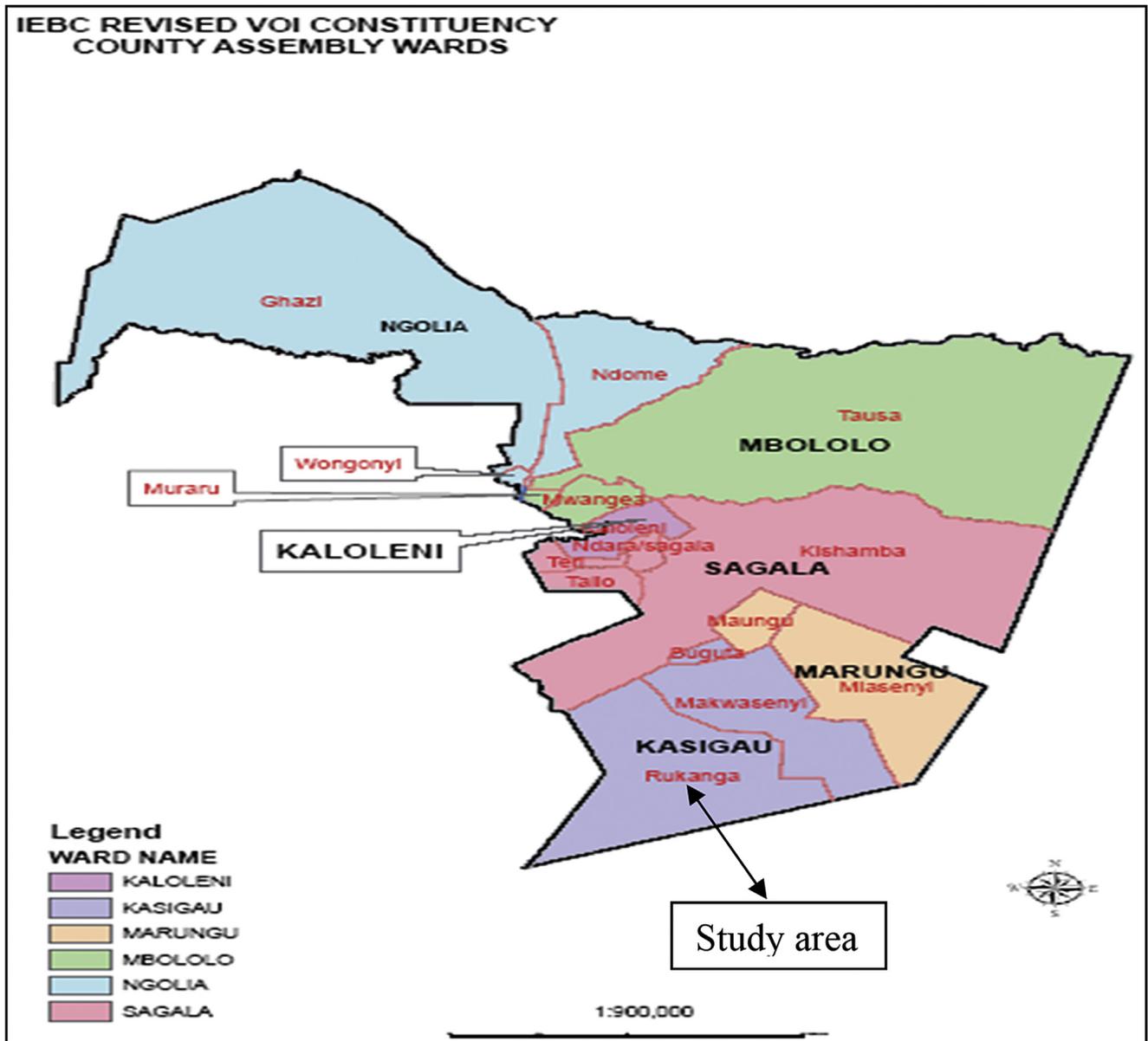


Fig. 1. Study area in Kasigau (Independent Electoral and Boundaries Commission, 2014).

2.3. Planning and mobilization for the study

Planning meetings were organized to identify the households for the study and mobilize women for the survey. The principal researcher took the participants through the planning process where the procedures of the PAR were elaborated so that the participants could understand and internalize them. The ToFs were taken through, in a participatory manner, the research techniques, methods of developing research tools and data analysis as well as techniques of developing actionable strategies which would engage women in the mining sector. The target women groups and villages were mapped out, with 49 households selected in 7 villages and 45 women mobilized to take part in the PAR process. A total of eight Focus Group Discussions (FGDs) were also organized, with one group discussion in each of the selected villages and an additional one with women from outside Kasigau, but identified as part of artisanal and small scale mining areas in the county, in order to share their challenges, their experiences and the benefits of the

mining sector with Kasigau women. The planning process ensured all participants internalized the research process and were able to discover the relevant information and data from the respondent households and FGDs.

2.4. Data collection, data analysis and action strategy

The ToFs developed and administered the questionnaires to the 49 households selected. The questionnaires consisted of semi-structured questions and the responses were coded and entered into an excel spreadsheet in a computer and a flip chart was created for further discussion and analysis. The discussion guide was developed for the 8 Focus Group Discussions (FGDs). The analysis was done by the ToFs under the supervision of the researcher. Regular feedback from the women and planning meetings facilitated an interactive data collection and analysis process. Land tenure and ownership, community livelihood options, challenges and mitigation measures, opportunities of

engagement, policy framework and actionable strategies were identified as parameters for analysis and discussion. The study's findings were discussed in reflection meetings which were attended by women from the seven villages and other mining areas in the coastal region. The principal researcher took the participants through the findings of the research and drew recommendations for actionable strategies. The participants gave their opinions and suggestions which were carefully analyzed and considered as part of the results. The women reflected on the findings of the study and developed strategies for strengthening the existing women's groups through creating awareness among the women about environmental accountability, land ownership, marketing and value addition, basic geological knowledge and skills, advocacy and empowerment, the mainstreaming of women's issues in laws and policies and lobbying for financial/credit facilities for the acquisition of tools and equipment for mining.

3. Results

3.1. Women in mining in Kasigau

The Kasigau ward consists of small scale mining communities which are employed in mining activities, as workers and as miners. It was observed that women had been engaged in the mining sector mostly as casual workers in the mining processes and mineral dealers with no legal mining rights (*Zururas*) and as marketing agents or brokers. These engagements have exposed women to different socio-economic and environmental impacts.

It can be observed that 43% of the households' women (Fig. 2), who work in the mining sector, work as *Zururas*, prospectors who scavenge and rent mining sites near abandoned or exhausted mining sites, with the belief that such sites have the potential for holding minerals (See Fig. 3). Household women who work as marketing agents selling gemstones of different types constitute about 21% of household women (Fig. 2). However, they face challenges as they can be conned and cheated of the value of the minerals due to their lack of basic geological knowledge and skills. Female casual labourers who constitute about 19% of the household women in Kasigau (Fig. 3) work long hours in the mines with meager payments, which is not a fair reflection of their efforts and the value of the minerals extracted. The operational environment for casual labourers is also not conducive for women as they are located in the wilderness with harsh mining conditions affecting their safety and health. Women work in deplorable conditions with limited water for drinking or bathing; this, in turn, discourages women from engaging in mining. However, with better terms and working environment, women would not be opposed to



Fig. 3. A woman *Zurura* at her mining site in Kasigau.

being employed in the mining sector (Labonne, 1996). Their employment must come with the conditions of benefit sharing or agreed payment terms that will not jeopardize the wellbeing of the female employee.

It can also be observed that artisanal and small scale mining is not an economic source or livelihood provider for women in Kasigau, however, many women are increasingly involved in mining activities (Labonne, 1996) thus there is a need to transform the mindset of the women towards engaging in high value mining activities.

3.2. The socio-economic status of women in Kasigau

This study aimed to understand the challenges facing women in the mining sector so that strategic interventions and actions can be developed to empower them to benefit from the artisanal and small scale mining sector in a sustainable manner. The sources of livelihood for the Kasigau community are comprised of small scale agricultural activities, trade and artisanal and small scale mining. About 45% of women in Kasigau (Fig. 4) take part in subsistence farming as their single main economic activity. Farming and livestock, and farming and artisanal mining each represent 20% of the women, while small scale business and farming attracts only 9% of the women. Basket weaving and small scale business enterprises are taken up by only 4% of the women and only 2% of the women solely engage in small scale business enterprises in Kasigau. To safeguard against the impact of crop failure in the production



Fig. 2. Women and mining in Kasigau.

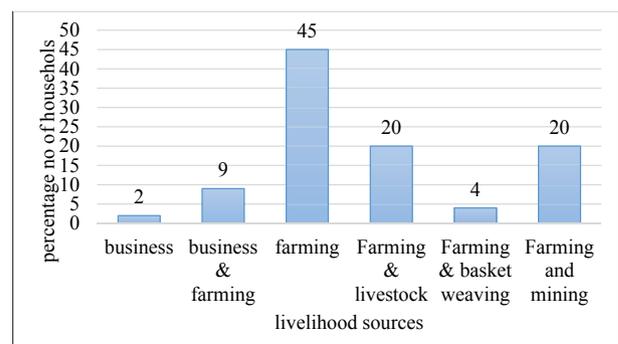


Fig. 4. Sources of livelihood of women in Kasigau.

system, women combine livelihood sources. Mining activities are increasingly becoming an economic activity that women take part in, although typically concurrently with other sources of income, probably due to the unpredictably low income from artisanal mining in the area.

Mining activities seem to be carried out in order to supplement other economic activities and it appears that women have not seen the huge potential of mining despite the significant mineral wealth in the area. A substantial increase in women's engagement in the mining sector as a source of livelihood is an indication of its potential for improving the wellbeing of the people of Kasigau and alleviating poverty in the area.

The incomes levels are varied depending on the kind of livelihood. Slightly over 60% of the households' women earn, on average, less than Kshs. 3000 a month (Fig. 5). This is equivalent to earning less than one dollar per day, an indication of the high level of poverty in the area. On average, only 18% of the households have women earning between Kshs. 3001 and Kshs. 6000 and only 3% earn over Kshs. 15,000 in a month.

The low income of women could be attributed to over reliance on traditional subsistence farming activities, which is affected by the weather conditions which can lead to low productivity. It can be deduced that there is a desire to engage in mining but a lack of certainty concerning the economic potential of these activities, and for this reason women combine it with other economic activities. Mining can be a potential driver of socioeconomic transformation in mining areas, and women can be empowered to exploit the high economic potential of the mining sector in order to reduce poverty and foster viable avenues for sustainable mining and improved welfare. Mwaipopo, Mutagwaba, Nyange, and Fisher (2004) contend that artisanal mining has considerable potential to reduce poverty and improve the creation of wealth.

3.3. Ownership of land and mining sites

According to the PAR findings, about 73% of women do not own land (Fig. 6a) in Kasigau due to the oppressive and parochial cultural practices. This is one reason why women are not economically empowered as they lack the means of production. Culturally it can be observed that woman do not participate in decision-making matters. Owning land empowers the woman to use it independently, a decision that should be made by a man in such a discriminative socio-cultural setup. Consequently 78% of the households' women (Fig. 6b) in Kasigau do not own mining sites. This is probably due to the cultural practices and the fact that mining activities are not one of the core activities of women.

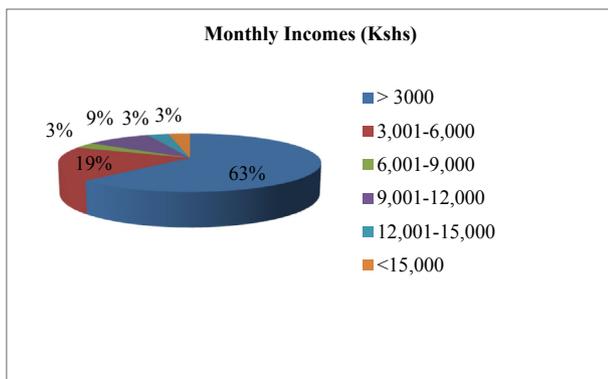
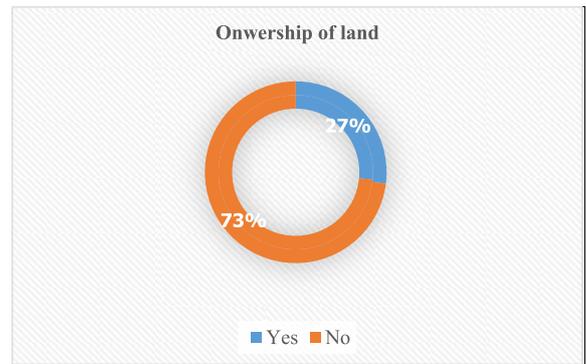


Fig. 5. Average monthly income distribution of women in Kasigau.

A



B



Fig. 6. (a) Percentage ownership of land in Kasigau. (6b). Percentage ownership of mining sites in Kasigau.

However, 22% of the households' women who own mining sites (Fig. 6b), lease them from either government agencies or cooperative societies. The leases are expensive and barely affordable for female prospectors. It is imperative to note, therefore, that women have been denied their rights to own land by the cultural values and the decisions relating to the productivity of the land being in the hands of their male counterparts. This compels women to work as *zururas* in prospecting and mining, adding to the increasing economic challenges women face when attempting to generate wealth from the sector.

The mining sites in Kasigau are located in the wilderness in ranches and national parks, which are often inaccessible by roads except by feeder pathways. It is difficult for women to walk long distance in the wilderness as it exposes them to the dangers of wild animal attacks. The infrastructure and facilities in the mines are extremely poor. There is inadequate basic equipment and tools to enable women to work effectively and they lack basic occupational health and safety facilities, exposing woman to pollution and other environmental hazards. There is no personal protective gear in the artisanal mines and a lack of adequate life savers and first aid kits exposes women to physical injuries and psychological stress. Female miners have no basic training on occupational health and safety issues, thus they are unable to protect themselves in the event of the occurrence of a hazard. The mining activities have contributed immensely to environmental degradation due to the clearance of vegetation to establish mining sites.

3.4. Level of compliance with regulations and standards

The standards and regulations most applicable to the field of mining are those dealing with the environment and occupational health and safety issues established under the Environmental Management and Coordination Act (EMCA) 1999 and the Occupational Health and Safety Act (OHS 2007). The Mining Act 2016 stipulates that all related laws, regulations and standards must be observed in the workplace to safeguard against the violation of the rights of the workers. Standards and regulations protect the health and safety of the worker and particularly women, and enhance sustainable engagement which leads to prosperity. It is evident that there are low levels of compliance with regulations and standards in Kasigau. The small scale mines have very few rules and regulations to guide their operations. However, the regulations and standards available seemingly focus on immediate challenges such as conflict resolution and mining site ownership.

It can be observed that mine workers lack basic personal protective facilities such as helmets, gloves and hearing protection. The mining tunnels are not adequately reinforced and could collapse at any moment while the mining site has an abundance of open pits and tailings which exposes the female workers to occupational health and safety hazards. The environmental regulations and standards are clear concerning the ideal conditions of mining sites to ensure the health and safety of the workers and the integrity of the environment of such sites. However, the county and national standards and guidelines are not adequately observed in mining sites, especially in those that are located in places that are inaccessible to enforcement agencies.

There are practical challenges that artisanal miners face in order to comply with environmental, health and safety regulations and standards in Kasigau (Table 1). These challenges include overcoming a lack of expertise in the mining sector to expedite enforcement during prospecting, exploration and the mining processes in general. The unskilled and inexperienced female miners find it difficult to carry out the enforcement of regulations and standards, which required substantial planning and financial costs, due to the low productivity emanating from the use of unskilled labour and rudimentary facilities. The Mining Act 2016 (GoK, 2016) has addressed compliance challenges by advocating for capacity building and the enforcement of regulations and standards in the mining sector. The act requires artisanal miners to form mining associations after being issued with mining permits, so that they can pool resources together to enforce the related laws and associated regulations and standards in the mining sector.

The harsh environmental conditions have been impediments to women engagement in artisanal mining activities, and they have slowed down sustainable mining and led to devastating environmental degradation. This study identifies the effects of mining

which has consequences on the environment and the effective engagement of women. Table 2 identifies some of the effects of mining with detrimental effects on the environment and the possible mitigation measures to allow women to participate in sustainable mining in the area. The mitigations suggested are common best practices which inspire the active engagement of women in mining processes.

3.5. Challenges in the mining sector in Kasigau

It is argued that the households' women need to be encouraged to find sustainable interventions to the challenges which face the artisanal mining sector in Kasigau. The challenges identified in the PAR are shown in Table 3 below.

The challenges are enormous and they need empowered and united communities of women to tackle them. Stakeholders should come to the rescue of women through educating, sensitizing and encouraging women to participating in high value end activities. However, women believe that there are collective strategies that will help them overcome the challenges. Some of the strategies identified are outlined in Table 4.

3.6. Actionable strategies to empower women

The PAR process generated actionable strategies that empower women to tackle the challenges and productively engage in the mining sector. Table 4 indicates that women have the potential to reap benefits from the mining sector when they are adequately empowered and facilitated. Education, training and awareness are critical elements of the empowerment that women need in order to galvanize themselves to support and facilitate each other. It is evident that woman in Kasigau are vulnerable to social, economic and environmental injustices and that they understand the challenges and have realized the need to take action to improve their health, safety and social wellbeing.

Strategic collaborative actions include organizing and galvanizing women's groups for capacity building through training and awareness creation, which would boost the confidence of donors and lead to the provision of financial and credit facilities as envisaged in the African Mining Vision (African Union, 2009). Women's groups need to be empowered on human and mining rights to safeguard against the violation of women rights in the mining sites. Strategic education and training, for women, to focus on the basic geological knowledge and skills including the identification of mineral sites and minerals, evaluation of the value of minerals, the use of mining tools and equipment, value addition and marketing are critical strategic actions that stakeholders should use to engage women groups in Kasigau.

4. Discussion

The study identified the challenges impacting the community livelihood system which drive women into mining to supplement their household income. Women work under deplorable conditions with occupational health and safety risks, and for low wages. The working environment is rife with contaminated stagnant water in abandoned mining pits resulting in water borne diseases, excessive noise, abandoned mining quarries which have become hideouts for criminals causing security risks and inadequate personal protective working gear exposing women to health and safety risks. The unhygienic and degraded environmental conditions expose women to dust, toxic substances and numerous occupational illnesses. They are susceptible to sexual harassment and attacks, therefore, potentially contracting HIV/AIDS and other associated health problems. The parochial culture denies women the traditional

Table 1
Challenge to compliance to mining standards and regulations in the mining sector.

S/No	Challenges to compliance
1	Lack of expertise in the mining sector
2	Lack of nearby health facilities or first aid facilities
3	No emergency response by the government from the mining sites
4	No good road network in mining areas
5	Threat of contamination & diseases
6	human/wildlife conflict and snake bites
7	Lack of occupational health and safety equipment
8	High cost of prospecting and mining ventures
9	Inadequate water in mining sites
10	Inadequate communication network (Roads and phone network)
11	Corruption in licensing and renewal of rights
12	Untrained mining workers

Table 2

The effects of mining and women participation.

Effects of mining activities in Kasigau	Mitigation measures
Pollution of water and air in the area due to the open cast mining and deposition of harmful tailings into rivers and streams	Provision of personal protective gear such as dust muffs in the mining sites and proper disposal of the tailings to avoid contamination of water in rivers and streams
Collapse of mining tunnels due to the use of explosives, which cause death or injuries to the women workers	Reinforcement of mining tunnels and regulating the use of explosives in the mining sites to avoid jeopardizing women workers
Loss of biodiversity due to clearing of vegetation without any rehabilitation of the areas during prospecting and mining	Rehabilitation of the mining sites by planting of vegetation where it was cleared and regulate the cutting of trees in mining areas
Land degradation with eroded gullies, abandoned mining tunnels and sites which are sites for injuries and hideout for criminals	Observation and implementation of policies and regulations on land reclamation and enforcement of EMCA 1999 law. Planting of trees and building of protective gabions to curb erosion and formation gullies. Security to be provided to protect the workers
Family breakage and loss of family values due to working for many days in the mines without going back home	Strengthen family values by counseling and encouraging mining workers to visit their families regularly and avoid cohabiting in the mines. Observation of labour laws and rights of women in the mining sector
Sexual harassment of women by their male counterparts, with minimal protection from the mine owners and the authorities	Empowerment of women on their rights so that they are able to report such injustices to the authorities and seek legal redress
Outbreak of diseases in the mining areas due to abandoned quarries and pits, which contain stagnant water the source of vector diseases like malaria and bilharzias	Rehabilitation and refilling programmes to be established and to start immediately prospecting, exploration or mining commences as any of these stages sources of abandoned quarries or pits
Mining sites located in national parks create threats of wild animals due lack of fencing of the mining sites and walking long distances in open wilderness	The sites to be mining sites to fenced off and proper regulations on mining sites in gazetted areas
Lack of water supply and basic amenities in mining sites in the area	Miners to provide portable drinking water to workers, and where possible drill boreholes
Social evils such as prostitution and other criminal activities likely to create fear, spread of diseases such HIV/AIDS and injuries	Strengthen social values and provide security in the mining areas. Counseling and encourage HIV/AIDS victims to take retroviral drugs and observe healthy living to avoid further spread of the virus

Table 3

Challenges of the artisanal mining sector in Kasigau.

Financial	Environmental	Infrastructure/Equipment	Institutional	Health and safety
Inaccessibility to financial credits	Long distance to mining sites in the wilderness	Inadequate mining equipment and machinery	Most women operate as <i>zururas</i> without any legal entity in mining	Social evils such as prostitution and spread of HIV/AIDS
Low income levels/high poverty levels	Lack food and water	Poor communication network such that in cases of emergency it is difficult to call for help	Child labour and violation of labour laws	Diseases outbreak such as malaria and bilharzia in mining areas
Poor/low wages in the artisanal mining sector	Poor or no shelter in mining areas, recipe for diseases	Inaccessible mining sites, exposing women to harsh mining conditions	Inadequate training, sensitization and awareness on policy and regulations in the mining sector	Sexual harassment of women in mining sites
Expensive to provide transport to mining sites	Lack of land ownership of women in the area	Lack of occupational health and safety equipment and accessories exposing women to injuries	Insecurity and safety of workers on the mining areas	Use of explosives that affect hearing senses and collapse of mine tunnels
Lack of capital for purchase of equipment	Wildlife menace causing injuries and sometimes deaths	Lack of equipment and facilities for value addition and innovation	Lack of education and training on basic geological skills and knowledge making women vulnerable to commens	Lack of protective gear which is likely to increase the rate of injuries
Lack of organized market for the minerals	Outbreak of diseases due to stagnant water in abandoned quarries and mine pits	Low levels of enforcement of policies and regulations	Lack of skills and knowledge on value addition and innovation	Lack of adequate shelter
Lack of alternative markets	Rock waste and debris	Lack of land compensation and resettlement	Mining conflicts	Lack of precautionary signage in mining sites

Table 4

Actionable strategies to overcome the challenges in the mining sector.

S/No	Actionable strategies
1	Empower women to legally acquire leases, own land and mining licenses through education and awareness campaigns
2	Support women groups with appropriate tools and equipment for purposes of mining, value addition and innovation
3	Establish women groups/associations and galvanize women for collective bargaining strategies
4	Workshops and training to sensitization and mainstream women issues into policies and strategies to enhance the rights of women in artisanal mining sector
5	Support the marketing, value addition and innovations of the minerals
6	Provision of basic geological and mineralogical skills and knowledge to women
7	Establish functional and effective financial schemes to support the artisanal mining activities, such government revolving funds
8	Establish environmental awareness and action lobby groups to fights for women rights and environmental sustainability
9	Empower women to take action and enhance enforcement of regulations and standards

rights to land ownership and decision-making which limits them from accruing benefits from land. However, women have invested in the sector, although largely as artisanal miners due to the inaccessibility of large start-up capital from financial institutions.

The PAR process has enabled women to strengthen their understanding of the challenges in the artisanal mining sector and therefore become able to strategize the actions to be taken. The women's communities targeted have been empowered and were

actively involved in the research process, and they agree that they are now knowledgeable and ready to bring change to their communities. The exchange and sharing sessions encouraged peer learning and women were able to talk freely, without fear or shame, about the challenges they face concerning their involvement in mining. Regular community feedback and planning meetings facilitated an interactive data collection and analysis process (Lykes et al., 2011). The PAR also enabled Kasigau women to think realistically about their problems and come up with solutions to reverse the situation. It made women realize it was a false stereotype to believe that mining should be a male-dominated economic activity. It can, however, be observed that women can effectively become involved in mining activities if stakeholders like the county government and other agencies take the lead to empower women to take up productive roles in mining.

Women are discriminated against in the mining sector in terms of access to land and credit facilities (Reid, 2004), and therefore they are not able to adequately engage in the sector. The location of the mining sites in ranches and parks areas has been associated with environmental destruction, loss of habitat and loss of biodiversity as argued by (Boadi, Nsor, Antobre, & Acquah, 2016). Women need to be empowered to realize their potential as stated in Agenda 2063 of the African Union (African Union, 2014). Women should be fully empowered in all spheres and have rights to own and inherit land and have access to products such as credit input and financial services. Basic gemology skills and knowledge, and legal recognition of the artisanal and small scale mining sector will provide the impetus to work in the sector which will lead to an improvement of livelihood and the creation of wealth. In realizing Vision 2030 (GoK, 2012) for Kenya and the African mining vision (African Union, 2009), Taita Taveta is establishing a gemology centre to provide the much needed technical knowledge and skills, which are likely to develop the sector for the economic growth of both the county and the country as well.

5. Conclusion

Most women are involved in mining as “Zururas” with no formal training, equipment or licenses to undertake mining activities because of low income and high levels of poverty. This scenario is similar to many other mining areas in Taita Taveta County, as stated by women from outside the Kasigau mining areas. Women in Kasigau need support and facilitation, to enhance their potential, through education and training, awareness and advocacy on land ownership issues, mining rights, mineral and value addition, and environmental sustainability. This will in turn lead to effective engagement in the artisanal mining sector. It should be noted that organized women’s groups can create networks within these groups and with other groups from outside Kasigau, which can lead to advocacy, campaigning and lobbying for female empowerment in the artisanal mining sector. The PAR process has enabled women to internalize the challenges in the artisanal mining sector and has enabled them to devise strategies to change the situation through socioeconomic, legal and environmental empowerment.

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