Research paper

Digital mapping as a tool for environmental and social corporate accountability in the extractive sector in Kwale County, Kenya

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ABSTRACT

Environmental and social injustices in the extractive sector in Kwale County are rampant and there are limited citizen participatory mechanisms to address the injustices to enhance dialogue among stakeholders. Community exclusion from corporate governance has perpetuated environmental and social injustice causing mistrust and conflicts between communities and investors in mining areas. This study aimed to evaluate a digital mapping platform as a tool for community engagement. A participatory study approach was used where selected stakeholders were trained to use the digital mapping platform and then participated in the study. Mobile phone digital applications and Poi mapper data collection and management applications were used to generate and quantitatively analyse stakeholder responses which were instantly transmitted to a computer server. Digital mapping is interactive, elicited effective interactions among stakeholders and supported citizen participation to enforce corporate accountability.

1. Introduction

The extractive sector boosts of a wealth of opportunities that the national and county governments can exploit for wealth creation and the socio-economic transformation of the people. The extractive sector's resources in Kwale County are widely distributed and range from the silica sand used for building and found on the earth's surface to heavy minerals, such as titanium, uranium ore, niobium and other rare earth minerals beneath the earth's surface. The diversity and the value of the mineral resources indicate the county's potential economic growth if the resources are viably exploited. The extractive sector is dominated by Artisanal and Small scale Mining (ASM) which is rife with illicit activities (GoK, 2016) with a limited capacity to fully exploit the potential of the mineral resources. The Artisanal mining of Jurassic limestone and Pleistocene coral limestone are the livelihood of the majority of the low-income population (Horkel et al., 1984) and if adequately mainstreamed can create employment and enhance environmental standards in the mining sector (GoK, 2016). Gemstones, silica sand and coral products sustain the income flow of the people of Kwale County.

Despite the much anticipated benefits accrued from the exploitation of the extractive sector's resources, environmental and social injustices are eminent as a result of a lack of communication and sharing of information, a lack of citizen engagement, environmental degradation

and the lack of relevant support infrastructure (GoK, 2016) for effective enforcement of governance processes. Air and noise pollution from dust and machines, abandoned open mines, land degradation and soil erosion due to the clearance of vegetation are some of the environment problems in mining areas. The exclusion of communities from involvement in the extractive sector, the fact that many have long working hours and experience sexual harassment, as well as nepotism and corruption that exists within employment in Kwale county have been a recipe for conflicts with citizens demanding corporate accountability among the investors in the affected areas. A lack of sufficient consultation, community engagement and information, as well as differing expectations of social and economic benefits, environmental concerns, influx into mining areas, land use disputes and economic compensation are some of the causes of social conflicts in the extractive sector (Mining facts.org, 2016). These injustices are clearly visible in the extractive areas in Kenya, for example, the Turkana communities have been complaining about a lack of transparency and disclosure of information on the Tullow oil projects (Mullins & Wambayi, 2017).

Communities in mining areas in Kwale County have limited platforms for engaging with mining investors with the aim of enforcing good governance due to a lack of communication which leads to suspicion and mistrust and consequently conflict between them. The lack of regular and effective communication platforms, where stakeholders can discuss and enhance citizen participation, has seen investors renege

on their obligations to minimize environment degradation and social injustices. The question to be addressed is does the digital mapping tool bridge the communication gap and enhance citizen participation in corporate accountability?

The extractive sector governance systems manipulate the spontaneous liaison meetings, failing the citizens from articulating freely the corporate injustices for redress. The lack of community voices has caused mistrust and social unrest in mining areas in Kwale County. Proactive and consultative approaches are required to make the predominantly artisanal and small scale extractive sector accountable for its actions (Zvarivadza & Nhleko, 2018) and to strengthen the relationship between the miners and the communities for mutual benefits (Zvarivadza, 2018). Mullins and Wambayi (2017) argue that effective community engagement through disclosure and consultation on matters that directly affect communities minimizes environmental and social risks. The theoretical basis of community engagement lies in citizen participation where the public supposedly influences public the decision-making process through the adequate discussion of information and ideas on public issues (Callahan, 2007; Loukis, 2018). Citizen participation encourages public support, resolves conflicts and cultivates good will and trust in development processes (Callahan, 2007). Citizen participation in the extractive sector is a corporate accountability mechanism that redresses environmental and social injustices.

The inadequate dialogue and information sharing mechanisms between communities and extractive sector investors is the reason why an alternative adaptive mechanism is called for. The development of Information, Communication and Technology (ICT) in Kenya, with high mobile penetration rates of 60% and high adoption of mobile services (Kariuki, 2015; Salome, 2016) can be adopted in the extractive sector to enhance proactive citizen participation. Pieterse (2017) supports the fact that the design of custom-made technology platforms and applications in consultation with the communities and accessible smartphone use among community members provide solutions to governance challenges. This paper discusses digital communication, as well as using mobile telephone technology and internet connectivity to enhance citizen participation in order to influence the redress of environmental and social injustices in the extractive sector.

2. Methods and materials

The study involved the use of a digital tool, the collection of data, evaluation and the analysis of responses from extractive sector stakeholders to validate the tool for enhancing citizen participation and delivery of environmental and social justice. The stakeholders included selected investors, community members from the extractive communities and Key Informants from the extractive sector in Kwale County. The study trained stakeholders on the use of the digital tool and these participants later took part in the study. The trained respondents included 300 youths and 50 women from selected mining community households, 10 Key Informants (KI) and 20 extractive sector investors, 15 of whom were from the ASM, mainly dealing with gemstones and silica sand extraction, and 5 large and medium scale investors in titanium mining and calcium production coral rock extraction.

A participatory study approach was used where the selected trained stakeholders were left to communicate, share information and respond to public issues by themselves using the platform for one month. The stakeholders then participated in assessing the viability and challenges of the digital mapping tool to engage investors on public issues, such as community involvement, Corporate Social Responsibility (CSR) initiatives and corporate governance in the extractive sector. The participation of the Key Informants (KI) in the interactions with the platform acted as a catalyst for the discussions and later they provided expert opinion on the performance of the tool with the aim of increasing citizen voices and improving good corporate governance in the extractive sector.

Guided interviews were conducted with the investors and Key Informants, structured questionnaires were administered to women and 20 focus group discussions were organized across the county. Mobile phones which contained digital applications and poimapper mobile data collection and management application were used to create the digital mapping platform to transmit responses *in situ* directly to a server for analyses. Geographic Positioning System (GPS) was enabled to facilitate the geo-referencing of data and analysis of the attribute information from the respondents. Internet connectivity is essential for the integrated mobile phone applications and the poimapper to function optimally. The digital mapping platform provides applications for cross-sectional engagement amongst the extractive sector stakeholders, which provides access to information, feedback and improves environmental and social corporate accountability. The data generated was analyzed qualitatively using the poimapper application to explain the type of digital content and the effectiveness of digital communication for citizen participation in the enforcement of corporate accountability. Mapping out the distribution of the extractive resources in the County was done using ESRI's ArcGIS Geographical Information Systems (GIS) and Remote Sensing software.

2.1. Study area

The study was conducted in the mining areas of Kwale County. Kwale lies between the coastal plain and the Nyika plateau which is which follows the geological set up of the coastal region with high potential for mineral resources. It is underlain with geological rock systems consisting of sedimentary system basement rocks, which consist of gneisses, schist, quartzite, granitoids and crystalline limestone in the northwestern region, the karoo sediment duruma sandstone is found along the Taru-maji-ya-chumvi Mariakani and the Mazeras formations, the jurassic – cretaceous rocks of Kambe limestone are found in the Northeast of Shimba Hills and the Western shores of Mombasa Island (Caswell, 1956; Aketch & Masibo, 2013). The south coastal region is characterized by a geological rock formation of carbonatite complexes that contain significant deposits of minerals (Kaniu & Angeyo, 2018). The County has the potential for niobium/rare earths deposits and several mineral occurrences of zinc, lead, copper, brylite and coal (Horkel et al., 1984).

3. Results

3.1. Distribution of the extractive resources in the Kwale County

The extractive mineral resources distribution (Fig. 1) depicts the diversity of the resources in the County. The extractive sector communities in Kwale County view the high value extractive resources as the panacea of their socio-economic challenges. Engaging these communities in the sector would benefit them directly through employment and extraction of the resources and indirectly through establishment of businesses that enhance income flows. However, the mining areas are characterized by severe degradation with abandoned tunnels and derelict sites.

3.2. Issue-based interactions in the extractive sector in Kwale County

The stakeholders solely engaged in public issues of interest in the extractive sector, which included corporate governance, community engagement and corporate social responsibility initiatives with a view to enhancing dialogue and citizen participation concerning corporate accountability.

3.2.1. Corporate governance

Corporate governance encompasses the rules, regulations, policies, systems and procedures of an organization exercising its authority. The company constitution, organizational policies, country or county laws, regulations, community expectations as well as the board of directors
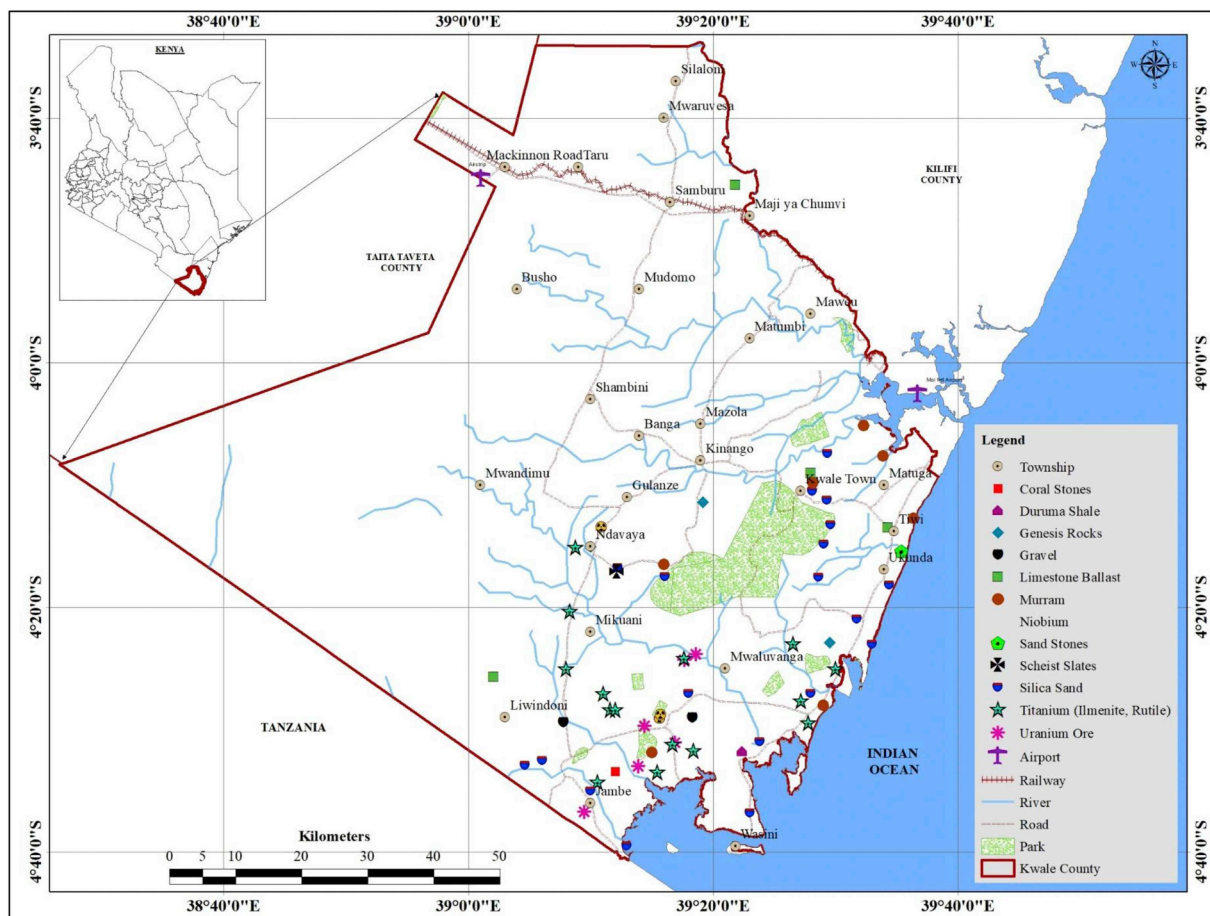
Fig. 1. Distribution of extractive mineral resources in the County. (Mwakumanya, 2017).
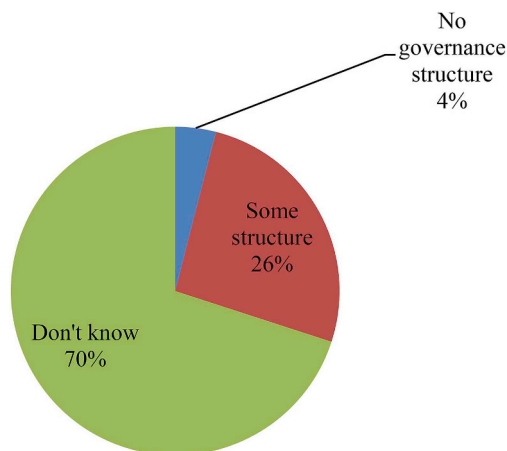

Fig. 2. Community knowledge of governance structure.

influence the organization's governance environment (https://www.investopedia.com/terms/c/corporategovernance.asp). An effective governance framework encourages enhanced organizational performance. Community members seem to be ignorant of effective governance structures with over 70% having no idea about what constitutes an effective governance framework (Fig. 2). From the interaction between the stakeholders, a significant proportion (26%) of the respondents, probably the KI and the investors, argue that an effective governance structure is composed of the board of directors and the company management, while only 4% of the community members (Fig. 2) insinuate that the extractive sector in the county has no

effective governance structures due to a lack of inadequate structures and policy framework concerning engagement with them. This is an illustration of the low level of interaction and the lack of understanding between the investors and communities and the need to build trust between them.

3.2.2. Community engagement

Community engagement is a continuous process which involves mining companies working with communities to alleviate corporate injustices and avoid social unrest, which are a heavy social cost for the investors. However, it has been observed that 50% of the stakeholders support the fact that extractive companies do not adequately involve citizens in their governance systems, while only 19% (Fig. 3) agree that the community is effectively engaged. This is probably due to the fact that there are few organized companies with elaborate governance
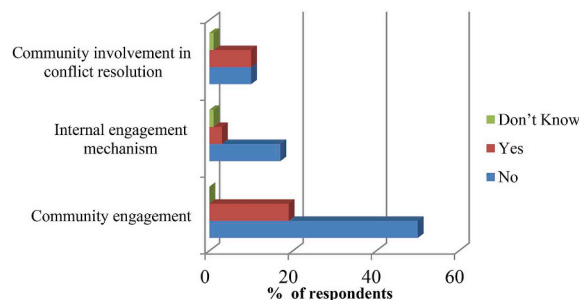

Fig. 3. Community engagement in the extractive sector.

Table 1
Desired forms of community engagement.

S/No	Forms of community engagement
1	Project site identification, planning, marketing and evaluation processes
2	Policy formulation processes
3	Supply and provision of goods or services
4	Recruitment and employment
5	Awareness and education campaigns
6	Sharing of information with the community
7	Public participation processes on pertinent social and environmental issues
8	Participation in management committees
9	Transparent and accountable collaboration with investors
10	Offer of shares, dividends and other benefit sharing processes
11	Provision of scholarships and bursaries
12	Sharing of the revenue accrued
13	Free and fair engagement with civil society organizations
14	Fight against corruption and violation of human rights
15	Conflict management
16	Rehabilitation/restoration of degraded mining sites

Table 2
Challenges of engaging with communities in the extractive sector.

S/No	Challenges of engaging with communities in the extractive sector
1	Political interference
2	Bad governance
3	Suspicion among community members
4	Poor attitude by the community towards investors
5	Interdependent communities
6	Demand for equal shares and rights
7	Low literacy levels of community members
8	Inadequate expertise among community members
9	High expectations of the communities
10	Community cultural beliefs

systems, with the majority operating at an artisanal level with no management structures. Internal engagement mechanisms also seem to be lacking in many of the extractive sector companies, as 17% of the stakeholders argue that companies do not have internal management structures to handle issues surrounding citizen participation, while 10% of them (Fig. 3) agree that in the event of any conflicts, the community was not involved in dispute resolution.

Communities have the right to be engaged as they argue that they took a risk by allowing their land to be used and therefore they must receive some benefits to compensate for the risks. The communities in extractive areas need to be involved in site identification, planning, operations, marketing and evaluation processes, because they bear the risks of environmental degradation and the loss of cultural heritage when the mining sites are exhausted (Table 1). Communities agree to be involved in policy formulation processes through public participation, and they would like to establish partnerships to directly extract minerals or for extractive investors to cede a certain percentage of the shareholding to them. On the other hand, the extractive sector companies should provide a policy on tendering which reserves some tenders for the community to provide services and goods, which provide business opportunities in order to improve the welfare of the people. Continuous education and awareness as well as a system of information sharing (Table 1) are desired so that the community is aware and knows what goes on in the company to enhance citizen dialogue in the extractive sector.

3.2.2.1. Challenges surrounding engagement with communities in the extractive sector. It has been observed that community engagement is not a straightforward process, as politics and bad governance prevent effective community participation. Additionally, the challenges of engaging with communities due to a none conducive operational environment was cited (Table 2). Bad governance leads to poor policy frameworks for eliciting engagement and, as such, impacting directly on the co-governance and conflict redress mechanism of the mining sector. Political interference creates nepotism, which prevents transparency and accountability among companies. Inadequate expertise and low levels of literacy lead to communities being unable to negotiate for better terms of engagement with mining companies. High expectations and cultural beliefs make engagement processes difficult, thus create a stumbling block for negotiations.

3.2.3. Corporate social responsibility (CSR) initiatives

These are obligations that corporations provide to the community around their business as a good will gesture for creating the business environment. CSR is a company's initiative aimed to promote a positive social and environmental change by representing an improvement in the environmental and social wellbeing of the local communities without financial gain for the company (Werner, 2009). The type and nature of the corporate responsibility are determined by the company without necessarily involving the communities. However, as best practice, the corporations should involve the community so that they can provide relevant services and/or goods depending on the needs of the community or something that compensates for business activities. The lack of involvement excludes the citizens in awareness and sense making process (Morsing & Schultz, 2006) creating animosity and, sometimes, protests as corporate social activities are viewed as insufficient or did not deal with the needs of the community. Throughout the interaction over 60% of the stakeholders (Fig. 4) support the fact that corporate activities are irrelevant to the needs of the community. For example, extractive operations contributed to the pollution of waterways, yet in some instances the company provided social amenities that do not tackle this issue. However, about 40% of the stakeholders (Fig. 4) argue that the corporate activities did provide for the basic socio-economic needs of the community (see Fig. 5).

The stakeholders identified relevant corporate activities that include: the provision of clean portable water through drilling of boreholes and construction of water pans, the financing of social amenities, scholarships and bursaries and providing alternative livelihoods (Table 3). The list also included employment opportunities, being prepared for disasters and management services. As earlier indicated, most of these activities are provided without due consultation with the communities, which is the reason that community members believe CSR activities are ill-suited to their needs. Since the community is dissatisfied with the CSR activities provided by the investors, the community feels that creating effective liaison committees would provide avenues for dialogue and consultation on every policy or regulatory making process that hinges on community wellbeing and the ability to work towards a cohesive and understanding community-organization relationship.

The basic principle of strategic corporate social responsibility in the extractive sector is to avoid violating human rights during the corporation's operations. The company can create liaison committees to
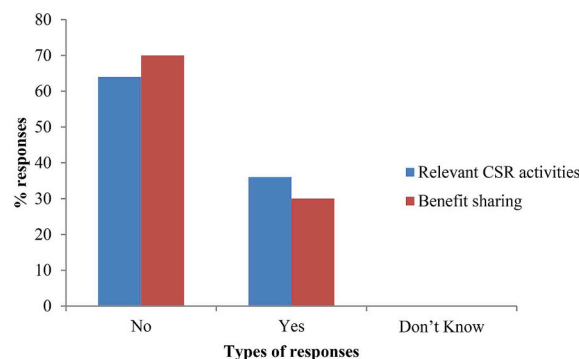

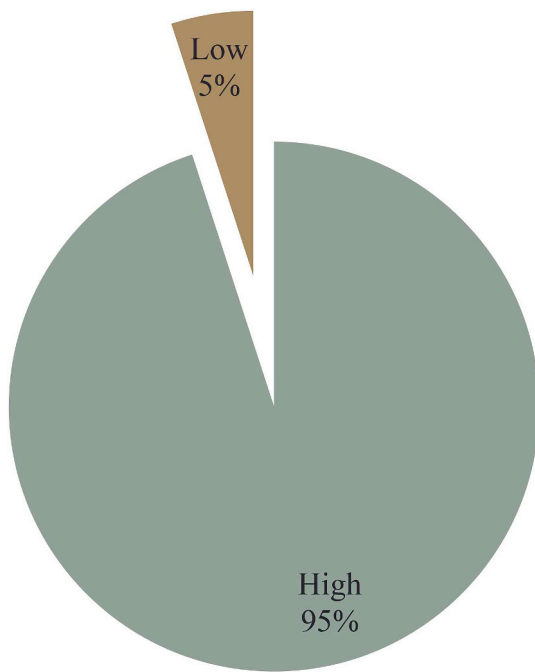Fig. 4. Relevant CSR activities in the extractive sector in Kwale County.

Fig. 5. Adoption of digital mapping in the extractive sector.

facilitate community engagement as set out in the standards to ensure public participation in decision making and development of appropriate CRS activities. Due to the limited exposure and level of education of the majority of the communities, it was challenging to identify the best CSR practices through digital platforms. Citizen participation, transparency, accountability and enhanced dialogue lead to the development of appropriate CSR programmes.

3.3. Information dissemination in the digital mapping platform

The platform provides a variety of methods of interactions, from which the stakeholders were able to share information and give feedback on the environmental and social issues raised (Table 4). Interactive digital media included computer and mobile phones through the use of internet web pages, short text messages and social media applications, while the conventional means used (Table 4) included seminars and workshops, electronic and print media (posters, brochures, television and radios) and community public meetings. The electronic and print media had low participant turnout with an average of 40%, due to the low literacy levels in the county. This was followed by seminars, workshops and public meeting with an average turnout of 46.8% due to the perceived control of these by the investors. Computer systems with internet connectivity were used by approximately 77.4%, while mobile

phones with internet connectivity and enabled applications were the most preferred with an average of 84.5%, mostly made up of the youth and young women (Table 4). Mobile phones services and applications such as the Short Message Services (SMS), WhatsApp, twitter, Facebook, Instagram and internet web pages were the most frequently used digital application in the county.

3.4. Adoption of digital mapping in the extractive sector

The access and interactive nature of the digital platforms made them more user friendly with over 90% (Fig. 4) of the respondents agreeing that digital media can enhance communication, thus being effective in allowing citizens to participate in dialogue that would enforce corporate accountability. This is an indication of the potential of this emerging tool in resolving conflicts through citizen participation that would make investors accountable for their operations. To aid the adoption of this tool the content displayed and disseminated in digital platforms must be relevant and accurate in real time. Digital content (Table 5) elicited interactive dialogue between the investors and the community.

Some of the digital interactive content enhanced citizen participation, which consequently improved environmental and social accountability performance in the extractive sector, including the governance system of the company, which created a positive environment for consultations and dialogue, and a legal and institutional framework, such as policies and an administrative organogram that depicts levels of engagement. The content of the website determines the accessibility and operations of the company and is a mechanism which determines the best practices of citizen engagement. Company profile, financial statements, benefit sharing mechanisms, lease agreements and corporate social responsibility activities represent the transparency and accountability of a company. (Table 5). Other digital content required included job vacancies, tender and business opportunities, rehabilitation programmes, compensation mechanisms, emergency and disaster preparedness and conflict resolution mechanisms of the company.

3.5. Challenges faced by digital-based platforms in enhancing citizen participation

The digital platform mechanism encountered a range of challenges which need to be addressed by all stakeholders in the extractive sector. The challenges in Table 6 require genuine effort from all the stakeholders to provide appropriate citizen engagement space. The challenges encountered included false information or propaganda disseminated on digital media, e.g. Twitter and Facebook. The Kwale county citizenry has limited access to internet services as well as limited network connectivity, especially in the remote areas of the county, which hinders the effective sharing of information through digital media. Limited public awareness, inadequate knowledge of environmental injustices and high illiteracy levels limit effective community

Table 3
Relevant CSR activities and how to increase involvement in the extractive sector.

S/No	CSR Activities in the Extractive Sector	How to be involved in CSR activities
1	Provision of water (Drilling of boreholes, water pans and wells)	Participation in community activities that enhance their welfare
2	Financing of self-help groups and social amenities	Participate in liaison committee meetings
3	Planting of trees as environmental protection measures	Involved in the planning and execution of rehabilitation and other environmental protection activities
4	Construction of social amenities (churches, dispensaries and schools)	Public participation in decision-making, policy and regulatory formulation processes
5	Provision of business start-up loans	Participate in the CSR finance committee
6	Disaster management responses measures	Participate in the training and management of disasters
7	Provision of employment opportunities	Participate in recruitment committee meeting
8	Funding education of students in need (Bursaries and scholarships)	Participate in the selection of students in need for bursary and scholarship awards
9	Funding of alternative livelihood activities	Participate in the evaluation and funding of livelihood activities
10	Improvement of infrastructure developments	Involved in the identification and upgrading of the infrastructure facilities
11	Good relationship and cohesion among stakeholders	Participate in peace and reconciliation training, campaigns and meetings

Table 4
Means of the dissemination of information in the extractive sector.

S/No	Dissemination of information	Youth	Women	Investors	KI	Frequency (%)
1	Seminars, workshops, community public meetings (*barazas*)	130	30	10	8	**178 (46.8)**
2	Computer system (internet)	250	22	15	7	**294 (77.4)**
3	Newspapers, magazine, reports and periodical	98	15	18	7	**138 (36.3)**
4	Mobile phones (social media, e.g. Facebook, Twitter, Instagram and WhatsApp)	255	42	15	9	**321 (84.5)**
5	Posters and brochures	100	25	12	8	**145 (38.2)**
6	Radio and Television	125	15	8	10	**173 (45.5)**

participation in promoting social and environmental accountability. The extractive companies sometimes restrict access to some information, which when coupled with the inadequate capacity (Table 6) to develop and manage interactive webpages and mobile phone applications, has negative impacts on the kind of content and engagement on digital platforms. However, high levels of mobile phone accessibility can sustain citizen interaction through digital communication media to ignite corporate accountability.

4. Discussions

Corporate governance indicates how a company relates with its workers, customers and other stakeholders and, therefore, a good governance system increases the accountability of a company and eliminates corporate challenges. Inability to utilize effective governance structures in the extractive sector led to the low involvement of mining communities. The digital platform bridges this gap and creates a mechanism for citizen advocacy which creates awareness amongst citizens of the governance structure that leads to effective citizen participation in public dialogue. There is a growing awareness in Africa of the potential benefits of improved corporate behavior (Chanda, Burton, & Dunne, 2017), with widespread demand for effective governance structures which would enable growing citizen participation in governance systems. Heller et al. (2016) recognizes the critical role of citizen voice and participation in improving governance. Digital platforms can provide an opportunity to create awareness of governance structures and show the flow of information that facilitate the engagement of communities effectively in conflict resolution when appropriate. Attuquayefio, Darimani, and Akabzaa (2013) assert that environmental governance is effective and productive with outcomes which are beneficial for communities and the environment. Information sharing regarding who should be involved in the event of a crisis, requires a certain level of awareness of the communities. In Kwale County, the small and medium scale mining companies seem to not have defined management structure, as many are either family or individually owned. The large mining companies with defined governance structures have limited access to communities, therefore

Table 6
Challenges of digital-based platforms in the extractive sector.

Challenges of digital-based platforms	
Technological challenges	Social challenges
Restricted dissemination and access to some information	Extractive companies' fighting back with propaganda
Limited internet or network connectivity	Inadequate knowledge and awareness on human rights
Lack of capacity to develop and operate an interactive website	High illiteracy levels
Hacking the information in the web pertaining the victims	Limited engagement forums
Lack of resources to maintain the systems	Dissemination of false information or propaganda
Limited access to smart phones	Lack of public aware on use of digital format
None interactive webpages, thus limited dialogue	Lack of organized dialogue or interaction with stakeholders

they do not enhance public trust.

Interactions with the digital media explain the low community engagement, which hindered the engagement processes in the mining areas of Kwale County. The strong ASM extractive sector lacks effective platforms to enhance public dialogue, which creates avenues for the perpetration of injustices. The ASM extractive sector has a strong presence of illicit activities that aggravate environment degradation (GoK, 2016). Community engagement as a strategic process involves citizens in an area and its purpose is to address public issues which affect these citizens' well-being. The low level of community engagement in Kwale County is an injustice and extractive sector companies should observe the principles of best practice and carry out responsible investment to promote community and citizen involvement. Mining investors obtain mining licenses from the government with little consultation from the communities. Community consent for mining activities is usually not taken into consideration and, as Macdonald (2017) agrees free prior informed consent is still a controversial issue in community engagement. Community engagement is a license to operate (Wilson, Best, Blackmore, & Ospanova, 2016), which can transform the operations of

Table 5
Content on digital-based platforms.

S/No.	Content on digital-based platform		
	Governance issues	Community issues	Environmental management issues
2	Governance structure (organogram, departments and sections)	Benefit sharing mechanisms	Environmental Impact Assessment reports
3	Company policies, regulations and guidelines	Lease agreements	Environmental Management plans
4	Applicable licenses and permits	Communities involvement work plans	Displacement and reconstruction plans
5	Annual sales and revenues accrued	Conflict resolution mechanisms	Decommissioning and rehabilitation plans of abandoned mining sites
6	Annual financial statement of the company	Compensation mechanisms	Disaster preparedness and risk reduction mechanisms
7	Market value of products	Corporate Social Responsibility (CSR) activities	Disposal of tailing and other waste materials
8	Daily news, notifications and alerts	Available job opportunities	Dust monitoring and controls on sites and atmosphere
6	Tenders for provision of goods and services	Civic education programmes	Health and sanitation issues

the extractive sector, including changes in the policy and regulatory frameworks, governance system and the corporate social responsibilities of the extractive companies.

The corporate social responsibility initiatives undertaken in the mining areas of Kwale County are deemed ill-suited in the sense that they do not protect communities from environmental and social risks. Inadequate measures have been taken to identify initiatives that would help the communities and a lack of dialogue between mining companies and these communities have increased the level of risk in the affected areas. The CSR initiatives should be relevant and respond to the impact of extractive activities in the mining areas. Corporate social responsibility (CSR) is relevant (Sapna, Magray, & Desore, 2017) and it involves balancing the needs of businesses, society and the environment by integrating best business practices with social benefits (Alves & Margarida, 2017; Mesicek, Weber, & Märk-Schlaisich, 2010). The CSR initiatives should be communicated to the community through participatory sense-making processes (Morsing & Schultz, 2006) for them to be understood and accepted in the society. The initiatives should balance out the economic, environmental and social concerns of a company. CSR is an indicator of corporate accountability as corporations involve the stakeholders in decision making processes in their operations. As Carroll (2015) puts it, accountability implies incorporating the needs of the community through enhanced governance systems, appropriate CSR initiatives and justifiable ethical and economic processes.

Digital mapping for social and environmental accountability is an emerging tool which seeks to enhance citizen dialogue in order to redress grievances in instances where conventional mechanisms seem to have failed. Mobile connectivity in Kenya stands at 82% with almost every household having access to a mobile phone, making it easy to communicate and access information from anywhere in the globe. Smart phones with internet access have enhanced functions making internet and social media, including twitter and Facebook, easy means of reporting the injustices of the extractive sector. Internet connectivity is also high, at 67%, making Kenya the leader in internet usage in Africa (Saturday White Paper, 2017), with 99% of internet users on mobile platforms. Web-based portals, according to Basu and Paul (2016), lead to increasing awareness among mining stakeholders regarding injustices committed. They act as a means of making the knowledge of workers and communities more effective when carrying out mechanisms necessary for redressing an issue. Koufou (2016) argues that concept mapping, with the accessibility and flexibility of a computer-based environment, makes the review, distribution and storage of digital information easy through networks, the internet and websites.

The mining subsector has created a strong society with increased per capita income from mining activities. Mining creates employment and mobilizes technology to be effectively used in the sector and expanded to other sectors of the economy (Martens & Rattmann, 2001). The Cooperation between the public and private sectors increases development potential, as a wealth of minerals leads to significant improvements in poverty reduction and human development (McMahon & Moreira, 2014; Kemp, 2010). Brain (2017) argues that mining transforms local livelihoods by generating new employment opportunities in those communities. However, mining activities have resulted in land degradation and the pollution of air and water resources (Yeboah, 2008), culminating in health problems and the high prevalence of diseases (Mallo, 2012).

5. Conclusions

The diversity of the extractive resources has the potential to improve the standards of living of the people of Kwale County. Kenya has recently passed a mining law which regularizes the ASM with the intention to make its operations in the mining sector mainstream. However, neither the country nor the county has enacted laws of benefit sharing, which has remained a cornerstone for injustices in the extractive sector.

The participatory approach to introducing the digital mapping tool provided an effective communication platform in extractive areas. The tool led to effective stakeholder participation in discussing the challenges and provided redress mechanisms to environmental and social risks from the sector's activities. The sector's investors adequately interacted with the other stakeholders on the platform and were able to contribute to the dialogue, which reduced mistrust and enhanced citizen participation in the enforcing of corporate accountability. The study also concludes that the digital communication platform enhanced citizen participation in identifying injustices and provided mechanisms for redress. The key issues revealed in this study are that;

(i) The digital mapping tool is interactive and user friendly to the citizens and provided an effective platform to engage the stakeholders

(ii) The tool encouraged communication, the sharing of ideas and provided feedback mechanisms, which reduced mistrust among stakeholders

(iii) The tool can influence environmental and social corporate accountability through enhanced citizen participation

(iv) The tool is able to identify extractive sector issues and the needs of the stakeholders which facilitated healthy interactions by opening up the digital space for interactive digital content relevant to the stakeholders

The digital mapping tool, therefore, has the capability to influence sustainable development by enhancing citizen involvement and the enforcement of corporate environmental and social accountability in the extractive sector.

Conflict of interest

None.

Ethical statement

Authors state that the research was conducted according to ethical standards.

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