Research article

Is the AKOBEN programme the panacea to gold mining related environmental degradation in Ghana? An integrated analysis of the AKOBEN programme

Kenneth Bedu-Addo*

Faculty of Water Technology, School of Engineering and Architecture, SRH Heidelberg University, Bonhoefferstraße 11, 69123 Heidelberg, Germany

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ABSTRACT

‘AKOBEN Programme’ named after an ‘Adinkra’ symbol signifying vigilance, circumspection, and preparedness the underlying principles for the first “environmental performance rating and public disclosure initiative” which came into effect in the year 2010 was to serve as a continuous monitoring tool for gold mining companies among others post their environmental impact assessment in Ghana. Based on several criteria including legal requirements, environmental monitoring/reporting, hazardous/toxic waste management, best practices in environmental management, complaints management, compliance to environmental quality standards, community relation and corporate social responsibility policy, the effectiveness of the ‘AKOBEN Programme’ as a wholly Ghanaian tool for promoting good environmental stewardship was assessed. An adapted version of the integrated policy analysis, which links actual programme performance with criteria for programme performance consisting of an ‘AKOBEN Programme’ commitment review, an ‘AKOBEN Programme’ strategy scan and an ‘AKOBEN Programme’ plan and strategy mix matrix were used in scrutinizing environmental commitments mandated by the ‘AKOBEN Programme’. Even though the ‘AKOBEN Programme’ does not have specific legislations it relies on legal frameworks ‘Environmental Protection Agency Act 1994 (Act 490)’ and Environmental Assessment Regulation 1999, Legislative Instrument 1652. The effect of the ‘AKOBEN Programme’ with reference to air/water quality monitoring, complaints management/community relations and corporate social responsibility’ are moderately positive (+ + M), highly positive (+ + + H) and moderately positive (+ + M) respectively. This study will provide scientifically credible suggestion to gaps in Ghana’s ‘AKOBEN Programme’ for improved environmental governance in Ghana.

1. Introduction

Ghana, the leading gold producer in Africa as of 2022 has gold deposits in commercial quantities in several of its regions, municipalities, and districts (Figure 1). The gold deposits have been mined on large scale, small-scale and artisanal levels since 1471 by either European explorers, successive Ghanaian governments, multinational mining giants and or artisanal and small-scale gold miners (Amankwah and Anim-Sackey, 2003; MC, 2010). This has resulted in high visibility of mining related environmental degradation in several communities across the length and breadth of Ghana.

In response to the anthropogenic pollution caused by mining, manufacturing, and other industries, several developed and developing nations globally have formulated and implemented environmental policies, programmes and plans to combat various environmental problems with varying degrees of success (Loomis and Helfand, 2006; Zeng et al., 2010; Rabhi, 2011; Bam and De Bruyne, 2017). Programmes including corporate environmental management, corporate environmental information disclosure and environmental performance rating and disclosure initiatives are gaining popularity in developing countries where business as usual methods have yielded little or no positive results with reference to environmental compliance (Haufler, 2010; Rabhi, 2011).

In Ghana’s bid to deviate from the business-as-usual way of solving environmental problems, Ghana’s environmental regulatory body the ‘Environmental Protection Agency (EPA)’ in 1999 introduced its first disclosure programme for mining firms through reclamation bonds as the basis for ascertaining performance to compliment environmental impact
Figure 1. Map showing distribution of gold in Ghana. Source: Minerals commission of Ghana.
assessment. Ghana’s EPA in collaboration with the World Bank subsequently introduced the Continuous Environmental Improvement Awards in Ghana in the year 2000. The Continuous Environmental Improvement Awards an awards scheme for manufacturing industries initiated by the Environmental Protection Agency, Ghana which rewarded companies with continuous environmental performance throughout a particular year under review was a highly subjective scheme, which made it a target of massive scrutiny and criticisms from participating firms (Sekyi, 2011; Darko-Mensah and Okeke, 2013). With adherence to compliance with stringent guidelines and the non-recognition of the commitment of firms in solving critical environmental problems as persistent complaints, Ghana’s EPA adapted a system that reflected the Ghanaian concept of environmental stewardship is formulated to satisfy all guidelines of public disclosure. A spectrum of five colours with red representing the worst environmental performance and gold representing the best environmental performance gives an indication of how well gold mining firms perform with reference to their daily operations post environmental impact assessment and issuance of an environmental permit. Data used as input for the assessment of the performance of gold mining firms in Ghana’s AKOBEN Programme are categorized into qualitative data, visual information, and quantitative data. Based on qualitative data, visual information, quantitative data and set indicators, gold mining firms are rated as red, orange, blue, green and gold to reflect their performance vis-a-vis commitments in their respective environmental impact assessments. With paucity of literature on the analysis of Ghana’s first environmental performance rating and public disclosure initiative, an integrated analysis of the ‘AKOBEN Programme’ was undertaken using key rating criteria including legal requirements, environmental monitoring/reporting, hazardous/toxic waste management, best practices environmental management, complaints management, compliance to environmental quality standards, community relation and corporate social responsibility policy.

1.1. Origin of disclosure programmes

To be considered as a responsible greener corporate citizen in the sight of the public, firms should be willing to disclose information on the impacts of their activities on the environment and why these impacts are occurring? what the consequences of their actions on the environment and humanity are? as well as what is being done to curtail negative impacts, and its effectiveness (Pintér et al., 2005). The disclosure of information on activities that result in the pollution of environmental media including water, sediment, soil and air based on the principle of rectifying unbalanced environmental reportage vis-a-vis a firm’s impact was referred to by Florini and cited by (Gupta, 2008) as “regulation by revelation”. “Regulation by revelation” a process that serves as a monitoring tool in ensuring fair, efficient, and transparent information flow to promote interaction between industry, employees, consumers, regulatory agencies and host communities among others aid in environmental protection (Tietenberg, 1998; Lopez et al., 2009). The first public disclosure initiative implemented by the United States in the late 1980’s in reaction to the pressure citizens of the United States mounted for transparency with reference to potential environmental impacts caused by toxic substances emission was a precursor to public environmental protection (Tietenberg, 1998; Kathuria, 2005; Lopez et al., 2009). Other continents and countries including Europe, Australia, China Canada, South Korea, Indonesia, and Mexico, have all made public environmental disclosure a priority as a way of cementing gains made through already existent conventional regulations with varying success stories (Wang et al., 2004; Palivai, 2006; Kathuria, 2009; Jin et al., 2010).

Though transparency is an important concept, presently there is paucity of research on environmental transparency in global environmental politics making establishing the “relationship between transparency and accountable legitimate and effective governance” difficult to assess hence more often than not being assumed. A hand full of academics who have written unambiguously about transparency in the global context have skewed their discussion on the behaviour of countries in complying with international environmental rules (Gupta, 2008). Transparency in environmental governance assumed to have the potential of informing, enhancing environmental performance and empowering stakeholders has thus fallen short of the expectation of stakeholders (Gupta, 2010). Due to the fact that there is so much emphasis on transparency in global environmental governance initiatives, Thompson (2017) posits there is keen scrutiny of information on voluntary disclosures about environmental, social and governance risk factors by investors and regulators. The existence of a gap between a form of public relation used in conveying misleading information to promote the perception of how environmentally friendly an organization’s products are and what should be known to stakeholders (green washing) vis-a-vis transparency “corporate disclosure effectiveness and sustainability has been reported by (Florini, 2010; Gupta, 2010; Kahle, and Gurel-Any, 2013; Marquis and Qian 2013).

1.2. Ghana’s AKOBEN programme

The ‘AKOBEN Programme’ named after an ‘Adinkra’ symbol signifying vigilance, circumspection, and preparedness the underlying principle for the first “environmental performance rating and public disclosure initiative” the brainchild of the Environmental Protection Agency and the Government of Ghana which came into effect in the year 2010 was to serves as a continuous monitoring tool for gold mining companies post their environmental impact assessment. Based on criteria legal requirements, environmental monitoring/reporting, hazardous/toxic waste management, best practices environmental management, complaints management, compliance to environmental quality standards, community relation and corporate social responsibility policy the ‘AKOBEN Programme’ which highlights the Ghanaian concept of environmental stewardship is formulated to satisfy all guidelines of public disclosure. A spectrum of five colours (Figure 2) with red representing the worst environmental performance and gold representing the best environmental performance gives an indication of how well gold mining firms perform with reference to their daily operations post environmental impact assessment and issuance of an environmental permit. Data used as input for the assessment of the performance of gold mining firms in Ghana’s AKOBEN Programme are categorized into qualitative data, visual information, and quantitative data. Based on qualitative data, visual information, quantitative data and set indicators, gold mining firms are rated as red, orange, blue, green and gold to reflect their performance vis-a-vis commitments in their respective environmental impact assessments. The ‘AKOBEN’ ratings enable the EPA to appraise gold mining companies based on commitments as documented in their submitted environmental impact assessments to the EPA. The ‘AKOBEN ratings with key components including rating criteria, data sets authentication, quantitative and qualitative data analysis, the process of disclosure thus complements the EIA process and thus serves as a monitoring and verification tool towards environmental compliance and sustainability” (EPA, 2010; Ghana AKOBEN, 2010). The legal backbone of Ghana’s ‘AKOBEN Programme’ are Act 1994, Act 490 section 2 (O) which mandates the Environmental Protection Agency of Ghana to gather and store data on environmental issues for the purpose of feeding the public with environmental information and the ‘Environmental Assessment Regulations, 1999 L.I. 1652’. The ‘AKOBEN Programme’ has indicators reflecting the Ghanaian model of what the environment based on natural resources, socio-cultural component, economic component, and institutional settings (Strategic Environmental Assessment Report, 2004). The key stages of the ‘AKOBEN Programme’ assessment include the collection of data, evaluation of the data, generating a ratings report card and disclosing the performance. During the data collection stage of the ‘AKOBEN Programme’, three key sources of information which include
monthly environmental returns of gold mining firms, data obtained through routine site inspections which is a key component of the EPA's enforcement protocol and information/visual evidence collected during field visits by EPA personnel. The ‘AKOBEN Programme’ additionally collects categories of both quantitative and qualitative data including monthly company level information on public complaints and hazardous waste management respectively. Quantitative water quality data on micropolllutants namely mercury, arsenic, cadmium, copper, cyanide, and physical-chemical parameters including pH, total suspended solid (TSS), total dissolved solids (TDS) electrical and conductivity (EC), are collected at monitoring locations. Data on particulate matter (PM10) and total suspended particulate (TSP) is collected for air quality assessment. The monitoring locations of the ‘AKOBEN Programme’ are organized into three categories namely compliance monitoring locations (gold mining firms responsible for monitoring), surveillance monitoring locations (gold firms not primarily responsible monitoring) and reference point monitoring locations (outside the zone of environmental impacts of mining companies). Site inspections are conducted by the EPA’s ‘AKOBEN’ monitoring team to ascertain at first-hand environmental and social issues, which may be difficult to capture using quantitative approaches as stipulated in the ‘AKOBEN Programme’. The site assessments afford the EPA inspectors the opportunity to do an independent verification of the monthly self-reported monitoring on water and air quality by gold mining firms. Pictures and videos are taken by ‘AKOBEN’ inspectors to serve as visual evidence to be added in a database for tracking and improvement purposes. The methodology of the ‘AKOBEN Programme’ is optimized using rating criteria, rating concept and rating rules in a computerized system to ensure accuracy (EPA, 2010; Ghana AKOBEN, 2010). The ‘AKOBEN Programme’ public disclosure is based on rating criteria viz legal requirements, environmental monitoring/reporting, hazardous/toxic waste management, best practices environmental management, complaints management, compliance to environmental quality standards, community relation and corporate social responsibility policy. The ‘AKOBEN Programme’ a rigorous simple tool for the assessment of environmental performance has rating rules (Table 1) with the objective of persuading gold mining firms to take their commitment towards environmental protection seriously to minimize impacts on ecosystems, ecosystem services and human health in and around communities that host mining firms (EPA, 2010).

2. Method

The author adapted his method from the ‘integrated analysis of environmental trends and policies’ described in the ‘United Nation Environmental Programmes training manual on integrated environmental assessment and reporting’ used extensively in Global Environment Outlook reports for the analysis of the ‘AKOBEN Programme’ (Figure 3). The analysis of Ghana’s AKOBEN Programme to ascertain its stringency based on its rating criteria’s capability of enhancing the environment and improving human health was undertaken in five steps. An AKOBEN Programme commitment review the first step in the ‘AKOBEN Programme’ analysis was carried out to take stock of plans and strategies for mitigating impacts on soil quality, water quality, air quality, sediment quality, human health and ecosystem services based on legal requirements, environmental monitoring/reporting, hazardous/toxic waste management, best practices environmental management, complaints management, compliance to environmental quality standards, community relation and corporate social responsibility policy. Identification of a mix of strategies to ascertain the effectivity of the ‘AKOBEN Programme’ in achieving positive impact on soil quality, water quality, air quality, sediment quality, human health and ecosystem services followed the AKOBEN Programme commitment review. Gaps in the AKOBEN Programme were evaluated, using a plan and strategy mix matrix based on the scale highly positive effect (++M), moderately positive effect (+ M), slightly positive effect (+), Neutral effect (0), slightly negative effect (–S), moderately negative effect (–M), highly negative effect (–H), unclear effect (?) respectively. An AKOBEN Programme Action-Impact Matrix (AIM) was finally used to evaluate the efficacy of the AKOBEN Programme for envisioned and inadvertent environmental and health impacts on soil quality, water quality, air quality, sediment quality, human health, and ecosystem services. An ‘AKOBEN’ narrative sheet was constructed to communicate credible statements regarding the adequacies and or shortfalls of the ‘AKOBEN Programme’ juxtaposing and contextualising it in the framework of sustainability. The methodology for the analysis of the AKOBEN Programme was validated using the steps proposed by the ‘United Nation Environmental Programmes training manual on integrated environmental assessment and reporting’ as well as the professional judgement of the author.

3. Results and discussion

Ghana’s ‘AKOBEN Programme’ sufficiently captures the principles of environmental performance not limited to corporate social responsibility (CSR) and voluntary over-compliance in Ghana. The ‘AKOBEN Programme’ is in tune with modern environmental disclosure concepts which aim to achieve good environmental stewardship and governance through conflict resolution, stake holder consultation, improved community relationships, and continual improvement the cardinal principles in transparency in environmental governance. The transparent and easy to comprehend nature of the ‘AKOBEN Programme’ which gives information not limited to source of disclose, target audience, scope and what the disclosure is meant to achieve has resulted in increased interest of

Figure 2. AKOBEN rating rules flowchart. Source: www.epaAKOBEN.org.
Table 1. Criteria/Requirements for AKOBEN environmental performance Evaluation.

| Rating Criteria                                   | Legal Requirements-Permits and Reporting                                                                 | Compliance Management System                                                                 |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Legal Requirements                                | 1 Validity of environmental permit                                                                      | 1 Existence of proper systems and plans for managing effluent quality                           |
|                                                   | 2 Submission of all monthly/quarterly returns by the end of the following month/quarter                  | 2 Existence of proper systems and plans for managing air quality                                |
|                                                   | 3 Submission of Annual Environmental Report by the end of the first quarter                             | 3 Definition and communication of environmental management roles and responsibilities           |
|                                                   | 4 Application for EMP renewal two months before expiry if applicable                                   | 4 Regular training of environmental staff                                                       |
|                                                   |                                                                                                          | 5 Existence of procedures for communicating environmental issues to employees                   |
| Hazardous and Toxic Waste Management              |                                                                                                          | Water and Energy Use                                                                            |
|                                                   | 1 Notification of the EPA of hazardous waste generation                                                 | 1 Monitoring and reporting process and non-process water usage to the EPA                      |
|                                                   | 2 Storage and handling of hazardous chemicals and wastes on-site                                        | 2 Reporting energy consumption to the EPA                                                       |
| Compliance with Environmental Quality Standards   | 1 Compliance with standards for effluent quality parameters for nine or more months over twelve months   | 3 On site energy generation and renewable energy sources usage                                   |
|                                                   | 2 Compliance with the standards for ambient air quality for nine or more months over twelve months       |                                                                                                 |
|                                                   | 3 Compliance with the standards for air emissions for nine or more months over a twelve months           |                                                                                                 |
| Environmental Monitoring and Reporting            | 1 Monitoring and submitting effluent quality data for at least nine months (75% reporting)              |                                                                                                 |
|                                                   | 2 Monitoring (PM10 and TSF) and reporting air quality data for at least nine months (75% reporting)      |                                                                                                 |
|                                                   | 3 Monitoring and reporting air emissions data for at least nine months (75% reporting)                   |                                                                                                 |
| Best Practices Environmental Management           |                                                                                                          |                                                                                                 |
|                                                   | Compliance Management System                                                                         |                                                                                                 |
|                                                   | 1 Existence of proper systems and plans for managing effluent quality                                   |                                                                                                 |
|                                                   | 2 Existence of proper systems and plans for managing air quality                                        |                                                                                                 |
|                                                   | Environmental Management Systems                                                                      |                                                                                                 |
|                                                   | 1 Conducting third party environmental audit                                                           |                                                                                                 |
|                                                   | 2 Existence of environmental performance objectives and targets                                       |                                                                                                 |
|                                                   | 3 Definition and communication of environmental management roles and responsibilities                  |                                                                                                 |
|                                                   | 4 Regular training of environmental staff                                                             |                                                                                                 |
|                                                   | 5 Existence of procedures for communicating environmental issues to employees                          |                                                                                                 |
| Complaints Management and Community Relation      | Responsiveness to Environmental Complaints                                                             |                                                                                                 |
|                                                   | 1 Firm has a Standard Operating Procedure for handling verbal and written public complaints           |                                                                                                 |
|                                                   | 2 The company has proper recording system to register and track public complaints                      |                                                                                                 |
|                                                   | 3 Regular and accurate reportage of complaints to the EPA in Annual Environmental Report                |                                                                                                 |
|                                                   | 4 Resolution of all environmental complaints                                                          |                                                                                                 |
| Corporate Social Responsibility (CSR) Policy      | 1 Existence of formal Corporate Social Responsibility Policy                                           |                                                                                                 |
|                                                   | 2 Public access to Corporate Social Responsibility Policy                                              |                                                                                                 |
|                                                   | 4 Support of community consultation by Corporate Social Responsibility Policy                         |                                                                                                 |
|                                                   | 5 Support of local training/economic empowerment of communities CSR Policy                             |                                                                                                 |
|                                                   | 6 Existence of data on annual expenditure on community development activities                         |                                                                                                 |
|                                                   | 7 Advertisement of all relevant job opportunities locally                                             |                                                                                                 |

Adapted EPA, Ghana.

residents of mining communities and stakeholders in Ghana's environmental governance (Darko-Mensah and Okereke, 2013; Bawua, and Owusu, 2018). The features of the ‘AKOBEN Programme’ namely vigilance, wariness, alertness, and readiness which are key in Ghana’s environmental governance seeks to elucidate transparency in environmental governance in a bid to reduce litigation between host communities and mining companies and to inculcate in residents’ traits key to ensuring responsible mining and ultimately sustainable development.

3.1. Legal requirements

Even though the ‘AKOBEN Programme’ does not have specific legislations on permissible emission levels for air quality, water quality and contamination of farmlands/crops, the effects of the ‘AKOBEN Programme’ vis-à-vis the protection of ecosystems, environment and human health is rated highly positive (+++H, Table 4) with respect to legal requirements in the context of environmental protection and safeguarding human health. The highly positive effect (+++H rating can be attributed to the existence of two legal frameworks the ‘Environmental Assessment Regulation 1999’, ‘Legislative Instrument 1652’ and the ‘Environmental Protection Agency Act 1994 (Act 490)’. Under the legal requirement criterion, ‘environmental permits and pollution abatement notices’ issued by the EPA aid regulate the constituents, volumes, types, and effects of potentially hazardous pollutants on human beings, water bodies flora and fauna. Ghana's environmental guidelines and standards on mining for air and water quality a supplementary requirement set by the EPA to complement the legal framework ensures effluents and other toxic discharges are managed to protect humans, flora, fauna, and the environment. Compliance with stringent environmental impact assessment regime where gold mining firms are required to submit annual environmental management plans with appropriate mitigation actions aimed at protecting the environment ultimately protecting flora, fauna and health of miners and residents of host communities is yet another plus under the legal requirement criterion ‘AKOBEN Programme’.
3.2. Hazardous and toxic waste management

Under the ‘hazardous and toxic waste management’ criteria of the ‘AKOBEN Programme’, gold mining firms are required to manage and store hazardous chemicals and wastes on the premises of gold mining firms properly and effectively. The ‘AKOBEN Programme’ seeks to ensure insignificant threats to the health of humans through preventing the contamination of environmental media namely water and soil with heavy metals, metalloids, and hazardous chemicals. The rating criteria hazardous and toxic waste management seeks to ensure that tailing dam spillages and process water discharges from pump stations do not end up in water bodies of fringe communities. Under the hazardous and toxic waste management criteria of the ‘AKOBEN Programme’ proper stacking, labelling, and storing of hazardous chemicals and reagents not limited to sulphuric acid, sodium cyanide, xanthate and aerophin are in line with international best practices seeks to ensure that residents of mining communities are not exposed to chemicals that can impact negatively on the health of residents. The effect of the ‘AKOBEN Programme’ in protecting environmental media and public health in relation to hazardous waste management is highly positive (+++H, Table 4).

3.3. Best practices environmental management

In a bid to ensure that the environment is properly managed through best practices, mining firms are obligated to make public safety and human health a priority through selecting the most appropriate soil type for backfilling of pits and waste dumps during the construction of waste rock dumps and pits. Under the best practices environmental management criteria (Table 2 and 3) gold mining firms are required to submit monthly environmental returns on particulate matter 10 (PM10) and total suspended particulate (TSP). The submitted monthly environmental returns is critical in the compliance to permissible discharge levels assessment by the EPA to safeguard public health (Table 2 and 3). The ‘AKOBEN Programme’ however does not delineate TSP into specific air pollutants which would have made it possible to monitor greenhouse
gases and the various species of chemicals which may be detrimental to the health of people. Gold mining companies are mandated under best practices environmental management to use high density polyethylene pipe among others in discharging effluent to mitigate against spillages and contamination of environmental media. Proper storage of toxic chemicals in tailing dams for subsequent transfer to appropriate disposal sites coupled with submission of monthly environmental returns, back filling of pits with appropriate materials and the use of high-density polyethylene pipes to mitigate against spillages to protect the health of humans, environment and ecosystems are the reasons for rating the AKOBEN Programme rating criteria best environmental management practices moderately positive (++) (Table 4).
Table 4. AKOBEN action impact matrix.

| AKOBEN Actions | Objective                                                                 | Impacts on Key Sustainability Issues | Other                                                                 |
|-----------------|---------------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------|
| Hazardous waste management | Prevent surface and ground water contamination | Compliance with regulation in order to attain world class air quality levels (+$S) | Reclamation of mined areas through reforestation (+ $M) | Tailings not allowed in surface water and treatment of waste water where possible (+ +++H) | Site handling and storage of hazardous chemicals and wastes (+1+H) |
| Environmental best practices | Ensure gold mining is done in a responsible way | Specific legislation on permissible emission levels for air (?) | Land degradation legislation (?) Soil degradation penalty (- -H) | Specific legislation on permissible emission levels for receiving surface water (?) | Specific legislation on contamination of farmlands and crops as a result of mining (?) | Valid environmental permit (+ + +H) EMP renewal (+ + +H) Submission of annual environmental report (+ +M) |
| Legal issues | Effectively manage pollutants linked with gold mining | Specific legislation on permissible emission levels for air (?) | Land degradation legislation (?) Soil degradation penalty (- -H) | Specific legislation on permissible emission levels for receiving surface water (?) | Specific legislation on contamination of farmlands and crops as a result of mining (?) | Valid environmental permit (+ + +H) EMP renewal (+ + +H) Submission of annual environmental report (+ +M) |
| Monitoring, reporting and compliance with environmental quality standards | Compliance with environmental quality standards | Monthly monitoring data on air quality to verify compliance demanded by the EPA (+ +M) Inspection of site to corroborate data submitted (+ +M) | Contaminants metals in soil (- -H) | Monitoring data on toxic/nontoxic water parameters to verify compliance demanded by the EPA (+ +M) Sediment pollution (- -H) Site visits to corroborate submitted data (+ +M) | Contaminants (heavy metals) in foodstuff (?) | Recycled water (+ +M) Monitoring and reporting noise pollution (+ S) |
| Corporate social responsibility (CSR) | Ensure peaceful coexistence | Annual site audits for qualitative assessments and to fill data gaps (+ +M) | Annual site audits for qualitative assessments and to fill data gaps (+ +M) | Existent of a formal CSR Policy (+ + M) | Environmental Complaints Responsiveness (+ ++H) |

### 3.4. Environmental monitoring and reporting

Under environmental monitoring and reporting criteria, gold mining firms are mandated to submit monthly environmental monitoring data on PM10/TSP and toxic/nontoxic water pollutants including arsenic, mercy, cadmium, cyanide, pH, dissolved solids, suspended solids, and conductivity (Table 2) which are key in knowing the state of air quality and water quality of receiving environmental media. Compliance monitoring locations (where maintaining environmental quality is the responsibility of gold mining companies), surveillance monitoring locations (monitored to identify possible linkages of gold mining operations with trends in pollutant types and levels) and reference point monitoring locations (monitoring not the responsibility of gold mining firms but the EPA to be abreast with the baseline conditions of locations in proximity to gold mining operations) to authenticate the monthly environmental returns submitted by gold mining firms are key requirements under environmental monitoring and reporting criteria of the ‘AKOBEN Programme’. The suitability of the quality of the monitored water bodies at compliance monitoring locations, surveillance monitoring locations and reference point monitoring locations to provide vital ecosystem services and ecosystems support including water for irrigation/domestic use, water to support aquatic life and wildlife among others are however not determined under environmental monitoring and reporting criteria of the ‘AKOBEN Programme’. The effect of the ‘AKOBEN Programme’ is therefore moderately positive (+ +M, Table 4) with reference to air and water quality reporting and monitoring based on the discussion above. The effect of the ‘AKOBEN Programme’ is however highly negative (− −H, Table 4) with reference to metals and metalloids monitoring and reporting in soils, sediments, and foodstuff since these they are not mentioned for monitoring.

### 3.5. Complaints management and corporate social responsibility policy

Gold mining firms are required to respond to verbal and written complaints by mining communities and their residents using Standard Operating Procedure for recording, registering, tracking and amicable resolution of complaints under the ‘AKOBEN Programme’ criteria Complaints Management. Through Complaints Management, issues with a potential of causing injury to the health of residents of mining communities are identified and solutions advanced by mining firms. As part of their corporate social responsibility large scale gold mining companies usually undertake social projects not limited to the construction of boreholes, educational facilities and malaria control programmes to improve the health of inhabitants. The ‘AKOBEN Programme’ thus has a highly positive effect (+ ++H, Table 4) when it comes to complaints management, community relations and moderate positive effect (+ +M) with respect to corporate social responsibility.
4. Conclusions

Based on the findings, the processes of data collection, data corroboration, data analysis coupled with several key indicators of environmental management and governance makes Ghana’s ‘AKOBEN Programme’ very comprehensive. The author posits the ‘AKOBEN Programme’ as having major pluses in efficient quality management, hazardous waste management, complaints management and establishing coo community relations.

The ‘AKOBEN Programme’ prescribes the determination of various physical and chemical water quality parameters for monitoring and reporting which is published during disclosures. The ‘AKOBEN Programme’ however does not cover and report on how cumulatively the physical and chemical water quality monitoring parameters could affect receiving water bodies, aquatic ecosystems, and ecosystem services specifically water for irrigation, aquaculture, recreation and drinking purposes.

Ghana’s ‘AKOBEN Programme’ has a weakness in its lack of an independent legal regime specifically dedicated to the monitoring of air, water, sediment, and soil quality for which reason the ‘AKOBEN Programme’ relies on certain provisions of ‘ACT 490 and the Environmental Assessment Regulations, L1 1652’.

A major limitation identified after the analysis of the ‘AKOBEN Programme’ is the inability to determine impacts of individual air pollutants which constitute total suspended particulate on ecosystems, ecosystem services and human health due to the lumping together of all the individual pollutants which is monitored as total suspended particulate.

5. Suggestions for improving Ghana’s AKOBEN programme

There is the need for a specific legislative framework for the ‘AKOBEN Programme’ on permissible emission levels for air quality, water quality and contamination of farmlands/crops. The scope of the AKOBEN Programme could be expanded to include soil and sediment monitoring since these are critical media responsible for polluting groundwater with metals/chemical water quality monitoring parameters could affect receiving water bodies, aquatic ecosystems, and ecosystem services specifically water for irrigation, aquaculture, recreation and drinking purposes.

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Declarations

Author contribution statement

Kenneth Bedu-Addo: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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The authors declare no conflict of interest.

Additional information

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References

Alloitey, J., Sekyi, R., Faaheloanu, L., Esquaye-Tetteh, E.N., Afful, H.H., Sarfo-Afriyie, Y., Foroco, S., Afah, S., 2011. Integration of environmental disclosure into regulatory management: the case of Akoben environmental rating programme. In: Innee 9th International Conference, pp. 527–538.

Amankwah, R.K., Anim-Sackey, C., 2003. Strategies for sustainable development of the small-scale gold and diamond mining industry of Ghana. Resour. Pol. 29 (2003), 131–138.

Bam, W., De Bruyne, K., 2017. Location policy and downstream mineral processing: a research agenda. Extr. Ind. Soc. 4 (3), 443–447.

Bawum, S.A., Osumu, R., 2018. Analysing the effect of Akoben programme on the environmental performance of mining in Ghana: a case study of a gold mining company. J. Sustain. Min. 17 (1), 11–19.

Content Report Strategic Environmental Assessment of Ghana Poverty Reduction Strategy, 2004. Environmental Protection Agency, Accra, Ghana.

Darko-Mensah, A., Okereke, C., 2013. Can environmental-performance rating programmes succeed in Africa? An evaluation of Ghana’s AKOBEN project. Manag. Environ. Qual. Int. J. 24 (5), 599–618.

EPA Environmental Protection Agency Ghana, 2010. Environmental Protection Agency. Florini, A., 2010. The national context for transparency-based global environmental governance. Global Environ. Polit. 10 (3), 120–131.

Ghana. AKOBEN. Rating and disclosure programme [Online] Available from: http://www.epaghanaakoben.org/. (Accessed 12 July 2017).

Gupta, A., 2008. Transparency under scrutiny: information disclosure in global environmental governance. Global Environ. Polit. 8 (2), 1–7.

Haufler, V., 2010. Disclosure as governance: the extractive industries transparency initiative and resource management in the developing world. Global Environ. Polit. 10 (3), 53–73.

Jäger, J., Areola, M.E., Chenjie, M., Pinter, L., Raihandare, P., 2009. IEA Training Manual. A Training Manual on Integrated Environmental Assessment and Reporting.

Jin, Y., Wang, H., Wheeler, D., 2010. The Impact of Environmental Performance Rating and Disclosure: an Empirical Analysis of Perceptions by Polluting Firms Managers in China, World Bank Policy Research Working Paper Series 5419, p. 5419. Washington DC, USA.

Kahle, L.R., Gurel-Atay, E. (Eds.), 2013. Communicating Sustainability for the green economy. ME Sharpe.

Kathuria, V., 2009. Public disclosure: using information to reduce pollution in developing countries. Environ. Dev. Sustain. 11, 955–970.

Loomis, J., Helfandy, G., 2006. Environmental Policy Analysis for Decision Making. Springer Science & Business Media.

Lopez, G.J., Sterner, T., Afah, S., 2009. Public Disclosure of Industrial Pollution: the Proper Approach for Indonesia? University of Gothenburg. Working Papers in Economics No. 414.

Marquis, C., Qian, C., 2013. Corporate social responsibility reporting in China: symbol or substance? Organ. Sci. 25 (1), 127–148.

MC-minerals Commission Ghana, 2010.

Paliwal, R., 2006. EIA Practice in India and its evaluation using SWOT Analysis. Environ. Impact Assess. Rev. 26, 492–510.

Pinter, L., Swanson, D., AGU, I.A.-J., Nagatani-Yoshida, K., Rahman, A., MNP, M.K., Abluhussain, A., 2005. Integrated Analysis of Environmental Trends and Policies.

Rabbi, A., 2011. Environmental Performance Rating and Public Disclosure: Strategic Policy to Promote Corporate Environmental Management. Institute for Global Environmental Strategies.

Sekyi, R., 2011. AKOBEN: Ghana’s New Initiative for environmental performance rating and disclosure in the mining sector. Proc. Tail. Mine Waste.

Thompson, T., 2017. Disclosure of Environmental, Social and Governance Risk Factors Transparency or green Washing. https://www.financialexecutives.org/getattachment/research/publications/2017/Disclosure-of-Environmental-Social-and-Governance/2017-001.pdf.aspx. (Accessed 2 September 2018).

Tietenberg, T., 1998. Disclosure strategies for pollution control. Environ. Resour. Econ. 11 (3–4), 587–602.

Transparency in global environmental governance: a coming of age? In: Gupta, A. (Ed.), Global Environ. Polit. 10 (3), 1–9.

Wang, H., Bl, J., Wheeler, D., Wang, J., Cao, D., Lu, G., Wang, Y., 2004. Environmental performance rating and disclosure: China’s green watch program. J. Environ. Manag. 71, 123–133.

Zeng, S., Xu, X., Dong, Z., Tam, V.W., 2010. Towards corporate environmental information disclosure: an empirical study in China. J. Clean. Prod. 18 (12), 1142–1148.