



Challenges and Opportunities of Mining Exploitation in Burkina Faso (West Africa) for a Sustainable Development

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ABSTRACT

At the end of December 2021, there were numerous mining titles and valid authorizations in Burkina Faso. However, there was a drop in the number of titles and authorizations for artisanal and semi-mechanized gold mining from 2015 to 2021, which is largely explained by the tightening of the environmental conditions for obtaining these titles and authorizations in the Mining Code of 2015. The Burkinabe mining sector is largely driven by the exploitation of mining substances. The socio-economic impact of the exploitation of quarry substances has so far remained very low compared to that of mines. The revenues have increased from 189.565 billion in 2012 to more than 430 billion in 2021. With the aim of ensuring a better distribution of revenues between the State, mining companies and local communities, it was established in 2015 in favor of the review of the Mining Code (article 25 of the Code), a Mining Fund of Local Development (FMDL). To mitigate the negative effects of artisanal mining, the State has set up both the Department of Artisanal and Semi-Mechanized Mining (DEMAS) and the National Agency for the Supervision of Artisanal and Semi-Mechanized Mining Operations (ANEEMAS). Nevertheless, to be effective, these structures should work in close collaboration with the environmental services. To date, it is difficult to show a provision of the Mining Code or its implementing texts that deals with the issue of future generations. Moreover, with regard to the current situation of the mining sector, it is difficult to provide convincing elements on a possible consideration of the problem of future generations. It is therefore urgent to take into account and without ambiguity future generations in the exploitation of mines and quarries that are non-renewable resources.

Key words: Burkina Faso; Mines, Quarries, Exploitation; Future Generations

INTRODUCTION

Burkina Faso, from a geological point of view, has Birimian volcano-sedimentary rock formations whose area represents about 22% of the total area of the territory. Recognized for their rich mineral potential, these rocks are similar to those in which the large deposits of mining countries such as Canada, Australia, the Scandinavian Shield countries and South Africa are found. It is precisely in these formations that the geological and mining research carried out over several decades by the Office of Geology and Mining of Burkina (BUMIGEB) has revealed numerous mineral resources, the most important of which include gold (60% of discoveries), iron, zinc, manganese, copper, antimony, lead and nickel. The sedimentary rocks also revealed phosphates, white and light bauxites, and above all important deposits of limestone and dolomitic limestone [1]. Recent large-scale geological work carried out by BUMIGEB has made it possible to highlight indices of strategic metals. To guarantee the development of the mining sector over time, it is important to work on the diversification of mining production in view of its monomineral nature, which is essentially based on gold. In addition to base metals, strategic minerals and oil, diversification must also focus on quarrying substances, which are very often neglected even though they have strong economic potential. In addition to its direct contribution in revenue to the benefit of the State budget, the quarrying sub-sector provides inputs to industry, agriculture, etc. It is also an area with high potential for job creation. In the field of industry, for example, substances such as limestone and dolomitic limestone are raw materials used for the manufacture of cement. The limestone

cement deposits of Tin Hrassan and Tin Dioulaf located in the province of Oudalan whose reserves are estimated at about eighty (80) million tons are suitable for the manufacture of clinker, the main material used in the cement [2]. The dolomitic limestones used as additions outcrop in the Bobo Dioulasso area with large reserves estimated at tens of millions of tons. Since 2009, the exploitation of mineral resources has become the primary source of exportations for Burkina Faso. It is also positioned as a major sector in terms of contribution to GDP and job creation. The mining sector thus occupies an important place in the national economy and the well-being of the populations [3]. To boost and strengthen the impact of this sector in the economy while reducing its negative impact, significant legislative and regulatory measures were taken, particularly in 2015 with the adoption of a new Mining Code, which reinforced the consideration of environmental management and dedicated the creation of the Mining Fund for Local Development (FMDL) [4]. With the operationalization of the FMDL in 2019, the municipalities hosting industrial mines receive large sums of money each year, which can reach the order of one billion for some of them. However, the disapproval of the national opinion, the conflicts and other manifestations of discontent of the populations living near the mines are legion. Civil society is also giving voice. These reactions are linked to perceptions of insufficient returns from mining, poor governance of the sector and ineffective controls of mining companies.

What are the real benefits and performance of Burkina Faso's mining sector? What are the challenges and opportunities for its sustainable development? This research gives an idea of the notion of sustainable development and particularly in the mining sector, outlines the situation of mining in Burkina Faso, describes the challenges, evokes the opportunities and addresses the shortcomings of the sector and formulates recommendations for the sustainable development of mining and quarrying in Burkina Faso.

MATERIALS AND METHOD

The mining industry, more than any other industrial sector, faces significant challenges in moving towards sustainable development [5-7]. Significant efforts have been made to consider the environment in the mining sector [8, 9]. These efforts have resulted in the adoption of policies and strategies concerning the mining sector, the establishment of regulatory texts to take into account the environment and the needs of the communities. According to Hilson [7], mining companies take environmental and social issues seriously. However, the efforts of mining companies to ensure an activity that respects the environment and society are often below the expectations of the population [10].

Intergenerational equity

Intergenerational equity is the responsibility of each generation to leave a sufficient legacy of resources to future generations to allow them to develop [11]. This is one of the fundamental principles of sustainable development. Mining companies mainly seek short-term economic benefits, while communities are concerned about their long-term survival. Governments can play an important role in pushing industry to adhere to sustainability principles through legislation and regulations that control the intensity of exploitation. One of the ways to reduce the rate of depletion of mining reserves is to recycle metals with the aim of extending their life and improving their efficiency [12].

Healthy environment before and after mining operations

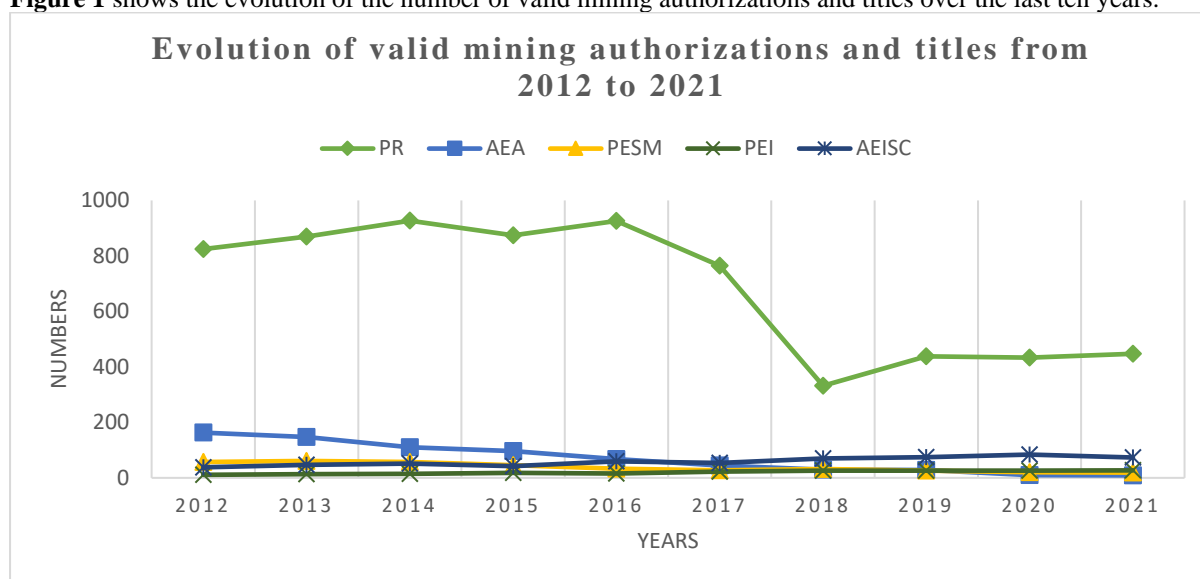
Mining activity generates a wide range of environmental impacts, both during and after mining: contamination of soil, water and air, destruction of wildlife and plant habitats, modification of landscapes, loss of biodiversity, etc. Consequently, mining companies cannot engage in a sustainable development approach without planning effective ways to mitigate the direct and indirect damage caused by this industry, during and after mining [6]. Moving towards a sustainable mining industry requires minimizing water consumption and reusing it as much as possible. The rehabilitation of mining sites after exploitation is another challenge for the mining sector. It is essential to have a closure plan before you even start mining. The restoration of sites must be done gradually, with the active involvement of the communities concerned [13]. To do this, the State must legislate the obligation to restore and the appropriate financial resources must be set aside from the start of operations and subsequently adjusted to take account of inflation and market fluctuations.

Well-being of communities

The mining industry can have an important contribution to the sustainable development of communities, either directly through the provision of jobs and services (education, health, etc.), or indirectly through the contribution to the development of other local businesses [14].

RESULTS AND DISCUSSION

Figure 1 shows the evolution of the number of valid mining authorizations and titles over the last ten years.

**Legend:**

PR: Exploration permit

AEA: Authorization for Artisanal Exploitation

PESM: Semi-mechanized Exploitation Permit

PEI: Industrial Exploitation Permit

AEISC: Authorization for Industrial Exploitation of quarry substance

Fig. 1 Evolution of valid mining authorizations and titles from 2012 to 2021

At the end of December 2021, there were numerous mining titles and valid authorizations as following: 447 exploration permits, 09 authorizations for artisanal gold mining, 19 semi-mechanized gold mining permits, 27 industrial gold mining permits and 73 authorizations for permanent industrial exploitation of quarry substances. Figure 1 shows the maintenance of a certain dynamic in mining activity despite the difficult security context of recent years [15]. The substantial drop in the number of exploration permits over the 2016-2018 period is partly explained by the consolidation and modernization of the mining registry. This made it possible to remove or withdraw invalid permits. As for the drop in the number of titles and authorizations for artisanal and semi-mechanized gold mining from 2015, it is largely explained by the tightening of the environmental conditions for obtaining these titles and authorizations in the Mining Code of 2015.

The Burkinabe mining sector is largely driven by the exploitation of mining substances. The socio-economic impact of the exploitation of quarry substances has so far remained very low compared to that of mines. Twenty-seven (27) industrial exploitation permits including twenty-four (24) gold permits, one (01) zinc, one (01) manganese and one (01) limestone cement are valid on the date of December 31, 2021. Of these twenty-seven (27) industrial permits granted by the State, seventeen (17) mines are in the exploitation phase and six (06) in the development phase. Of the four (04) remaining industrial exploitation permits, two (02) relate to satellite deposits, namely those of Bouroum and Samtenga which are respectively exploited and processed in the mines of Taparko and Bissa Zandkom. There was therefore no construction of new mines for these 02 permits. The 02 other permits relate to the abandoned Kalsaka mine then taken over by the Baladji Group under the name of the "Seguenega permit". In addition, of the seventeen (17) industrial mines in the operating phase, five (05) are shut down: Komet, Inata, Tambao, Youga, and Netiana. The production of the industrial mines over the last ten (10) years is presented in **Figure 2**.



Fig. 2 Evolution of industrial mining production from 2012 to 2021

Besides gold and zinc, Burkina Faso also produced manganese through the small Kiéré mine and the Tambao mine. The small kiéré mine, which operated from 2009 to 2011 with a total recorded production of 117 tons of ore. Regarding the Tambao mine, its operation was affected by a legal dispute between the company and the Burkinabe State over the terms of the operating contract. Gold production has increased from around 30 tonnes in 2012 to over 66 tonnes in 2021 [16]. The mining sector occupies a prominent place in Burkina Faso's economy and in job creation. The contribution of the mining sector to the State budget over the past ten years is shown in **Figure 3**.

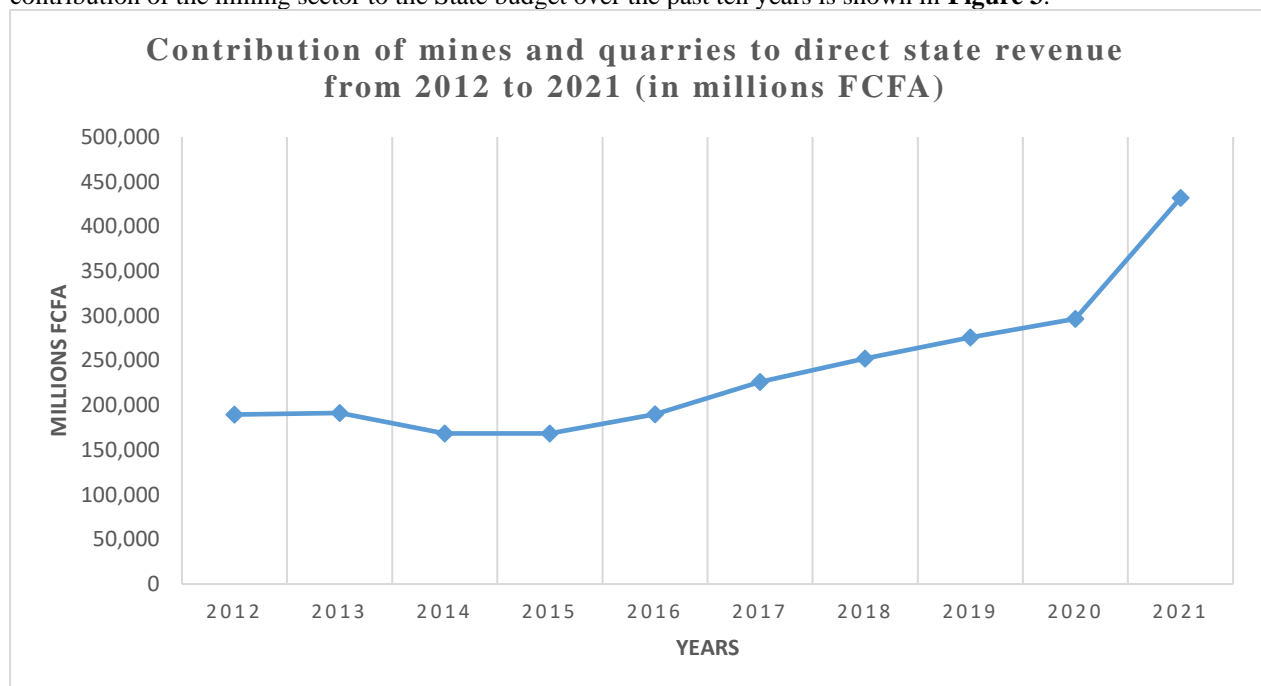


Fig. 3 Contribution of mines and quarries to direct State revenue from 2012 to 2021 (in millions FCFA)

Figure 3 shows that direct mining revenues for the benefit of the State budget have experienced continuous growth over the last ten years. These revenues have increased from 189.565 billion in 2012 to more than 430 billion in 2021. With the aim of ensuring a better distribution of revenues between the State, mining companies and local communities, it was established in 2015 in favor of the review of the Mining Code (article 25 of the Code), a Mining Fund of Local Development (FMDL). Article 26 of the Code specifies that the FMDL is allocated to the financing of regional development plans and municipal development plans. The resources allocated to local authorities under the FMDL are included in the community investment programs of the beneficiaries. They are primarily assigned to the social sectors. In addition to the contribution of the mining sector to the levels of the State budget, job creation and the development of local communities. These services relate to specialized technical services. National suppliers are more present in the markets for the most common provision of services and supplies. However, they find it difficult to enter the markets for specialized technical services. Industrial and artisanal mining activities generate multiple social effects, some of which are linked. These effects include both positive and negative impacts. Among the positive impacts, we can cite:

- the creation of direct or indirect jobs, particularly for young people with professional skills (industrial mines). In addition to these jobs, which may be permanent or temporary, there is the creation of income for young rural people and other categories of people, including women, through the supply of goods and services for both industrial mines and small mines and gold panning. ;
- the contribution to the improvement of living conditions for families whose members are lucky enough to be hired in industrial operations or for certain operators and/or service providers on gold panning sites;
- the reduction of the rural exodus towards the big cities as well as idleness;
- improvement of the living environment of relocated populations through the construction of modern housing equipped with (a) drinking water and sanitation systems, and (b) education and health infrastructure.

Among the negative impacts, we can cite:

- the displacement of all or part of the local populations who thus lose traditional, cultural and economic resources (sacred places, agricultural land, pastures, water points, fruit trees, etc.).
- inflation and the increase in the cost of living for vulnerable local populations due on the one hand to the demographic explosion which leads to a sharp increase in demand for food products and other basic necessities and on the other hand due to a substantial increase in the purchasing power of mining workers and artisans.
- conflicts between local populations and miners or between miners or between mining workers and the population.
- the deterioration of social mores including in particular the development of prostitution, banditry, drug addiction and the general increase in insecurity (attacks with armed robberies, thefts, murders);
- the resurgence of diseases including AIDS, sexually transmitted infections, tuberculosis and lung diseases (including silicosis in gold panning areas), the appearance of cancers including skin cancer due to the anarchic handling of chemical products including mercury (Hg).

Generally, for industrial mines, social impact mitigation and compensation measures are identified and assessed during the environmental and social impact study and included in the environmental and social management plan (ESMP) which is implemented even before the start of mining operations. This is unfortunately not the case for gold panning, whose sites develop spontaneously and wildly and whose operations are also quite often short-lived. For this type of exploitation, it appears necessary to strengthen supervision and intensify monitoring and control of the negative social impact by strongly involving decentralized social action services and local or national CSOs with experience in matter.

Environmental impacts

The nature of the mining activities and the means (equipment, chemicals) used for the extraction and processing of the ores cause the destruction or severe degradation of the vegetation, the topography as well as the pollution of water and soil. Environmental and social impact studies (ESIA) prior to the construction and operation of industrial mines are always established. Their implementation, which is accompanied by the development of an Environmental and Social Management Plan (ESMP), is monitored by the National Agency for Environmental Assessments (ANEE). The ESIA makes it possible to identify and measure the nature and extent of the negative impacts and to consider mitigation and restoration measures. These rehabilitation actions are necessarily integrated into the operating costs of the mines and should be carried out essentially before, during and after the closure of the mine.

In order to mitigate these negative effects of artisanal mining, the State has set up both the Department of Artisanal and Semi-Mechanized Mining (DEMAS) and the National Agency for the Supervision of Artisanal and Semi-Mechanized Mining Operations (ANEEMAS). Nevertheless, to be effective, these structures should work in close collaboration with the environmental services. The main challenges of the Burkinabe mining sector are economic issues; development issues of communities affected by mining projects; issues of transparency and good governance in the mining sector; social issues; the challenges of diversifying mining production; environmental issues and security issues.

Opportunities for achieving sustainable development of the mining sector

The existing mining potential and the inventory of the mining sector as well as certain measures taken by the Government present opportunities for the achievement of sustainable development of the mining sector. The Ministry of Mines and Quarries is a young Department with a young senior staff. It faces enormous challenges to ensure the governance, promotion and development of the sector. Among these challenges, there is primarily the need to train a critical mass of qualified human resources for the management and operation of the mining sector. The lack of work force and qualifications is a serious handicap for the full development of the mining sector in Burkina Faso. This is even truer since, despite the initiatives developed by universities and other higher education centers, the intensification of mining activities over the past ten years means that the need for qualified human resources is still far greater than the supply. Strengthening the rule of law and maintaining the stability of political institutions as well as the advantages offered by the regulatory framework remain important factors in attracting, maintaining and reassuring investors. If the stability of political institutions is difficult to predict, on the other hand everything should be implemented so that the legal and regulatory framework as well as the agreements made between the State and the mining investors are respected as much as possible. The quarrying sub-sector has strong potential for creating wealth and jobs. It is advisable to work on an increased promotion of this sub-sector and the valorization of the products that come from it.

The contribution of the mining sector to the State budget is traditionally the first expectation both of the Government and of national opinion. This largely explains why during the evolution of the legal and regulatory framework relating to this sector, special emphasis was gradually placed on strengthening taxation. Today, even if it is recognized that the direct financial contribution is not the only contribution of the mining sector, it remains very important all the same. The feasibility study must also define a plan for anchoring the activity of the mining company to the local and national economy, which indicates the economic links upstream and downstream with companies and economic agents, as well as the effects of training". The local technical structures of the State should be more proactive and "anticipatory" when preparing the installation of mines in their respective areas.

Make industrial mines catalysts for integrated development

Mining can be a great opportunity both for the national economy and for the development of local communities in mining areas in particular [17]. As already indicated, the development of industrial mining requires or engenders the construction of infrastructure and related socio-economic activities, covering several sectors (infrastructure, energy, trade, education, health, water and sanitation, housing, agriculture, livestock, forestry, etc.). For these activities to contribute in a harmonious and sustainable way to the integrated development of the zones of influence of the industrial mines, it is necessary that they be designed and carried out within the framework of a public-private partnership involving the mining company, the State, the local authorities and the service providers and suppliers of mining goods and services. This partnership should be made with a view to maintaining and continuously improving the living conditions of the populations in the post-mining period. Such integration, if effective, would make the area of influence of the mine a true pole of integrated development. Thus, the mining sector would ultimately have a greater contribution to the socio-economic development of the country.

To promote the sustainable development of the mining sector, a number of actions must be implemented.

✓ **Increase and promote mining potential**

This action aims in particular to maintain and increase over time the performance of the mining sector in the creation of wealth. This will include working to increase mining potential and to promote the mining and quarrying sector. To increase the potential of the mining and quarrying sector, the priority actions will consist of building the capacities of BUMIGEB and supporting research to deepen geoscientific knowledge [18]. Actions to promote the mining and quarrying sector will specifically consist of capacity building and modernization of the mining cadaster, the organization of promotional days and forums for the mining and quarrying sector in Burkina Faso and promoting the diversification of quarry production and mine.

✓ **Strengthen the institutional framework and governance of the mining and quarrying sector**

This second action also aims to increase the share of extractive industries in the national economy by strengthening governance and increasing the number of direct and indirect jobs generated by the mining sector [19]. To achieve this, it is necessary to provide: (i) support for institutional, organizational and managerial development for better governance of the sector, (ii) support for the strengthening of transparency and control capacities, (iii) support for the development of small-scale mining and supervision of artisanal mining; and (iv) support for strengthening the security of mining sites.

✓ **Take into account the issue of future generations in mining**

As defined above, sustainable development is: "Development that meets the needs of present generations without compromising the ability of future generations to meet theirs" [20]. To date, it is difficult to show a provision of the Mining Code or its implementing texts that deals with the issue of future generations. Moreover, with regard to the current situation of the mining sector, it is difficult to provide convincing elements on a possible consideration of the problem of future generations. It is therefore urgent to take into account and without ambiguity future generations in the exploitation of mines and quarries that, it must be remembered, are non-renewable resources.

CONCLUSION

In recent years, the mining sector has established itself as a key sector in the national economy. It weighs concretely on the national economy through its contributions to the State budget, trade balance, balance of payments, GDP, job creation and community development. However, challenges remain to be met and opportunities to be seized to expect a sustainable development of the exploitation of mines and quarries in Burkina Faso beneficial to present and future generations.

REFERENCES

- [1]. Gueye, D., *Small-scale mining in Burkina Faso*. London: IIED, 2001.
- [2]. SHIELD, V., *BURKINA FASO*. Geologisches Jahrbuch: Mineralogie, Petrographie, Geochemie, Lagerstättenkunde. Reihe D, 1996(102-106): p. 91.
- [3]. Kansole, M.M.R., et al., *Environmental Management of Silmiougou (Burkina Faso) Artisanal Gold Mine Waste*. European Journal of Advances in Engineering and Technology, 2022. 9(9): p. 1-8.
- [4]. Drechsel, F., B. Engels, and M. Schäfer, " *The mines make us poor*": Large-scale mining in Burkina Faso. 2019, GLOCON Country Report.

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- [5]. Kansole, M.M.R., et al., *Mining Activities and Sustainable Development Issues in Burkina Faso (West Africa)*. International Journal of Plant, Animal and Environmental Sciences, 2021. **11**: p. 627-638.
- [6]. Azapagic, A., *Developing a framework for sustainable development indicators for the mining and minerals industry*. Journal of cleaner production, 2004. **12**(6): p. 639-662.
- [7]. Hilson, G. and B. Murck, *Sustainable development in the mining industry: clarifying the corporate perspective*. Resources policy, 2000. **26**(4): p. 227-238.
- [8]. Hamann, R. *Corporate social responsibility, partnerships, and institutional change: The case of mining companies in South Africa*. in *Natural resources forum*. 2004. Wiley Online Library.
- [9]. Hirons, M., *How the Sustainable Development Goals risk undermining efforts to address environmental and social issues in the small-scale mining sector*. Environmental Science & Policy, 2020. **114**: p. 321-328.
- [10]. Capron, M. and F. Quairel-Lanoizelée, *Mythes et réalités de l'entreprise responsable: acteurs, enjeux, stratégies*. 2004.
- [11]. Spijkers, O., *Intergenerational equity and the sustainable development goals*. Sustainability, 2018. **10**(11): p. 3836.
- [12]. Gorman, M.R. and D.A. Dzombak, *A review of sustainable mining and resource management: Transitioning from the life cycle of the mine to the life cycle of the mineral*. Resources, Conservation and Recycling, 2018. **137**: p. 281-291.
- [13]. Veiga, M.M., M. Scoble, and M.L. McAllister. *Mining with communities*. in *Natural Resources Forum*. 2001. Wiley Online Library.
- [14]. Esteves, A.M. and F. Vanclay, *Social Development Needs Analysis as a tool for SIA to guide corporate-community investment: Applications in the minerals industry*. Environmental impact assessment review, 2009. **29**(2): p. 137-145.
- [15]. Downie, R., *Collective insecurity in the Sahel: fighting terror with good governance*. Georgetown Journal of International Affairs, 2015. **16**(1): p. 70-78.
- [16]. Ministry of Mines and Energy, *Perception Spécialisée du Ministère des mines et des Carrières*. 2022, Burkina Faso.
- [17]. Gisore, R. and Z. Matina, *Sustainable mining in Africa: standards as essential catalysts*. ARSO Central Secretariat Nairobi, Kenya <http://www.arso-oran.org/wp-content/uploads/2014/09/Sustainable-Mining-in-Africa-Standards-as-Catalysts.pdf>, 2015.
- [18]. Campbell, B., G. Belem, and V.N. Coulibaly, *Poverty Reduction in Africa: On Whose Development Agenda? Lessons from cotton and gold production in Mali and Burkina Faso*, 2007.
- [19]. Aris, N.M., *SMEs: Building blocks for economic growth*. Department of National Statistics, Malaysia, 2007.
- [20]. Kaufman, F., *The end of sustainability*. International Journal of Sustainable Society, 2009. **1**(4): p. 383-390.