

Research Article

Copyright © All rights are reserved by Abdul Amid Aziz Jalloh

Mineral Resource Exploration and Its Impact on Bidikoum Community

Abdul Amid Aziz Jalloh^{1*}, Maurice B Kargbo², Emmanuel Battuta Saidu Koroma³, Brima Turay⁴ and Daniel Albert Sesay⁵

¹Research Fellow & Lead Consultant: Azmid Research and Management Development Consultancy (ARMDEC), Sierra Leone

²Senior Lecturer: Department of Agriculture and Food Security, Ernest Bai Koroma University of Science and Technology (EBKUST), Sierra Leone

³Lecturer: Department of Economics, School of Social Sciences and Law, Njala University, Sierra Leone

⁴Senior Lecturer: Department of Economics, Faculty of Social and Management Sciences, Ernest Bai Koroma University of Science and Technology (EBKURST), Sierra Leone

⁵Lecturer: Department of Business Administration, Faculty of Social and Management Sciences, Ernest Bai Koroma University of Science and Technology (EBKURST), Sierra Leone

***Corresponding author:** Abdul Amid Aziz Jalloh (PhD), Research Fellow & Lead Consultant: Azmid Research and Management Development Consultancy (ARMDEC), Sierra Leone.

Received Date: June 05, 2023

Published Date: June 21, 2023

Abstract

Exploration of bauxite mining has created numerous issues of concern in communities of operations, and this has triggered engineering researchers and consultancy agencies to engage in investigations to establish causes of problems reported by communities regarding mining operations. The thrust for mineral exploration in different parts of the world has led to the destruction of many communities and their habitats. This study, however, focused on uncovering problems caused by mining activities in Bidikoum community and employed primary data collection to enhance its objectives. The study reviewed pieces of literature from books, journal articles, magazines and other periodicals published on the subject matter. This study developed suitable data collection methods, which led to the design of questionnaires used to obtain first-hand information. A sample size of 300 was used, which facilitated the gathering of first-hand information that led to thorough analysis, discussion and conclusion. The study, however, used descriptive statistics and correlational methods to analyse survey data with the help of statistical package for social science (SPSS). Data analysed disclosed issues such as air pollution, water and land pollution and increased poverty, which has adversely affected the Sangaredi community. Respondents emphasized that air pollution has caused permanent blindness and lungs problems in the lives of community people and that, mining exploration exercises have changed the community landscape, which has caused degradation and adversely affect agricultural activities. In consideration of the aforementioned negative effects caused by mining operations, it is but fitting for government and mining companies to dialogue and find appropriate solution towards community development deterrent. This study is however significant to mining practitioners, researchers in mining and exploration activities, Bidikoum community and Government of the Republic of Guinea.

Keywords: Mineral Resource; Exploration; Bidikoum community

Introduction

Mineral exploration has brought tremendous consideration in the mining industry and has attracted considerable attention by government officials in many areas of the world. In the African

continent where minerals flood many countries, examination of lands for suspected minerals, pose several challenges, as it requires commitment on governments to engage expatriates from

other parts of the world to assess and ascertain the availability of minerals in identified areas. Unlike other African countries, Guinea's commitment on mineral exploration encompasses quantum challenges, since experts/mining company's specialists hired to conduct surveys on different parcels of land, only reveal few of the minerals discovered in the said parcels of land. This makes it difficult for government officials to ascertain the different kinds of minerals discovered in sites assessed. As a result, undisclosed minerals are explored secretly by foreign mining companies, which consequently affects the development process of the country. Such secret deals do not contribute to the country's economy. In consideration to aforementioned facts, sustainable development in all sectors of the country will be a great challenge since the dictates of the country's mining code is not adhered to. Several efforts have been made by government officials to ensure that mining codes are strictly followed so that the mining sector's contribution towards the economy will be enormous. Organisations operating in Bidikoum have embarked on exploration activities, which have caused numerous problems for such a community. However, it is from this backdrop that this study is conducted to uncover issues of concern expressed by the community. Large power has remained invested in designing a systematic background that can be recycled to strategically support and maintain progress [1,2]. This task involves some practical experiments, extending after demanding to describe what is predestined by sustainable expansion, and establish pointers to monitor, improve current happenings that match up with existing issues [3-5]. The Republic of Guinea has a rich and varied mining potential spread over its entire territory. The diversity of this potential offers investment opportunities that support very strong economic growth. However, as mineral resources are little known and valued for the moment, their contribution to supporting the country's desired economic take-off and its sustainable human development remains relatively modest (Wells 2017, World Bank 2002 Yan et al 2012 Zalasiewicz et al 2017). Several internal and external factors contribute to this situation, including the fact that until 2015, the Ministry of Mines and Geology (MMG) still did not have a real sectoral strategic development plan. In order to remedy this situation, the ministry has undertaken to equip itself with a set of strategic and operational planning tools, allowing it to better organize and manage its activities according to its mission and national obligations to extractive industry and the society as a whole. The Republic of Guinea is a country rich in mineral resources. Its exploitation exercises have always followed the political evolution of the country and has been considered as a priority sector of all regimes (Nordstrom 2011). However, despite the continuity of this operation and the place occupied by the sector, expectations are far from being fulfilled [6-8]. On average, mining revenues have represented 21.9% of overall government revenues over the past 10 years compared to 40% during the 1980s and early 1990s [9,10]. Mining development has not reached its full potential, which has significantly limited its impacts on socioeconomic development and poverty reduction. Despite its wealth, most of Guinea's nine million people live in extreme poverty (Murdoc et al 2002 & UNSCEAR. 2017). According to the UN Human Development Report, less than a third of adults are literate, ranking

Guinea 160 out of 177 countries. Thus, unless appropriate policies and institutions are developed, mining development will not be able to constitute a source of economic development. In this regard, instability will remain a dominant factor and investments will decline drastically [1,2,11]. Already, in current mining areas, there is probability for these impacts to be felt cumulatively, with lasting effects on the well-being and health of communities, on biodiversity, as well as on human and natural resources (Rosemarin 2010). The main challenge for mining development in Guinea is to make the exploitation of non-renewable resources an engine of sustainable development and the fight against poverty; better manage negative environmental and social impacts that are already worrying, cumulative and long-term [10]. These are opportunities that require an upstream strategic vision to place mining development in a sustainable ecological, monetary, and social framework to strengthen the governance capacity of the State accordingly [12]. Faced with these challenges, the Republic of Guinea has initiated a major reform of governance on mining organisations. This decline in revenues is the result of several factors, including lower taxation in sectors of mining exploration after the adoption of the 1995 mining code and the consequences of corruption in the sector's operatives [13]. The foregoing has descriptively expressed the study overview; however, subsequent elements will discuss review of literature, suitable methods and critically analyse result obtained from survey.

Literature Review

Environmental impact caused by mineral exploration (Air pollution caused by mining activities)

Air pollution is the introduction of any substance, which, due to its concentration, could become harmful to health and the environment. Also known as air pollution, it refers to the contamination of the air by gases, liquids and suspended solid particles, biological matter and even energy. The consequences of environmental pollution in Bidikoum community are caused by mineral exploration [14]. The population living along the roads and mining sites of Bidikoum, periodically revolt against authorities whom they accuse of being kind to mining companies [15]. Mining in Guinea has many negative impacts on the villagers of mining sites, impacts on the environment and the population living around mining activities [16]. Numerous mining companies now reside in Bidikoum community affect inhabitants living condition, environment issues and agro-pastoral activities of the population in the community. Rivers are drying up; animals no longer freely graze on grasses because toxic deposits have polluted the topsoil. In addition, the excessive cutting of wood leads to drought [1].

Land degradation caused by mineral exploration

The main cause of land degradation is erosion. Erosion is the detachment of fragments or particles of soil or rocks from their original location by water or other geological agents such as wind, waves, and ice. Erosion can either be of geological origin (geological erosion) or of human origin (accelerated erosion or soil erosion). Geological erosion is a natural phenomenon that has shaped the earth's surface over the ages or geological eras [10]. Accelerated erosion or erosion of soils happens due to various kinds of human

activities, which includes agricultural practices, forestry operations, pastures, construction of roads and buildings, mining operations, etc. which modify the phenomena of erosion [11]. In most inhabited regions of the world, erosion and sedimentation phenomena are strongly influenced by humans. In many places, man-made erosion is predominant while natural geological erosion is only of minor importance [17]. However, erosion, whether natural, geological, or man-made, is caused by water (water erosion) or wind (wind erosion) in rural or urban and industrial environments. Direct pressures on natural resources and ecosystems from human activities such as overgrazing, overuse of land and deforestation leads to reduced vegetation cover, exposing soils vulnerable to erosion [8,18].

Water pollution caused by mineral exploration

Water is essential for life on our planet. A prerequisite for sustainable development must ensure that waterways are not contaminated. This is the reason for the existence of the freshwater condition in Canada. Water pollution from mining can take decades or even centuries to clear up after the mine closes [8]. These impacts depend on a variety of factors such as the sensitivity of the terrain, the composition of minerals extracted, the type of technology employed, skills, environmental knowledge, commitment of the community and the ability to manage and control environmental regulations [6]. One of the problems with mining is that growing technology allow mines to extract more minerals than ever before, which multiply mining waste. With the advancement of technology, even more waste is expected to be produced in the future [7].

Poverty caused by mineral exploration

Even though Guinea is one of the poorest countries in the world, its bauxite mining is booming. Since 2015, the government of President Alpha Condé has made Guinea one of the world's leading exporters, and the largest exporter of bauxite mineral to China, the world's largest aluminium producer. Guinea bauxite now accounts for a large portion of the aluminium produced internationally for automotive and aircraft parts as well as consumer products such as cans and aluminium foil [19]. Several mining companies operating in the interiors of Guinea are determined to increase their export quota. Guinea, which has the largest deposits in the world, could soon become the world's largest producer of bauxite. The region of Bidikoum, in north-western Guinea, is the focal point of recent growth in the mining sector [20].

Mineral exploration on agriculture (Loss of land and livelihoods)

Dozens of farmers from different villages near mining companies' extraction sites, roads and ports, described how their ancestral farmlands are utilized without adequate compensation. Even the little money given does not replace the benefits that families and communities derive from the land. In Guinea, rural land is organized in accordance with customary (or traditional) law. This recognizes the rights of a family, lineage or community to land, based on its historical connection [21]. Although the Guinean land code recognizes customary rights, in practice, communities or individuals who occupy land under customary law must register

their property or ensure that it is registered and recorded in land plans in order to benefit from legal protection [22].

Sustainable development (Human and Environmental sustainability)

Human sustainability aims to maintain and improve the human capital in society. Investment in health and education systems, access to services, nutrition, knowledge, and skills are all solutions under the sustainable protection of humanity. Natural resources and available space are limited, and there is a need to strike a balance between sustained growth and improved health and economic well-being for all. In a business environment, organizations see themselves as members of society and promote respect for the business value of human capital. The sustainable development of humanity focuses on the importance of anyone directly or indirectly involved in product manufacturing, service provision or wider stakeholders (the human capital of the organization). Environmental sustainability aims to improve human well-being by protecting natural capital (such as land, air, water, minerals, etc.) [23]. When initiatives and programmes ensure that the needs of the people are met without jeopardizing the risks of future generations, they are classified as environmentally sustainable. Environmental sustainability emphasizes how companies can achieve positive economic results without causing short-term or long-term damage to the environment. An environmentally sustainable company seeks to integrate all four sustainable development pillars. The principles of the four pillars of sustainability stipulate that the complete sustainability issues related to all four pillars of sustainability must be solved and then maintained. In order to achieve this goal, everyone must be treated equally [24].

Methods

This investigation was conducted from a perspective, which constitutes uncovering problems caused by mining exploration activities in Bidikoum community. The conduct of this study emanated from critical reasoning and objective analysis on issues that surround sustainable development. This research carefully examined issues of mineral exploration from a wider perspective, through residents of Bidikoum community in the Republic of Guinea. This study reviewed secondary data published on the subject matter. Materials consulted are journal articles, books, magazines etc. In addition, primary data collection was employed with the aid of questionnaires, which facilitated the gathering of first-hand information from respondents in the community. However, this study distributed 300 questionnaires to respondents through random selection to ensure a constructive balance in the research process [25]. The sample frame used here is the community where the research was conducted. There is a disparity in the random selection of sample units since the number of male respondents outweighed their female counterpart. Primary data obtained from survey was analyzed with the aid of SPSS, which enabled constructive discussion and objective conclusion of the fact-finding process. Because of the nature of this study, findings were limited to the Bidikoum community, and all sample units were obtained from the said community [26].

Results and Discussion

This segment discussed respondents' opinion about mining activities regarding air pollution and health threats. Responses from participants unveiled that many residents' health is affected by constant air pollution caused by mineral exploration exercises. Respondents noted that toxic deposits in rivers and streams have polluted the water used by the community. In this regard, pure drinking water has become a great challenge. Information disclosed by respondents specified that extensive blasting in the community has caused several illnesses amongst inhabitants [27]. They added that addressing such illnesses is a great challenge because of poor health facilities. Respondents indicated that the increase drop out of school going children is influenced by the mining activities since money can be earned more quickly in mining sites than educational

institutions. The thrust for environmental protection has been the desire of every nation in order to prevent global warming [28-30]. However, respondents noted that extensive exploration exercises have led to deforestation and increased heat in the community. The effects of mining activities are depicted from the outcome of their exercises, which respondents emphasized that most mining sites are flooded with water after exploration. This situation prevents future infrastructural and other development activities. Respondents mentioned that accessing good health facilities is a great challenge and such a situation has caused the increase of infant mortality rate. Further highlights from respondents show that previously, social relationships within the community were effective, however, the presence of mining companies and their activities have changed the social relationship amongst inhabitants (Tables 1&2) [31].

Table 1: Descriptive Statistics on the distribution of respondents on air pollution.

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic	Skewness Statistic	Std. Error	Kurtosis Statistic	Std. Error
HACPRM	300	2	1	3	2.42	0.035	0.778	0.605	-0.887	0.109	-0.782	0.218
WIRDT	300	2	1	3	2.3	0.035	0.782	0.611	-0.581	0.109	-1.135	0.218
SIILEB	300	2	1	3	2.3	0.034	0.756	0.571	-0.559	0.109	-1.053	0.218
CAJSM	300	2	1	3	2.24	0.034	0.764	0.584	-0.436	0.109	-1.169	0.218
DAE	300	2	1	3	2.32	0.032	0.706	0.499	-0.544	0.109	-0.866	0.218
FEAMP	300	2	1	3	2.4	0.03	0.664	0.441	-0.66	0.109	-0.622	0.218
SCCHF	300	2	1	3	2.26	0.033	0.744	0.554	-0.46	0.109	-1.074	0.218
CSRICM	300	2	1	3	2.36	0.031	0.687	0.471	-0.605	0.109	-0.746	0.218
Valid N (listwise)	300											

Table 2: Descriptive Statistics on the distribution of respondents on increased poverty.

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic	Skewness Statistic	Std. Error	Kurtosis Statistic	Std. Error
PCIMA	300	2	1	3	2.36	0.032	0.715	0.511	-0.654	0.109	-0.812	0.218
MIECH	300	2	1	3	2.37	0.034	0.758	0.574	-0.732	0.109	-0.898	0.218
GAIWEE	300	2	1	3	2.3	0.035	0.782	0.611	-0.581	0.109	-1.135	0.218
PECMA	300	2	1	3	2.26	0.033	0.744	0.554	-0.46	0.109	-1.074	0.218
GCMCDG	300	2	1	3	2.4	0.034	0.762	0.581	-0.817	0.109	-0.815	0.218
MAPCS	300	2	1	3	2.4	0.035	0.788	0.621	-0.838	0.109	-0.884	0.218
CUEASI	300	2	1	3	2.36	0.031	0.687	0.471	-0.605	0.109	-0.746	0.218
PEFCT	300	2	1	3	2.21	0.034	0.766	0.587	-0.377	0.109	-1.21	0.218
Valid N (listwise)	300											

This study has disclosed quantum information regarding community issues and this table describes how mining activities have increased poverty in the community instead of alleviating it. It is registered by a large number of respondents that intensive mining activities have increased poverty in the community. Activities of mining and exploration have not only increased poverty, but also increased hunger, starvation and malnutrition.

The wellbeing of people in every community is a paramount concern since psychological and emotional issues are generated through unpleasant living conditions. However, respondents mentioned that extensive exploration has greatly affected inhabitants' wellbeing. Education is the thrust for every nation's development and negligence on its path adversely affects all sectors of operations. Respondents registered that intensive mining

activities have disturbed educational operations in the community [32-35]. They added that this has also affected human capital growth in surrounding communities. Maintaining gender parity in a community flooded with mining activities encompasses enormous challenges. In this regard, respondents disclosed that gender disparity in on the increase and respect for female counterpart is not evident in such community. Streams in which inhabitants fetch water have been polluted by toxic deposits by mining companies, in their quest to unearth precious minerals from the ground [36]. This

situation has extensively affected several sectors of agricultural activities in the community. Environmental hazards have increased because of poor sanitary operations caused by extensive mining and exploration activities. Respondents indicated that because of extensive exploration activities, the community is deprived of an effective electricity supply. They added that power supply is classified according to economic status, which consequently deprives lower class consumers (Table 3) [37-39].

Table 3: Descriptive Statistics on the distribution of respondents on water and land pollution.

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic	Skewness Statistic	Std. Error	Kurtosis Statistic	Std. Error
FECARD	300	2	1	3	2.19	0.034	0.755	0.57	-0.337	0.109	-1.179	0.218
TMESNV	300	2	1	3	2.37	0.031	0.703	0.494	-0.66	0.109	-0.76	0.218
GIEAAG	300	2	1	3	2.27	0.033	0.734	0.538	-0.471	0.109	-1.025	0.218
GOCCL	300	2	1	3	2.22	0.035	0.783	0.613	-0.407	0.109	-1.26	0.218
CEAPL	300	2	1	3	2.16	0.035	0.785	0.616	-0.29	0.109	-1.322	0.218
CEIESD	300	2	1	3	2.41	0.03	0.68	0.463	-0.725	0.109	-0.612	0.218
DJCJ	300	2	1	3	2.35	0.033	0.727	0.529	-0.646	0.109	-0.867	0.218
Valid N (listwise)	300											

Description of water and land pollution is relevant in environmental protection. Many mining exercises in the world have left communities with unpleasant living conditions, which has caused devastating effects on those communities. Respondents therefore registered that, toxic deposits in rivers have caused unpleasant fishing activities, which has deprived fishermen from big catch. Soil nutrients contribute towards effective cultivation and plants growth. In this regard, the surface of the soil should not be contaminated with any dangerous substance. However, respondents noted that surface soil nutrients have lost their value because of toxic mining elements. Gracing, which enhances animal wellbeing is also affected, as cattle cannot grace in areas with intensive exploration exercises [40]. Extending mining operations in different parts of the community creates infringement into private lands, which are

utilized by mining companies without satisfactory compensation to their owners. However, a larger share of such compensation goes to government officials. Peaceful coexistence is the desire of every community since everyone can go about his/her normal duties without interruption. Nevertheless, respondents mentioned that continuous exploration has caused unrest and affects community peaceful living. Respondents indicated that sustainability in different community engagements is interrupted by exploration activities. The legal expression says that everyone is equal before the law, but it is difficult to see such expression manifest in every court proceeding. Survey results disclosed that the justice system in the community is affected since status is greatly concerned in the dispensation of justice (Table 4) [41-44].

Table 4: Correlations on mineral exploration and environmental issues.

	1	2	3	4	5	6	7	8	9	10
CNHEM	1									
MASET	0.915	1								
MCNEB	0.927	0.893	1							
PWIRDT	1	0.915	0.927	1						
IAMCSM	0.953	0.967	0.877	0.953	1					
DAE	0.915	0.963	0.923	0.915	0.935	1				
RIECDTP	0.915	0.963	0.923	0.915	0.935	1	1			
GAEEAE	0.932	0.981	0.911	0.932	0.95	0.981	0.981	1		
MOCIEIA	0.938	0.949	0.861	0.938	0.983	0.918	0.918	0.934	1	
TEDFL	0.918	0.964	0.868	0.918	0.965	0.93	0.93	0.947	0.983	1

This section shows correlation amongst the different constructs of mining exploration. There are indications that extensive mining and exploration activities have led to changes in nature and its habitat. In addition, evidence shows that toxic deposits endlessly destroy soil nutrients, which consequently hinders the progress of farming activities. As a result, it also causes poor road network, which deprive inhabitants of quick access to neighboring villages. Evidence further disclosed that toxic deposits in streams pollute drinking water. However, it is emphasised that mining activities have led to many children dropping out of school in search of fast money. This has restrained the development of the community's human capital. Quantum evidence disclosed that extensive exploration has led to deforestation, which has increased heat in the community and deprived cattle from grazing [45]. It is also noted that grazing is not only deprived by deforestation but also deposit of dangerous waste from mining activities. Since mining operations focus purely on exploring minerals, educational activity is not their primary concern, therefore education in the community is influenced by constant mining and exploration activities. Negligence in environmental impact assessments causes numerous environmental problems. However, it was disclosed by respondents that mining companies in Bidikoum are not committed to environmental assessment activities. It is emphasised that bountiful harvest is no longer visible because of soil contamination by toxic elements deposited on the surface of the earth. In consideration of the elements discussed, it is evident that there is a positive correlation amongst the various components [46-48].

Conclusion

Conducting investigation regarding mining exploration involves an assessment of issues from a wider spectrum to ascertain the relevance of the subject been studied. The study employed primary and secondary data collection methods in order to establish constructive assessment of components studied. In this regard, the study reviewed pieces of literature from sources published on the subject matter. The review process involves published articles, books, magazines, and other periodicals. Reviewed contents were adopted, which helps to identify limitations and gaps of previous studies. The study further developed questionnaires using the Linkert scale with the following description 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. The community, where the investigation was conducted served as the sample frame and inhabitants are described as sample units with the following designations: businessperson, farmer, technician and unskilled. Three hundred (300) people were selected randomly from different works of life who served as respondents in the study. Among the 300 people selected as representative sample size, 200 are men whilst 100 are women. Questionnaires distributed provided series of information that led to constructive analysis, discussion and objective conclusion. The study further employed descriptive statistics and correlational methods in its analysis conducted, using statistical package for social sciences (SPSS). Results obtained from the survey mentioned air, water, land pollution and increased poverty as issues affecting the community. Respondents emphasized that the aforementioned elements are key destructive components that have ravaged the community.

They however affirmed that, if government could constantly monitor and engage mining companies in their operations, such problems will definitely minimize. They added that, because of mining exploration activities, the community's landscape and its habitat have been greatly affected. Even though this study is limited to Bidikoum community, future research could consider extending investigation to other communities and increase the sample size or possibly employ different research method.

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

References

- Hore Lacy I (2016) Uranium for nuclear power: Resources, mining and transformation to fuel. Elsevier, Woodhead Publishing, Amsterdam.
- Karen A Hudson Edwards, Heather E Jamieson, Bernd G Lottermoser (2011) Mine wastes: past, present, future. *Elements* 7(6): 375-380.
- Robert B Jackson, Avner Vengosh, J William Carey, Richard J Davies, Thomas H Darrah, et al. (2014) The environmental costs and benefits of fracking. *Annu Rev Environ Resour* 39: 327-362.
- Jain R, ZC Cui, JK Domen (2016) Environmental impact of mining and mineral processing. Elsevier, Butterworth-Heinemann Publ, pp 322.
- Maiah Jaskoski (2014) Environmental licensing and conflict in Peru's mining sector: a path-dependent analysis. *World Dev* 64: 873-883.
- Basov V (2015) True giants of mining: World's top 10 iron ore mines. Available at (accessed 1 November 2020).
- Bury JT (2002) Livelihoods, mining and peasant protests in the Peruvian Andes. *J Lat Am Geogr* 1: 1-19.
- Fernando P Carvalho (2011) Environmental radioactive impact associated to uranium production. *Am J Environ Sci* 7(6): 547-553.
- Brown LR (2011) World on the edge: how to prevent environmental and economic collapse. W.W. Norton & Company, New York, London. pp 240.
- Carvalho FP, F Conceição, F Catuane S Taímo, JM Oliveira, M Malta (2017) Heavy mineral sands exploitation and exposure to ionizing radiation in Mozambique. IAEA Proceedings of NORM VIII Conference held in Rio de Janeiro, 2016. International Atomic Energy Agency, Vienna (In press).
- Chang SE, J Stone, K Demes, M Piscitelli (2014) Consequences of oil spills: a review and framework for informing planning. *Ecol Soc* 19:26.
- Bebbington A, M Williams (2008) Water and mining conflicts in Peru. *Mt Res Dev* 28: 190-195.
- Jeffrey Bury (2004) Livelihoods in transition: transnational gold mining operations and local change in Cajamarca, Peru. *Geogr J.* 170(1): 78-91.
- Carvalho FP, JM Oliveira, M Malta (2016) b. Preliminary assessment of uranium mining legacy and environmental radioactivity levels in Sabugal region, Portugal. *Int J Energy Environ Eng* 7: 399-408.
- Dana Cordell, Jan-Olof Drangert, Stuart White (2009) The story of phosphorus: global food security and food for thought. *Glob Environ Change* 19(2): 292-305.
- Fernando P Carvalho Russel Edge (2013) Uranium mining and milling: the need for reference materials in environmental radioactivity monitoring programmes. *Int J Environ Stud* 70(4): 603-610.
- Javier Fernández Lozano, Gabriel Gutiérrez-Alonso, Miguel Ángel Fernández Morán (2015) Using airborne LiDAR sensing technology and aerial orthoimages to unravel roman water supply systems and gold works in NW Spain (Eria valley, León). *J Archaeol Sci* 53: 356-373.

18. Natasha Gilbert (2009) The disappearing nutrient. *Nature* 461(7265): 716-718.
19. F P Carvalho, M J Madruga, M C Reis, J G Alves, J M Oliveira, et al. (2007) Radioactivity in the environment around past radium and uranium mining sites of Portugal. *J Environ Radioact* 96(1-3): 39-46.
20. Ilan Alon, Marc Fetscherin, Philippe Gugler (2012) Chinese international investments. Basingstoke, UK: Palgrave Macmillan.
21. Anttonen Marja, Kumpula Jouko, Colpaert Alfred (2011) Range selection by semi-domesticated reindeer (*Rangifer tarandus tarandus*) in relation to infrastructure and human activity in the boreal forest environment, northern Finland. *Arctic* 64(1): 1-14.
22. Parama Barai, Pitabas Mohanty (2014) Role of industry relatedness in performance of Indian acquirers-Long and short run effects. *Asia Pacific Journal of Management* 31(4): 1045-1073.
23. Florian Bauer, Kurt Matzler (2013) Antecedents of M& A success: The role of strategic complementarity, cultural fit, and degree and speed of integration. *Strategic Management Journal* 35(2): 269-291.
24. Dynah A Basuil, Deepak K Datta (2015) Effects of industry-and region-specific acquisition experience on value creation in cross-border acquisitions: The moderating role of cultural similarity. *Journal of Management Studies* 52(6): 766-795.
25. Fernando P Carvalho (2017) Pesticides, environment and food safety. *Food Energy Security* 6(2): 48-60.
26. Fernando P Carvalho, João M Oliveira, Margarida Malta (2014) a. Exposure to radionuclides in smoke from vegetation fires. *Sci Total Environ* 472: 421-424.
27. Murali DR Chari, Jaya Dixit (2015) Business groups and entrepreneurship in developing countries after reforms. *Journal of Business Research* 68(6): 1359-1366
28. Raveendra Chittoor, Prashant Kale, Phanish Puranam (2015) Business groups in developing capital markets: Towards a complementarity perspective. *Strategic Management Journal* 36(9): 1277-1296.
29. Andrea Colli, Asli M Colpan (2016) Business groups and corporate governance: Review, synthesis, and extension. *Corporate Governance: An International Review* 24(3): 274-302.
30. Dineen BR, Williamson IO (2012) Screening-oriented recruitment messages: Antecedents and relationships with applicant pool quality. *Human Resource Management* 51(3): 343-360
31. Edler J, Georghiou L, Blind K, Uyarra E (2012) Evaluating the Demand Side: New Challenges for Evaluation. *Research Evaluation* 21(1): 33-47.
32. David A Fleming, Thomas G Measham (2014) Local job multipliers of mining. *Resour Policy* 41: 9-15.
33. Pablo de la Flor (2014) Mining and economic development in Peru. *ReVista*, Harvard Review of Latin America, Harvard University, Rockefeller Centre.
34. Freese B (2004) *Coal: a human history*. Penguin Books, London Pp137.
35. Ajai S Gaur, Vikas Kumar, Deeksha Singh (2014) Institutions, resources, and internationalization of emerging economy firms. *Journal of World Business* 49(1): 12-20.
36. Antonio Giangreco, Andrea Carugati, Antonio Sebastiano, Hadeel Al Tamimi (2012) War outside, ceasefire inside: An analysis of the performance appraisal system of a public hospital in a zone of conflict. *Eval Program Plann* 35(1): 161-170.
37. Gibson G, Klinck J (2005) Canada's resilient north: the impact of mining on aboriginal communities. *Pimatisiwin* 3: 116-139.
38. Gomes Mejia LR, Balkin DB, Cardy RL (2012) *Managing Human Resources*. Prentice Hall.
39. Gordon RB, M Bertram, TE Graedel (2006) Metal stocks and sustainability. *Proc Natl Acad Sci* 103(5): 1209-1214.
40. Gubbi SR, Aulakh PS, Ray S (2015) International search behavior of business group affiliated firms: Scope of institutional changes and intragroup heterogeneity. *Organization Science* 26(5): 1485-1501.
41. Gupta A, Upadhyay D (2012) Impact of effectiveness of performance management system on employee satisfaction and commitment. *International Journal of Management IT and Engineering* 2(7).
42. Heckenmüller M, D Narita, G Klepper (2014) Global availability of phosphorus and its implications for global food supply: an economic overview. *Kiel Working Paper No. 1897*. Kiel Institute for Working Economy, Kiel, Germany.
43. Gavin Hilson (2002) An overview of land use conflicts in mining communities. *Land Use Policy* 19(1): 65-73.
44. Delwar Hossain, Don Gorman, Betti Chapelle, Wayne Mann, Rod Saal, et al. (2013) Impact of the mining industry on the mental health of landholders and rural communities in southwest Queensland. *Aust Psychiatry* 21(1): 32-37.
45. Johnson CJ, Boyce MS, Case RL, Cluff HD, Gau RJ, Gunn A, Mulders R (2005) Cumulative effects of human developments on arctic wildlife. *Wildly Monogr* 160: 1-36.
46. Kang C, German F, Grewal R (2016) Washing away your sins? Corporate social Responsibility, corporate social irresponsibility, and firm performance. *Journal of Marketing* 80(2): 59-79.
47. Saim Kashmiri, Vijay Mahajan (2014) Beating the recession blues: Exploring the link between family ownership, strategic behavior, and firm performance during recessions. *International Journal of Research in Marketing* 31(1): 78-93
48. Son A Le, Jung Chul Park, Mark Kroll (2014) Differential effects of pre-and post-acquisition R & D expenditures on post-acquisition performance. *Journal of Business Research* 67(2): 92-99.