Issues on Sustainability and Resource Use: Analysis of Post-Management Efforts in Solid Mineral Extraction Industry in Akwa Ibom State, Nigeria

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Abstract
The study examined issues bordering sustainability and resource use in Solid Mineral Extraction Industry in Akwa Ibom State, Nigeria. Multi-stage random sampling was used to select five (5) Local Government Areas and subsequently five (5) communities were purposively sampled from the selected local Government Areas totalling 25. Primary data were collected with structured questionnaires, interview and field survey. Chi-square was used to examine the impact of stakeholders on management of solid mineral extraction in the environment. The result indicated a value of 204.565 at $p<0.05$. This shows that stakeholders contribute significantly to the management of sand mining environment in Akwa Ibom State. The researchers recommend that stakeholders in the solid mineral exploration industry should re-direct their interest toward post-management of resource-degraded environment so as to restore resource-degraded ecosystem for further land use purposes.

Keywords: *Sustainability, Resource Use, Post-Management, Solid Mineral, Extraction*

Introduction

Sustainability in natural resources management cannot be over-emphasized given the rate of competitive demand of natural resources and its associated environmental degradation. Several studies over the years have focused on socio-economic impact of sand aggregates mining (Attah, 2014). Others have tilted their research focus towards environmental implications of the solid mineral extraction industry with little or no discussion on post-management of resource-degraded environment. Recently, it has come to fore that within Nigeria and parts of Sub-saharan Africa, the attitude of sand dealers toward the abandonment of resource-degraded sites is very appalling and contradict the principles of sustainability. To buttress this fact, as soon as the solid minerals are extracted either from the river bed or plain surfaces, no effort is made to either landfill the degraded sites or restore the ecosystem for posterity sake.

Studies by Jimmy *et al* (2019) attested to the fact that post-management of sand mining environment in Akwa Ibom State is still at infant stage and policy makers do not consider such plan as a priority. As a result, sand miners and construction companies have degraded a larger portion of land during road construction. This ecologically unwise decision is one of the reasons for soil losses, agricultural failure and hunger by extension. For onshore sand mining in Abak, Etinan, Etim Ekpo and Nsit Ibom, the degree of water pollution is so alarming in such a manner that local communities have been deprived of their source of water, aquatic resources depletion coupled with the loss of riparian resources (including forest, raffia palm, herbs, wetland, snails, milipede, monkey, birds, snakes, timber and non-timber resources).

Solid mineral extraction as an informal activity has generated a lot of discussions and controversies over time due to non-renewability and degradative tendencies (Hackney, 2019). Issues on management of solid mineral extraction sites has affected many part of the world. Jimmy (2016) in Nigeria had attempted to establish a link between ecosystem degradation, solid mineral extraction and collaborative management of sand mining in Etinan and Nsit Ibom LGAs, Akwa Ibom State. This was the first attempt to deconstruct sand mining environment and ecosystem from conventional standard within Nigeria. His classical investigation introduced post-management of mining sites as a pathway for efficient resource exploitation and this calls for introduction of post-management plan in the Nigerian Solid Mineral Extraction Industry.

Many centuries ago before the discovery of sand mining as a source of livelihood, the relevance of sand resources in wealth creation, building and construction was minimal since the barbarian lived in caves, rocks and forest. In those good days, men had a stronger relationship with nature in such a way that respect and recognition to the environment and the splendour of its resources were buried in the spirit of men. At this time, the geomorphic parameters of natural streams and rivers were not as rugged and unstable as they are today, rivers were good places for swimming and leisure with little or no risk of drowning. People were afraid to destroy the local stream in search for sand and gravel due to the fear of desecrating the homes of gods and goddess, and by placing such value on the ecosystem, local streams were protected and were found to be the purest and cleanest source of water. The sudden discovery of quality sand resources in streams and land surface raised the hope of the people for development unknown to them that this development would breed environmental hazard to their immediate surroundings, farmlands and biodiversity. In their innocence, they welcomed sand exploitation with an open hands and also mortgage their future generation by privatizing sand beaches for economic gains, they believed that government agencies as well as mining companies were interested and committed to their development (Jimmy, 2016). They later realized that this was not the case, and that the two stakeholders shared a common interest in the maximization of profit and accumulation of capital at all cost at the expense of host communities (Safi, 2017).

The race for quality sand has destroyed several natural ecosystem and threaten food production as farmers wake up to realize that their once fertile farmland are converted to wasteland, gully erosion, biodiversity disappearance, contamination of ground water, surface water pollution by chemicals from mining, landslides, coastal erosion, flooding and many others have mounted serious weight on environmental stability (Kumed, 2017). Sand aggregates mining has also destroyed roads in local communities, threatened agricultural productivity and exposes concerned vulnerable communities to high risk of death and health challenges. Although, government has devised statutory guidelines as contain in the Nigerian constitution of 1999 .no.39 as well as section 2(1) of the revised Nigerian mineral and mining Act of 2007 to address this issue, but the challenges involve in management of degraded sand mining sites are traceable to the fact that there is no clear cut statutory guidelines and monitoring institution to ensure that polluted rivers as well as degraded landscape are reclaim for further future purposes after solid minerals are excavated. There is need to restore this resource-degraded ecosystem due in part to substantial fertile land lost.

Mining of sand aggregates takes various mode of operation including in-stream, opencast excavation and so on**.** In-stream sand mining entails the removal of sand materials directly from the stream, ocean, lake and other fresh water bodies. This can be done either through the use of shovel or any other crude tools to extract sand from the river bed or with a

modern-day dredger and other machines to augment production scale (Akpan, 2015). Nevertheless, the rural Africans often make use of canoes, metal buckets and shovels due to low skill in handling industrial-scale machines. Once at a right spot, they dive with the bucket into the water, dragging the bucket along the river beds and capturing the sand into the bucket and when the bucket is filled to its capacity, they swim out of the water. The contents of sand in the bucket are then emptied into the canoe that floats on the water surface. The canoe when filled to capacity is paddle away from the river and emptied to the shore, subsequently the sand products are being taken by tippers and trucks to their various destinations. This form of sand mining is practice virtually in all part of Akwa Ibom State and Cross River State.

According to Abraham et al (2022) the open cast method or pit excavation (Borrow pit) involves the removal of the surface material (Overburden) to expose the desired deposit of sand buried underneath the overburden. The exposed material is then excavated laterally and horizontally depending on the depth and areal extent of the deposited sand. This method also involves digging and throwing up of sand into a vehicle or unto the surface by either the use of crude implements or loaders but where these processes are limited due to the access of these implements or huge machines, the sand excavated materials or product are conveyed manually by the use of head pans and buckets of their storage points by women and younger people who are paid on daily basis for their abilities in carrying various quantities (Marian et al 2020; Muhammad *et al*., 2011). Much of the borrow pit mining are handled by road construction firms for infrastructural development and sand are subsequently exploited at industrial scale.

Besides these two methods, off-shore riverbed excavation is also practiced whereby a receding stream accumulates a large deposit of sediment in layers until exploration is made by curious miners. In some cases, they are found in farmland around receding stream and the various product ranges from gravel, sharp sand and pure plastering sand as the sediment had undergone thorough erosive processes. This form of sand is influence by erosional processes, transport of bed load, deposition following reduction in fluvial energy in a stream. Some mining sites in Abak, Ibeno and Ibaka falls under this category.

Sand aggregates are extracted globally and they account for the largest volume of solid minerals gotten by erosive processes (Jimmy, 2016). Globally, between 47–59billion tonnes of sand is mined every year (Dan-Gavriletea, 2017) of which gravel and sand account for both the largest share from 68%-85%. The demand for sand and gravel in infrastructural development today cannot be underestimated and these resources have become the major raw materials for building and constructional industry. As development heightened, the demand for sand and gravel correspondingly increases. For instance, in Dubai, the famous palm Jumeirah, an artificial set of islands utilized 186.5 million m^3 of sand and 10million m^3 of rocks worth US$ 12 billion (Jan De Nul Group, 2013). In 2000, United State of America consumed about 1.12 billion metric tons of construction sand (Wallace, 2000). Meanwhile, some nations are having deficit in the volume of sand aggregate despite demand, whereas some are having surplus. A report by Jan De Nul Group (2013) noted that about 517 million tonnes of sand was imported from Indonesia, Malaysia, Thailand and Cambodia to meet its construction need in Singapore. Sequel to this, post-management becomes imperative in order to guarantee future exploitation.

Unfortunately, in developing economies, the procedure for ownership of sand mining sites does not necessarily put sufficient attention to land reclamation and water quality restoration. Mining licenses are issued to prospective investor with little enforcement in the area of sanctions and penalties. While Šofranko et al (2020) reiterated the huge benefit to be harnessed from reclamation of ecologically-ravaged surfaces in Slovekia, Abraham et al (2021) from Niger Delta fringes made similar observation that reclamation of resource-degraded

ecosystem will boost food production and sustain water quality, sanitation and efficient hygiene practices. Lombard (2018) in South Africa, admitted the existence of post management plan in gold mining industry. He stated that the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) mandated mining companies and other stakeholders to draft Environmental Management Plans (EMPs) that spelt out the restoration of mines after closure before any mining activities commences. This statutory framework supports post-management initiative of which mining companies are accountable for every damages caused on the environment.

Still in South Africa, Van *et al.* (2009) investigated the weaknesses of Legislative instrument concerning mine closure and Social responsibility on the West Rand. Tumai (2013) analysed the deficiencies in regulating Mining activities in South Africa and Zimbabwe following issues like land and mineral rights, conflicting mining revenue and accountability, land deprivation and land grabbing by the elites. For instance, the popular Marange diamonds saga in Zimbabwe shown how rural villages (diamond-rich communities) suffer the consequences of insecure tenure as mining companies grab communal lands which had been a long-standing source of communal livelihood, and thus conflicts erupted across the stakeholders in the mining sector. A report by Lex Africa, one of the largest legal network on mining, had reviewed the policy weaknesses and strength of about 22 African countries legislative framework on mining (Lex Africa, 2015). Considering mining in Botswana, one of the world's richest economy by natural resources deposit, Besada and O'Bright (2018) study analysed how Botswana's policies in diamond mining industry had attracted investment and revenue with little emphasis on accompanying post management initiative.

From critical observation, every common man needs a house, every owner of bungalow needs a skyscraper, the elites need a mansion, every poor man dreams about owning a property, every village wants to be urbanized, every slum areas wants to be developed, every rural roads need accessibility, likewise every region clamour for infrastructural development. In spite of all these gigantic and unending desires, policy makers have failed in organizing an institutional framework that could address both pre-management and post management of resource-degraded environment. More attention seemed to be tilted towards the economic benefit of solid mineral extraction at the expense of post-management which constitute the core ingredient for sustainability. Government agencies have been in a dilemma of what practices could sustain livelihood with environmental management consideration. Policies like imposition of ban, licensing and reform in tenure system yet, numerous borrow pits are left abandoned after mining. It is on this note, that this paper seeks to re-awaken policy makers in mining industry on the need for post-management to be prioritised.

Materials and Method

Multi-stage sampling was adopted to select five (5) local government areas that were purposely sampled and five (5) communities were selected for collection making a total of 20. Data for the study were obtained primarily from the use of structured questionnaire, personal observation of mining sites and through guided or semi-structured interviews. Three hundred and ninety six (396) structured questionnaires were administered to various targeted population which included sand miners, owners of sand dredgers, community council of chiefs, local indigene, sand distributors and association of sand miners. Descriptive statistics was also used involving the use of tables to present the data obtained from the study. Chi-square statistical technique (using SPSS) was employed in testing for the impact of stakeholders on management of mining environment.

Table 1: Selected Sample Location

Local Government	Villages
Abak	Manta Abak, Ediene Abak, Ukpom Abak, Oku Abak
Ibesikpo	Obot Idim, Afaha Udoeyop, Nung Oku Akpasima, Ikot Akpaso, Akpautong
Etinan	Ndon Utim, Ekpene Ukpa, Nkana Iman, Ikot Ekang, Ikot Inyang Osom
Nsit Atai	Etobodom 1, Ndaha Nsit, Ikot Ekpot, Ibedu, Iwok
Itu	Ikot Ebom Itam, Ntiat Itam, Ntak Inyang, Ikot Ekwere Itam, Ikot Ekang Itam

Source: Field Survey, 2024

Results and Discussion

From the analysis of table 2, the detail of age composition of miners showed that from 15-20 (14.65%) fall under the vibrant population with a youthful age group. 35.10% of the population fall within 21-25, 15.15% fall within 26-30, 14.65% fall within 31-35, and 20.45% fall within 36 years and above. For the sex of sampled respondent shown in table 2, 93.94% of the sampled respondents were male and only 6.06% were females. This revealed that males involved in sand mining activities more than females.

Table 2: Age and Sex

Age	Number of Respondents	Percentage
15-20	58	14.65
21-25	139	35.10
26-30	60	15.15
31-35	58	14.65
36 and above	81	20.45
Total	392	100
Sex	**Number of Respondent**	**Percentage**
Male	372	93.94
Female	24	6.06
Total	396	100.00

Source: Field Survey, 2024

From the marital status of respondent, it shows that 45.45% of the respondent sampled were single, 35.35% were married, 15.15% were divorced, and 4.05% were widow/widower. For educational status of respondents, 176 sampled respondents representing 44.44% had primary education, 202 respondents representing 51.01% had secondary education, 10 respondents or 2.53% had post-secondary education while 8 respondents representing 2.02% of the total respondents had no formal education.

Table 3: Marital Status and Educational Level of the Respondents

Marital status	**Number of Respondent**	**Percentage**
Single	180	45.45
Married	140	35.35
Divorced	60	15.15
Widow/Widower	16	4.05
Total	396	100
Educational Level	**Number of Respondent**	**Percentage**
Primary education	176	44.44
Secondary education	202	51.01
Tertiary education	10	2.53
No formal education	8	2.02
Total	396	100

Source: Field Survey, 2024

In table 4, sand aggregates are spatially distributed across the sampled locations. Clay is exploited in Itu axis comprising Ikot Ekang Itam, Ikot Ebom Itam and Ikot Ekwere Itam. Ntiat Itam has a large deposit of granite and hard core and other mining communities are blessed with a rich deposit of Sharp sand, gravel, and laterite.

Table 4: Forms of solid mineral extracted in the study area

Name of Communities	**Resources found**
Etobodom 1	Sharp sand, gravel, laterite
Ndaha Nsit	Sharp sand, gravel
Ikot Ekpot	Sharp sand, gravel ,laterite
Ibedu	Sharp sand, gravel
Iwok	Sharp sand, gravel, laterite
Ntak Inyang	Laterite
Ikot Ekang Itam	Clay
Ikot Ebom Itam (clay)	Clay
Ikot Ekwere Itam (clay)	Clay
Ntiat Itam (granite and hard core)	Granite and hard core
Obot Idim	Sharp sand, gravel, laterite
Afaha Udoeyop	Sharp sand, gravel, laterite
Nung Oku Akpasima	Sharp sand, gravel, laterite
Ikot Akpaso	Sharp sand, gravel, laterite
Akpautong	Sharp sand, gravel, laterite
Ndon Utim	Sharp sand, gravel, laterite
Ekpene Ukpa	Sharp sand, gravel, laterite
Nkana Iman	Sharp sand, gravel, laterite
Ikot Ekang	Sharp sand, gravel, laterite
Ikot Inyang Osom	Sharp sand, gravel, laterite
Manta Abak	Sharp sand, gravel, laterite
Ediene Abak	Sharp sand, gravel, laterite
Ukpom Abak	Sharp sand, gravel, laterite
Oku Abak	Sharp sand, gravel, laterite

Abak Usung Idim	gravel, laterite, sharp sand

Source: Field Survey, 2024

Decisions on post-management of sand mining environment plays a critical role in sustainable sand mining. From table 3, 12.6% of respondent agreed that federal government contribute significantly to management of sand mining, 22.7% on state government, and 30.3% on local government area, 27.8% on association of sand miners and 6.6% on NGOs. In terms of post management of sand mining environment, 7.6% of respondents agreed that post-management strategy to be made in sand mining should incorporate imposition of ban, 20.5% on landfilling, 16.4% on polluted water treatment, 17.7% on effective monitoring and fines as well as 37.9% on environmental damage tax. In the study area, the idea of sand banning have been seriously condemn among the rural dwellers, given the level of dependence on sand beaches for livelihood. The emergence of sand banning has really affected the socio-economic development of the concerned communities. Meanwhile, majority of respondents (30%) agreed to the idea of introducing environmental damage tax as well as other post- management options including landfilling and ecological restoration. This implies that sustainable sand mining can only be achieved through an interplay of two or more post-management options (Isikong, 2015; Gabriel, 2015; Akpan, 2015). Following this, sustainable sand mining must adopt institutional guidelines in line with structural development of the degraded areas through bank protection mechanism, land filling and other measures.

Thus, this argument agrees with the work of (Singh et al 2014) that sand banning increases the risk of illegalities in concerned communities in the form of conflict, high crime rate, joblessness, poverty and hopelessness. In most communities employment rate was gradually decreasing in line with the introduction of modern-day dredging machines most especially in Ekpene Ukpa and by this the demand for skill dredgers exceeds manual labourers. This agrees with the findings of Benson (2010) that the contribution of sand mining to the socio-economic development of rural communities is determined by the method of excavation tools used. The transition from artisanal sand mining to industrial-scale mining reduce labour force, promote accumulation of surplus capital to fewer sand dredgers as well as redouble environmental degradation which in turn influence agricultural productivity. This agree with the findings of Saviour (2008) that unsustainable sand mining impede agricultural productivity.

Finally, community- based management practices are often considered to contribute to sustainable sand mining. From our findings, 20.2% of respondents agreed that community-based management of sand mining involves seasonal banning of sand mining, 17.7% agreed on bank protection with bamboo, 21.5% agreed on beach leasing to indigenes, 15.2% agreed on community vigilante for effective monitoring, 11.4% agreed on community river protection, 10.1% agreed on community pipe borne water supply while 4% agreed on the use of local injunction (mbiam) in enforcing compliance and rule-based management system.

Table 5: Management of Sand Mining Environment

Items	Variables	Frequency	Percentage (%)
Stakeholders in management of sand mining environment	Federal Government	50	12.6
	State government	90	22.7
	Local government	120	30.3
	Association of sand miners	110	27.8
	NGOs	26	6.6
	Total	**396**	**100**
Post-Management of Sand Mining Environment	Imposition of ban	30	7.6
	Land filling	81	20.5
	Polluted water treatment	65	16.4
	Effective monitoring and fines	70	17.7
	Environmental damage tax	150	37.9
	Total	**396**	**100**
Community-Based Management	Community seasonal sand banning	80	20.2
	Bank protection with bamboo	70	17.7
	Beach leasing to indigene	85	21.5
	Community vigilante for monitoring	60	15.2
	Community river protection	45	11.4
	Community pipe borne water supply	40	10.1
	Local injunction (Mbiam)	16	4.0
	Total	**396**	**100**

Source: Researcher, 2024

Table 6: Summary of Chi-Square Tests Impacts of Stakeholders on Management of Sand Mining Environment

The summary of chi-square test on the impacts of stakeholders on management of sand mining environment is presented on table 6 below.

	Value	Df	Asymp. Sig. (2-sided)
Chi-Square	204.565[a]	12	.000
Livelihood Ratio	203.635	12	.000
Linear-by-Linear Association	86.764	1	.000
N of valid cases	15922		

Decision: From the Chi-Square value of 204.565 was obtained and the Asymp. Sig. (2-tailed) was 0.000. However, since the significant value of 0.000 is less than 0.05 HO is rejected and HI is accepted; thus the result was significant and can therefore be concluded that stakeholders contribute significantly to the management of sand mining environment in Akwa Ibom State.

The research study was done with the view to assess the level of environmental degradation that arises from sand mining and the post-management options adopted in order to restore the numerous resource-degraded ecosystem. An assessment of the level of degradation

showed that no adequate measures was put in place to mitigate environmental degradation. The researcher reveals that post-management guidelines of sand mining environment were not adopted in the study area and this contribute to the failure in resource management in which a larger expanse of agricultural land have been converted to waste land and borrow pit.

Figure 1: Borrow Pit
Source: Field Survey, 2024

The study further found out that many of the miners are not complying with the regulations meted out to them. In some of the mining sites, thugs and criminals were found and they consider those areas as their safe haven. Sand miners were too violent and uncultured and this has been one of the reason for accelerated environmental degradation. This was reported in a study by Rege (2016) on India's sand mafia and unruly attitudes towards policy compliance. Unless government intervene by ensuring that behavioural change is made possible among the miners, resource sustainability would be a mirage.

Figure 2: Degraded Clay and Kaolin extraction sites at Ikot Ebom Itam
Source: Field Survey, 2024

The study also revealed that stakeholders mandated to monitor sand mining sites did not visit the sites and were relatively unaware of the illegal businesses going on in the sand mining sites. Interview conducted reveals that government agencies rarely monitor the sites and as such too many dredgers were brought in by the local dealers. It was further discovered that some level of conflict often arose among stakeholders. The interviewee (anonymous) cried out that most of the decision towards mining and management are imposed upon them from the state authorities without engaging them in the process. He cited a mining permit being given to highest bidder, but not on merit. From his viewpoint, State government decision on mining permit issuance without monitoring mining activities on-site is a terrible ecological disaster.

Figure 3: Land slide due to solid mineral extraction
Source: Field Survey, 2024

It was also revealed that acquisition of sand mining permit was grossly ignored among sand miners in some mining communities, whereas other miners who obtained their permit deliberately hired too many dredgers in their allocated sand mining sites and this escalate conflict as well as uncontrollable degradation. Interviewee 2 (anonymous) stated that he will prefer to extract solid mineral ‘’illegally’’ than to spend much money to secure mining permit for fear of being held accountable for destroying land and water environment. Robert (2014) has made similar findings that illegal mining is endemic in Sub-Saharan Africa and very high in Ghana, Kenya and South Africa as well as in India as cited by Grewal (2017). Moreover, no statutory guideline has spell out the number of dredgers and local miners (with crude implement) per site and there is bound to be more devastation.

Figure 4: Sand Dredger - a major source of river pollution
Source: Field Survey, 2024

Figure 5: Polluted Local Stream in Nkana Iman, Etinan
Source: Field Survey, 2024

Interviewee 3 (whose name remain anonymous) made known that during high demand for sand, more dredgers and labourers are employed to meet up with patronage. This correspond with studies made by Jimmy (2019) where about 72 dredgers were found in a single sand mining site and this forced the state government to arrest the miners. In this light, this

study has challenge the notion of mono-centric resource governance where policies are enforced by a unilateral body. As such, the study advocate for a collaborative management option whereby host communities are fully engaged in decision making.

Conclusion

Management of solid mineral extraction sites is one of the most contentious and complicated issue in contemporary geographic research, most especially in the field of environment and development. It has been difficult to regulate the activities of sand miners in developing countries including Nigeria as a result of a clash of interest among relevant stakeholders and man's irresistible desire to own property.

Recommendations

Due to the lapses in post mining in the Nigerian solid mineral industry, the researchers recommend adherence in areas of land reclamation-food security nexus**,** phyto-remediation capabilities for on-shore and off-shore mining in order to ensure ecological stability and protection of threatened species, and the economic returns in the restoration of post-mining landscape. Inventory of abandoned mining site and polluted rivers should be made to assist in restorative planning. Implementation of sanctions to licensed and non-licensed miners so as to curb their excesses. In addition, the rate of excavation, the number of dredgers per site, number of labourers and tons of sand aggregate excavated should be well- spelt out at each strategic mining site to control the depth of sand mining sites.

References

Abraham, C. M, Essien, K., Umoh, E. U., Umoh, E. C., Ehiremem, L. E. *et al.* (2022). Towards effective monitoring of sand mining sites and post management techniques in sand dredged environment of Akwa Ibom State, Nigeria. *Glob J Ecol 6(1): 092-099.* DOI: https://dx.doi.org/10.17352/gje.0000150

Abraham, C. M, Udoh, J. C, and William, N. I. (2016). Sand Mining as a Veritable Informal Sector Activity for Rural Livelihood in Abal, Akwa Ibom State, Nigeria. *Proceedings of the Association of Nigerian Geographers Conference, UNILAG 2016.*

Attah, I (2014). Pivotal issues in the management of sand mining landscape in Akwa Ibom State. Unpublished seminar paper, Department of Geography and Regional Planning, University of Uyo, Akwa Ibom State

Besada, H. and O'Bright, B. (2018). Policy Impacts on Africa's Extractive Sector. Botswana, Diamond Dependence and Diversification in the Post-Diamond Period. *Revue Governance. 15(2) 86-105.* http://doI.ORG/10.7202/1058089ar.

Dan Gavriletea, M. (2017). Environmental impacts of sand exploitation. Analysis of sand market. *Sustainability (Switzerland)*, *9*(7), 1. https://doi.org/10.3390/su9071118 demand for sand. *The Guardian.* Retrieved from https://www.theguardian.com/world/2017/dec/30/india-sand-mining-conflict-deaths-building-boom-environmental-damage

Grewal, P. (2017, March 29). India's struggle with illegal sand mining. *SBS News.*

Hackney, C. L. I. (2019). *World is running out of sand, here's why you should be worried*. *June*.

Kumed, D. (2017). Socio Economic Impact Study of Mining and Mining Polices on the Livelihoods of Local Population in the Vindhyan Region of Uttar Pradesh

Lombard, D (2018) Law Enforcement in the South African Gold Mining Sector: The nexus between company, environmental and equity law. MSc Environmental Science. University of South Africa.

Marian, S., Oľga, V., Tomáš, K., Vladimír, S., Ján, B. and Martin, Š. (2020). Effect of Reclamation on an Environment Impaired by Mining Activity: A Case Study. *Pol. J. Environ. Stud. Vol. 29, No. 5 (2020), 3329-3337 Original Research*

Muhammad A, Mohd. J, Ismail Y, Abdul, W. and Karamat, M. (2011). Sand mining effects, causes and concerns: A case study from Bestari Jaya, Selangor, Peninsular Malaysia. *Scientific Research and Essays Vol. 6(6), 1216-1231*

Rege, A. (2016). Not biting the dust: Using a tripartite model of organized crime to examine India's sand mafia. *International Journal of Comparative and Applied Criminal Justice, 40(2),* 101-121. doi:10.1080/01924036.2015.1082486

Safi, M. (2017) Villagers pay tragic price as Indian building boom drives Socio Economic Impact Study of Mining and Mining Polices on the Livelihoods of Local Population in the Vindhyan Region of Uttar Pradesh. *Submitted To* NITI Aayog, New Delhi

Van, E. S., Liefferink, M. and Durand, J. F. (2009). Legal Issues concerning mine closure and social responsibility on the West Rand. *The Journal for Transdisciplinary Research in Southern Africa, 9 (1) 51-71*.