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SAND MINING: ECONOMIC GAINS, ENVIRONMENTAL ETHICS, AND POLICY IMPLICATIONS

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ABSTRACT: *Sand mining which been a major contributor to economic growth and development has turned out to be a source of environmental degradation based on the fact that the renewal rate of sand is lower than its rate of consumption. This study reviewed the universe, earth, and finally focused on sand as one of earth's most consumed natural resources after water. The study shows how countries of the world engage in sand exportation to grow their economy by creating job opportunities to both skilled and unskilled individuals in the society. Key issues surrounding the ethical conduct of sand mining were discussed in details by angling towards environmentalists' view that are of the opinion that sand mining activities ought to be drastically reduced and strictly regulated in order to save the depleted state of the ecosystem. The study was anchored on the Green theory which emphasizes that there is a need to regulate the overconsumption of shared natural resources such as land, water, and sea animals by individuals and organizations.*

KEYWORDS: Aggregate Mining, Environmental Ethics, Environment Programme, Natural Resources, United Nations.

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INTRODUCTION

The Universe consists of Planet Earth and all its living organisms, as well as the moon, stars, sun, and all other known and unknown planets (William, 2017). Scientists and philosophers from time past seem to be in obscurity regarding the cosmology and cosmogony of the universe; that which relates to the universe's origin and structure respectively. Overtime, scientists have made several attempts to explain the origin of the universe through known theories such as the Big Bang theory, the Steady State theory, and the Oscillating Universe theory (Williams, 2017).

Earth been one of the planets that orbits around a 4.5 billion year old medium sized star called the Sun, takes approximately 365.26 days to make one rotation as it continuously spin around its axis once every 23.93 hours (Anthony, 2009). Alongside planet Earth, Mercury which has a close proximity to the Sun, Venus, Earth, and Mars sum up a group known as the *"terrestrial planets"*, out of which Earth is the largest, the greatly dense, and is uniquely distinct as the only planet where water exists not only as a surface liquid, but also as solid and gas (Anthony, 2009); and is endowed with natural resources which can be classified as renewable and non-renewable resources. While renewable resources are resources that can naturally be replenished because its recovery rate exceeds the rate of its consumption, non-renewable resources on the other hand are resources that have its recovery rate lower than its consumption rate (Rinkesh, 2020).

Earth's natural resources include energy resources, non metallic resources, metallic resources, water, air, animals, and natural vegetations (South Carolina Geological Survey, 2005). The subcategories of these broader resources include for Energy resources petroleum products like oil, natural gas, coal, uranium, and other alternative energies such as wind, tidal, and solar. Non-metallic are rocks and soil, and finally for metallic resources there are iron, copper, aluminum, lead, zinc, gold, silver and many others (South Carolina Geological Survey, 2005). Still for the purpose of this study, we shall narrow down to sand which is a type of soil. There is an utmost need to untangle the complexity of differentiating sand from soil. Soil on one hand has pores which permits it to hold water and nutrients, while sand on the other hand, is grainy loose without the presence of pores for neither holding water nor nutrients (Diksha, 2015).

Mining of sand has been an activity that is as old as anyone can remember as in various periods and time, people and organizations have always utilized sand in one way or another either in the building of houses, construction of bridges, roads , making of glasses or in other things that can be made out of it. In-spite of its usefulness, there is an outcry regarding its renewal rate which is far below its rate of consumption. Environmentalists' have constantly warned that aggregate mining is endangering earth's ecosystem and lives of underwater species, and also threatens the longevity of infrastructural facilities especially those erected on water. This is a difficult situation to handle as naturally sand-endowed countries are involved in the exportation of sand to countries that demands it thereby contributing positively to the exporting countries gross domestic product and overall economic growth rate.

The problem therefore lies in either to adhere to environmentalist warning by halting or reducing the rate of sand mining thereby reducing GDP of countries or to continue with sand mining activities which increase countries GDP and create employment opportunities.

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Aggregate Mining

Aggregate mining which entails both sand mining and gravel extraction is a daily global activity witnessed in both developed and developing countries (Draggan, 2008). Globally, out of the 59 billion tonnes of material mined yearly (Steinberger, Krausman & Eisenmenger, 2010), aggregate mining accounts for about 68% to 85% making it the fastest extraction (Krausmann, Gingrich, Eisenmenger, Haber & Fischer-kowalski, 2009). Sand is a heavy grainy resource that consists of tiny pieces of rocks and minerals that form in water channels such as rivers and beaches, and also can be seen in deserts (Tariro, 2013). Sand is a material identified as having loose, gritty particles of disintegrated rock that are often deposited along shores of water bodies, in river beds, or desert dunes (Shaffer, 2006). Even more concisely, Atejioye and Odeyemi (2018) perceived sand to be an underground geological resource formed from eroded mountain rocks carried by streams and rivers. One can draw inference from the above definitions by saying that sand is first a natural resource that is loose in appearance, and emanates from loose rocks and can be seen along/in shores, in water channels.

The importance of sand as a natural resource is given by the fact that, after fresh water, sand is seen as the next most consumed natural resource on this planet (Villioth, 2014). Sand accounts for one of the largest amount of natural material extracted globally (Peduzzi, 2014). In sharp agreement, United Nations Environment Programme (2014) asserts that sand and gravel are the widely used natural resources only next to water.

A major way to analyse global aggregate utilization is to examine the production of cement for concrete which is made using cement, water, sand and gravel (United Nation Environment Programme, 2014). Countries production of cement reached a staggering figure of 3.7 billion tonnes in 2012 (USGS, 2013a), and for each tone of produced cement, construction industry requires more than 7 tonnes of sand and gravel, which makes the world's use of aggregate in 2012 to be around 29.6 billion (USGS, 2013b), a figure that is enough to build a concrete wall of about 27 metres high and 27 metres wide round the equator (UNEP, 2014). This excessive rise in the demand of sand whose primary aim is to facilitate economic activities is on one hand generating revenue and profit for government and companies respectively, while on the other hand, is a major cause of serious environmental issue owing to these facts: that its renewal rate is far below its consumption rate, and that it impacts negatively on the environment. Environmental concerns occur when extraction rate of sand exceeds the natural renewal processes of sand generation (Mattamana, Varghese & Kichu, 2013). The increasing request for sand can be linked to its importance and role in construction and other uses which currently make it indispensable (Kori, & Mthanda, 2012). Sand is a key developmental component utilized in the modern world (Tayler, 2018) which is employed in the production of outputs ranging from concrete to glass to asphalt to electronics, and also is central to man's daily economic activities (Delestrac, 2013). Sand is utilized in the construction of projects with both economic and social value such as land reclamation, construction of artificial islands and coastline stabilization. These however are not without environmental consequences (Ashraf, Maah,Yusoff, Wadij & Mahmood, 2011). This multidimensional use of sand has given rise to an exponential consumption rate and this trend is expected to continue due to population growth and increased demand for improved standard of living (Gavriletea, 2017). Considering the fact that deserts cover almost 20% of Earth's land surface and 20–30% of the world's deserts are covered by sand (Harris, 2003), one may erroneously conclude that this thus meets the

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demand for sand. This is an incorrect assertion because desert sands have continuously failed to meet industry required standard (Gavriletea, 2017), because wind erosion in deserts makes it difficult for sand grains to bind together (Zhao, Li, Zhuo, Guo, Liao, & Xie, 2014).

Nurhasan and Saputra (2018) described mining as involving the extraction of valuable minerals and/or other geological materials from the earth, usually from an ore body, lode, vein, seam, and reef or placer deposit; with these deposits forming mineralized package that is economically beneficial to miners (Amir, 2016). Sand extraction is a worldwide activity in both developed and developing countries as was realised by Draggan (2008). Sand and associated sediments mining is the removal, excavation, extraction, quarrying or dredging of sand, gravel, rocks, boulders and other deposits from the bed, bank, or floodplain of a river, or from a river reserve (Environmental Conservation Department, 2000). From environmentalist perspective, Saviour and Stalin (2012) simply defined sand mining as the process of extracting sand and gravel at a level that makes it become an environmental issue. This therefore means that the process of removing sand from its natural configuration is referred to as sand mining (Ashraf, Maah,Yusoff, Wadij & Mahmood, 2011). Sand deposits can either be based terrestrially or in marine (Gelabert, 2016). Terrestrial sources include residual soil deposits, river channel deposits and floodplain alluvial deposits, with the most common marine sources being shore and offshore deposits (Gelabert, 2016). According to Kowalska and Sobczyk (2014), sand deposits are located in the majority of areas on the mountain and river valleys which are often environmentally valuable regions. Being expensive than terrestrial exploitation, developed economies utterly involved in offshore dredging as a result of the cost of specialized equipment and special environmental permits required (Pereira, 2016). The Environmental Conservation Department (2000) identified three methods of extraction in relation to sand mining which are; Mechanical method that pertains to the use of construction machinery such as excavator, backhoe, bulldozer; Hydraulic dredging involving specially built equipment to dredge sand, either by excavation, dragging or suction; and finally, Manual method that involves the use of manpower with hand shovel, scoop". Globally, sand mining is mainly carried out on rivers and associated environments where excavation equipments are readily available (Gurubachan, Meht, Sharma, Chawla, Joshi, & Yaduvanchi, 2005). Atejioye and Odeyemi (2018) note that as large scale excavation may require heavy equipment or rubber-tired front-end loaders, small-scale terrestrial sand miner in Nigeria, excavate and load mined sand on trucks by hiring labourers that make use of shovels. According to Greory (2017), before sand get to buyers, it goes through these processes; first is to extract sand either from pit or underwater using suction pipe to suck the sand; secondly, the extracted sand is being transferred into a truck and conveyed to the processing facility; thirdly, the extracted sand will undergo a sorting process where it will be mixed with water into a slurry' fourthly, the mixed sand will be thoroughly washed and the sand that settles at the bottom of the slurry will pumped out and crushed into desired shape; and finally, the processed sand will be transported to the demand location either through trucks or boats which solely depends on the delivery location. Sand mining to a large extent has contributed immensely to the growth of countries over the years; this therefore means that there are significant economic gains associated with sand mining. The diagram below shows the classification of sand comprising its method of formation, composition, and the distribution of grain size.

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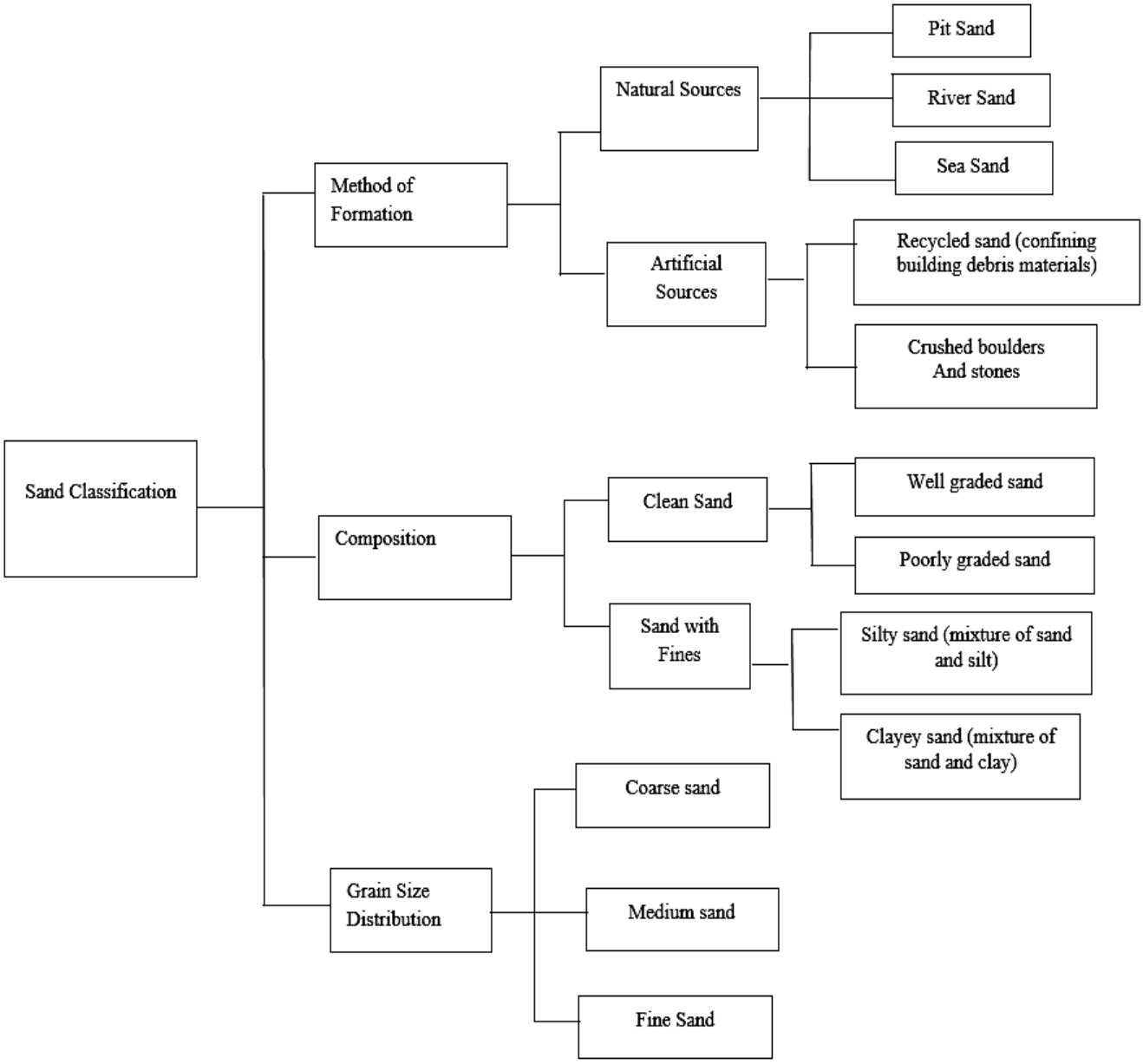

Figure 1: Classification of sand, adopted from Gavriletea, (2017).

Economic Gains of Aggregate Mining (Sand and Gravel)

Over the years, economists in their long debated arguments have all suggested how best to create and sustain economic stability in regard to national income or output, full employment, and probably the control of inflation and deflation both in the short and long run. From our basic knowledge of economics, recall that in the national flow of income in a two sector economy, the two key players are the household and the business firms. We thus know that the sum of the household's consumption and the business firm's investment gives us a numerical value which we equate as our aggregate expenditure or aggregate demand within a

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given period. Our focus however will be on consumption and investment demand as they contribute to national income corresponding to full employment by singling out the contribution of sand mining to the Gross Domestic Product of countries.

A positively skewed economic growth being the bedrock of long-term sustainability is an indicator that human development, social welfare, employment, purchase power and productive capacity are all moving progressively in line with the growth plan of an economy (Łukasz, 2014; Kemal, Hale & Husam, 2020). The two main contributors to the neoclassical growth theory are Robert Solow and J.E Meade. According to Gabriel (2018), the neoclassical theory maintained that independence decision-making should be encouraged with little or no interference from government. The tenet of this theory rests on being able to shape economic activities only when the role of government has been reduced intensely. He further explained that in relation to the neoclassical theory, the category that gets wealthy do so by hard-work and frugality while those who become poor do so by profligacy and laziness. According to Supriya (2014), neoclassical growth theory laid emphasis on; firstly, capital accumulation as an important determinant of economic growth. Secondly, the amount of available unskilled labour, and thirdly, the utilization of technology which is likely increase labour productivity. One would then wonder, if government is encouraged to limit its involvement in the economic activities; who then regulates the over-bearing powers of most private investors. The global demand for sand utilization has leaned towards the natural law of demand which states that as the demand for a commodity increases, its corresponding price is likely to increase; this has consequently caused the price and demand for sand increase.

Due to the abundant availability of sand, rural dwellers have been able to upgrade themselves economically which are evident in the erection of strong durable building for their inhabitation (Madyise, 2013); the creation of employment for both youths and adults who are utilized as loaders that move sand to dispatch trucks (Sada & Shestha, 2013); as well as improving the quality of road networks (Mngeni, Musampa & Nakin, 2016). Being a developing country, Singapore is rapidly developing infrastructural facilities to meet up with its population which grew from 1.63 million in 1960's to 4.84 million in 2010 (UNEP, 2014), so is growing their need to import sand for the construct of infrastructures. Also, bearing in mind that Singapore is a small country; their need for space has made them utilize most aggregates in reclaiming land from the sea needed for infrastructures thereby increasing its land space at about 20% in about four decades (Aquaknow, 2014). Singapore's importation of 517 million tonnes of sand in the last 20 years makes them the world's top ranked importers of sand (UN Comtrade, 2014); excluding alleged illegal sand trade (Global Witness, 2010).

The human population on earth as at 2011 was estimated to be around seven billion, and even till now, there is a continuous global population growth (Gavriletea, 2017). According to the United Nations Department of Economic and Social Affairs Population Division (2014), about 54% of the global population dwell in urban cities and is expected to rise to 66% by 2050. This continuous growth in population will increase the global aggregate demand for houses therefore putting pressure on governments and construction companies to tackle the problem of accommodation (Gavriletea, 2017).

Having this in mind, it should also be noted that concrete being the core material used in construction (BCET Staff, 2016) is invariably making the demand of sand and gravels

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explode (UNEP, 2014). The value of sand and gravel imported by Qatar as at 2012 stood at $6.5B (Schoof, 2014), which makes them the highest importers of sand at that particular period (Gavriletea, 2017). Also within same year, United Arab Emirate import value of sand, stone and gravel was $456M (Churchill, 2016), and China alone constructed 146,400 kilometers of road in a year (EDE, 2013) which is an indicator of global demand for aggregates. Dubai City in United Arab Emirates is among the few cities in the world with stunning architectural piece which implies that huge amounts of tension have been laid on marine aggregate for the erection of such master class (UNEP, 2014). The construction of Palm Jumeirah an artificial island in Dubai required 186.5 million cubic metres of sand and 10 million cubic metres of rock costs a stunning US $12 billion (Jan De Nul group, 2013). United Arab Emirate having exhausted its marine sand had to import sand from Australia for the construction of projects such the Burj Khalifa tower which is 828 meters making it the tallest building in the world (Delestrac, 2013).

Analytically, we shall examine the top global exporters of sand in 2019, top 5 importers of sand in 2019, countries with highest import tariffs, countries with highest export tariffs, fastest growing sand exporting countries, and fastest growing sand importing countries in tables and graphs.

Table 1: Top 15 Sand Exporters by countries in 2019

S/N	Countries	Export Value (Million Dollars)	Percentage Rate (%)
1.	United States	461.3	27.7
2.	Netherlands	225.6	13.5
3.	Germany	133.4	8.0
4.	Belgium	120	7.2
5.	Australia	97.9	5.9
6.	France	53.8	3.2
7.	Egypt	41.6	2.5
8.	Saudi Arabia	38.6	2.3
9.	Taiwan	36.6	2.2
10.	Malaysia	32.3	1.9
11.	Vietnam	30.5	1.8
12.	Canada	28.4	1.7
13.	Mozambique	25.4	1.5
14.	United Kingdom	23.3	1.4
15.	Portugal	22.9	1.4

Source: Adapted from Workman (2021).

Table 1 above shows the value of exported sand and its associated percentage rate as performed by fifteen (15) countries in 2019. United States of America is the highest exporters of sand with an export value o 461.3 million dollars representing about 27.7% of global export. Portugal on the fifteenth position had an export value of 22.9 million dollars representing a value of 1.4% of the world's global export.

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Table 2: Sand Exports made by continents in 2019

S/N	Continents	Export Value (Million Dollars)	Percentage Rate (%) (Global Export Rate)
1.	Europe	579	34.7
2.	North America	489.7	29.4
3.	Asia	138	8.2
4.	Australia	97.9	5.9
5.	Africa	67	4.0

Source: Researcher's conceptualization (2021)

In terms of the contribution of continents to global sand exports, the key continents are; Europe, North America, Asia, and Africa. The first placed continent is Europe with participating countries including; Netherland, Germany, Belgium, France, United Kingdom, and Portugal with a cumulative export value of 579 million dollars with a percentage rate of 34.7% of global export rate. The second placed continent is North America where only United State and Canada made the top 15 global exporters of sand with a dollar value of 489.7 million dollars with a percentage rate of 29.4% of the global export rate. The third placed continent is Asia where key participants are Saudi Arabia, Taiwan, Malaysia, and Vietnam with a dollar value of 138 million dollars at a percentage rate of 8.2% of the global export rate. The forth continent on the list is Australia with a value of 97.9 million dollars representing 5.9% of global export rate. Finally, Africa had just two representatives in Egypt and Mozambique with dollar value of 67 million dollars representing 4.0% of global export rate.

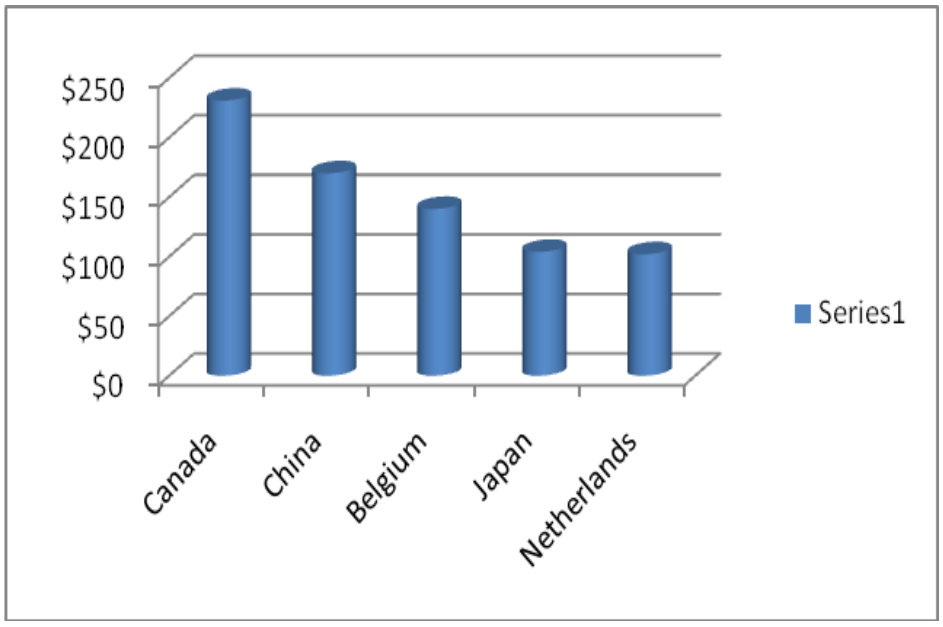

Figure 2: OEC Sand Importation by Countries, 2021

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The Graph above shows the value of sand importation made by five Countries. Globally, Canada is the highest importers of sand with a value of about $231 million, with China second in rank with an import value of $170 million, while Belgium, Japan, and Netherland are the other countries that make up the top five with values of $140 million, $104 million, and $102 million respectively.

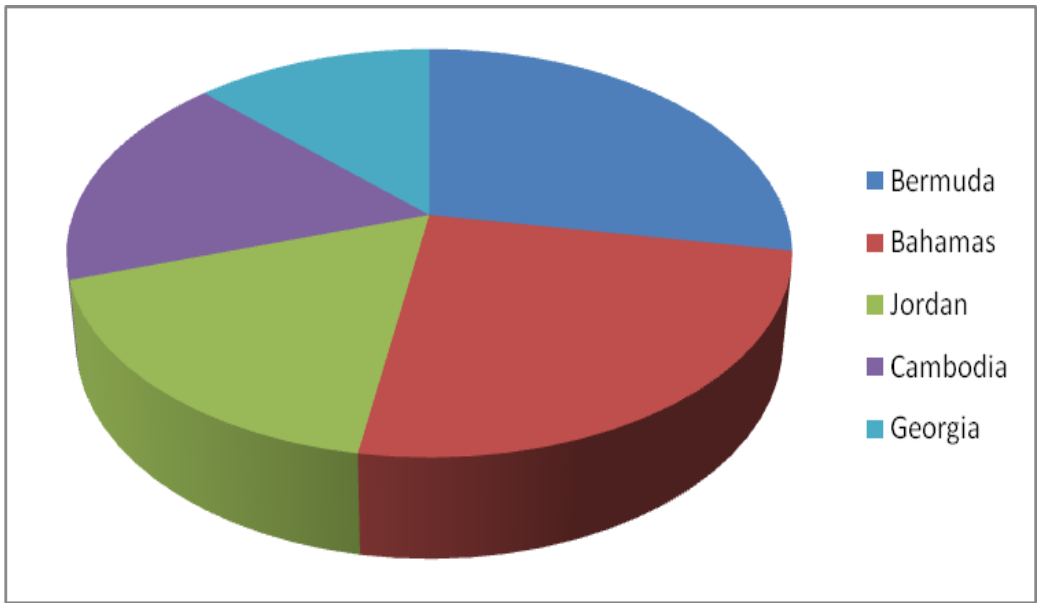

Figure 3: OEC Sand Importation Tariff, 2021

The chart above represents the countries with the highest rate of tariff imposed on the importation of sand. Worldwide, Bermuda is the country that places high tariff on the importation of sand, with a percentage rate of 25%, while Bahamas, Jordan, Cambodia, and Georgia have their rate at 22.3%, 15.6%, 15%, and 11.4% respectively. However, countries like Angola, Kenya, Mauritius, Rwanda, and Tanzania all have zero tariffs on the importation of sand.

According to the Observatory of Economic Complexity (2019), between 2018 and 2019, there seems to be a tremendous growth in the export and import of sand; "the fastest growing exporting countries and their values include; Philippine ($21.6m), Oman ($20m), Myanmar ($11.5m), Australia ($11.4m), and Vietnam ($7.29m); while the fastest growing importing countries are Hong Kong, United Arab Emirates, Chinese Taipei, Turkey, and Iran with import value of $34.2m, $15.9m, $5.56m, $5.54m, and $3.39m respectively".

In-spite of the tremendous contribution of sand mining to the economic development of countries, it is not without environmental challenges as environmentalists more than ever are speaking up as regards the danger of sand mining. This will be discussed in details in the subsequent section.

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Environmental - Ethical Issues in Sand Mining

Ethics pertains to the analysis of what is good or bad and what can be termed as a right or wrong behaviour which usually occurs in the framework of making ends meet (Tota & Shehu, 2012).

More differently, the utilitarianism ethical theory which is a form of consequentialism determines right from wrong by focusing on outcomes (McCombs Business School, 2021). Utilitarian theory emphasizes on the greatest good for the greater number of people (Gareth, 2000). However, a major limitation in this theory rests on the fact that since the future cannot be predicted, it then makes it difficult to tell if the consequences of an action will be good or bad (McCombs Business school, 2021). However, in sharp contrast to the neoclassical theory which advocates a capitalist economic system where private individuals rather than governments determine the production and distribution of goods and services; also states that there should be less government interference in economic activities, Siam (2018) explained that the constraints of capitalism on the basis of ethics are inequality and waste. *Inequality* in capitalism does not in any way promote equality of opportunities. Individuals who do not have the necessary support needed may never make it to the top. The idea that "if you work hard enough you will get rich" is a fallacy. *Waste* in a capitalist society where there is uneven distribution of resources, waste is inevitable. Whenever these excess resources do not find their way to the poor, the tendency of being wasted will be extremely very high.

From the researchers' observation global hardship seems to have ushered an era characterised by abandonment of code of ethics as individuals, groups, and organizations have swayed form approved behaviour towards embracing unethical practices which heightened unemployment is a key contributing factor. Economists over the years have continued in their stead of achieving economic stability both in the short and long run rather than paying attention to environmentalist cry of economic morality. Tota and Shehu (2012) opined that economists' understanding of ethics will adequately improve the quality of their policy formation, implementation, and evaluation since they have a good knowledge of what informs individuals moral behaviour.

In the global mining of sand, there seems to be varying opinion as regards its positive and negative environment impact as well as its positive and negative impact on an economy. The argument exists between environmentalists on one side, and economists on the other side. This thus gives rises to the concept of ethical dilemma; which refers to the complexity of situation an individual or business is faced with, which urgently requires that a decision be made in regard to an action (Harrison, 2005). A dilemma may arise from the conflict between the rightness and wrongness of an action as well as how good or bad the consequence of the actions turns out to be (Tota & Shehu, 2012). From environmentalists' perspective, as given by UNEP (1992), "continuous mining of sand is lowering the productive capacity of land either temporary or permanently". While from an economist point of view, sand mining has been a key source of employment creation for both urban and rural dwellers which is contributing immensely to the gross national product of countries.

Tayler (2018) warned that sand mining has negative significant ecological and social impact on an environment. In terms of the ecological impact of sand mining to an environment, Mingist and Gebremedhin (2016) reveal that aggregate mining had a number of negative impacts on local fish populations when spawning surface are destroyed, continuously altering

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the escape routes of large fishes, thereby being the cause of large scale fish being killed. Aggregate Fish are usually threatened by suction dredging pipes during their embryonic stages (Harvey & Lisle, 1998). For instance, an endangered crocodile was found in Asian river systems which mean that of sand mining is destroying sand banks where these animals bask (Torres, Liu, Brandt & Lear, 2017). Arguably, Rempel and Church (2009) conducted an experiment in the Fraser River, British Columbia, Canada, to discover that there was no threatening impact on local fish community. They also revealed that the temporal experimental mining altered both the abundance and diversity of invertebrates, after which the experimented region was restored to normal thereby ensuring that the mined area disappeared after a flood event (Tayler, 2018).

Aggregate mining does not only affect ecology of rivers but also the community within the river catchment as it causes concern for the state of infrastructures, availability and quality of groundwater, and the continuous eroding of productive land (Tayler, 2018). Mining activities conducted on rivers are seriously threatening the longevity of bridges in particular, which is evident in the observation of Ming-wang, Jyh-Jong, Yii-Wen and Meng-Hsiung (2014) when they reported that four of the five failed bridges in Bachang River Taiwan failed as a result of high rate of sandstone and sand mining extraction. Also, in certain regions, underwater cables and gas-lines have been terribly exposed due to aggregate mining activities (Rinaldi,Wyżga & Surian, 2005), thereby endangering the lives of people. The continuous extraction of gravel and sand (aggregate mining) has been linked to flooding in Nogalte Stream, Spain (Ortega-Becerril, Garzon, Bejar-Pizarro, & Martinez-Diaz, 2016) and the increased risk of flood in Poyang Lake in China (Nakayama & Shankman, 2013).

In regards to groundwater availability and quality, as water levels continue to deplete, wells may cease to give out water to users (Kondolf, 1993; Rinaldi, et al., 2005) and is likely to hamper or limit the water usage needed in for human consumption, agricultural activities, and gross economic setback.

Owing to the fact that sand is probably everywhere, individuals, groups, and communities are on daily basis getting involved in its mining both legally and illegally paying less or no attention to its environmental repercussion (Draggan, 2008); which now leads us to scrutinizing the global operations of sand mafias. Sand mafias operate globally, as they are involved in the mining and exchange of sand for monetary rewards in avenues that have negative impact on the social, environmental, and economic configuration of a country (Khan, 2020).

The sand industry is a multi billion industry with a staggering figure of about USD 60 billion (Khan, 2020). Technically, this industry alone is far richer monetarily than some countries due to the growing nature of these industries. Tweedie (2018) explained that construction companies as much as possible avoid purchasing expensive sand from licensed miners thereby engaging in illegal activities such as going to a remote area and blasting their sand, or suck up marine sand with suction pipe or more extremely they can steal away beach and dismantle an entire island with the help of sand mafias.

Sand Mafias have their activities running from Jamaica to Morocco to India and Indonesia as they continuously destroy habitats, make away with virtually all the sand in beaches in just a single night as they render farming portions and fishing ground unpleasant, and even threaten environmentalists, investigative journalists and even more extremely, honest security agents

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are often inflicted with life threatening injuries and death (Khan, 2020). In a small village in Jamaica, the villagers reported to the authority that on a particular night, a group of people that are fully armed with guns came with trucks and stole their beach away right in front of them (Fritts, 2019). Yearly in Morocco, about 10 million cubic meters of sand supplied are all traced to illegal coastal sand mining (Au fait, 2011) where sand smugglers degraded a large beach to become a rocky landscape between Safi and Essouira (Economiste, 2005; Khardijamal, 2011). Sands extracted from beaches are usually used in building hotels, roads, and other tourism – related infrastructure (UNEP, 2014). Pegged among the most dangerous and influential criminal organizations in India, the "sand mafias", consists of individuals who control both construction firms and administration through their political affiliations, making them an impenetrable organized crime groups in India (Aiyar, 2013; Delestrac, 2013). This group is responsible for a number of deaths in India ranging from government officials, policemen, and to the least, ordinary people who speak in favour of halting and dismembering their activities (Beiser, 2018).

One major economic consequence of the sand mafia's activities is depletion of natural resources, resulting in much agricultural land becoming uncultivable (Khan, 2020). This invariably makes it cumbersome for farmers to earn a living from occupation (Torres et al., 2017; ABC News Australia, 2017), and as a consequence, the immediate economy suffers (Khan, 2020). Another critical economic impact of sand mining is that sand mafias' wherever they domicile usually employ more people than the government or other privates investor are currently doing, thereby breeding a corrupt group system that covers-up sand theft and other social disturbances (Khan, 2020).

From 1995 to 2001, the monetary value of sand imported by Singapore was USD 3.00 per tonne, but this increased to USD190 per tonne between 2003 to 2005 (UN Comtrade, 2014) thereby making it a lucrative business for local sand mafias (Global Witness, 2010), which explains part of the disappearance of sand Islands in Indonesia. Export of sand to Singapore was reported to be responsible for the disappearance of some 24 Indonesian sand islands which triggered political tensions regarding maritime borders between the Singapore and Indonesia (New York Times, 2010; Guerin, 2003) as this was followed by a decline and temporary ban on sand exportation to Singapore in 2002 (Guerin, 2003). This disappearance was as a result of the increase in the price of sand going to Singapore.

Also, it is painful to note that the City of Dubai having exhausted so much sand to construct projects, it was observed that about 31 percent of office space was vacant in the centre of Dubai (Jones, 2013); this means that the economic impact was not duly ascertained. Other palm projects like The Palm Jebel Ali and The World islands project which cost US $14 billion to construct and required 450 million tonnes of sand with only a few of these islands currently hosting infrastructures having exhausted marine sand resources in land reclamation projects (Delestrac, 2013).

Amalie (2020) shared the following experiences of the African countries he visited which are Ghana, Kenya, and Benin Republic. Starting with Ghana, he reported that the coastal regions in Ghana have been deserted as there was no swimming and other beach activity which is a result of beach sand mining and as a consequence made the beach rocky and unkempt. In kemboi sand mine in Kenya, children meant to be school are forced by either their parents or guardians to miss classes and work at sand site to load sand into trucks to enable them raise money for the purchase of school items. Finally in the Republic of Benin, it was reported that

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the main diggers of sand are women and youths who earn around USD87 to USD125 per truckload which makes earn higher than the average salary workers in the country. This implies that more people are likely to engage in sand mining as a result of the attractiveness of pay.

Elsewhere from the Western part of Nigeria, Adedeji, Adebayo and Sotayo (2014) reported that aside the negative environmental impact of sand mining, other infrastructures like roads, water and electricity are constantly damaged by illegal sand miners. They reported that in Lusada area of Ado- Odo/Ota LGA, electricity poles are frequently knocked down by illegal miners and recklessly abandoned regardless of the blackout which will be experienced by electricity users. Also they warned that in Shagamu, the base of electricity substation had been extracted thereby exposing the whole area to erosion. More worrisome is the fact that these illegal miners have removed the base sand of high-tension wire.

From this brief review, the ethical dilemma that still exists is hinged on whether neither to tilt towards the side of the environmentalists that are a seriously speaking up on the dangers that surround unregulated aggregate mining nor to stand with the economists that have been emphasizing on maintaining economic stability and not preaching economic morality.

Theoretical foundation of aggregate mining and environmental sustainability

In the 1960s, there was as an outcry from the public as a result of the excessive activities of self-interested individuals and organizations who were overusing shared resources such as land, water, and fish without considering their rate of replacement (Dyer, 2018). As regard the issue of resource overuse, a Green United Nations conference was held in 1070s aimed towards explaining and understanding the political behaviour behind individual and organizational utilization of shared resources. The outcome of this conference brought about the emergence of the Green theory which firmly serves as the theoretical underpinning of this study. This Green theory can also be described as green political theory, or ecologism, or environmentalism or ecological political theory or environmental political theory (Barry & Dobson, 2003). Green political theory focuses on issues with political and philosophical background existing among human and non-living entities, animals' moral importance, and the role of ethics in restricting harmful political behaviours and the aftermath of technological innovation on the entire environment (Barry, 2013). It also considers the economic and political impact of climate change, overconsumption of natural resources, and the levels of global inequalities (Barry, 2013).

Before the introduction of Green theory, there has been a huge contest between liberalism and environmentalism in regard to the well being of the environment. While liberalism focuses on human right regarding choice and consumption and not concerned with the implication of man's consumption, environmentalism on the hand seeks the establishment of practical structures that identifies environmental issues by attempting to make room for policies that protect the environment from abuse (Dyer, 2018).

Green theory is characterized by radical changes as it continuously challenges recent political, social, and economic structures which give backing to liberalism regarding the environment as it transcends beyond environmentalism and political agency. Green morality emphasized on the need to curtail human material procurement by preserving the interest of non-human environment, this however restricts man's right to consume as much as required

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(Dyer, 2018). Green theory is centered on strict moral vision which promotes green theory of value that is independent of political theories (Goodin, 1992).

As regard the implication of excessive consumption and abuse of aggregate extraction, Green theory is a better fit in explaining and understanding the repercussion of economic and political actions and intentions. Both legal and illegal aggregate extraction is a global issue that requires urgent attention as a result of an existing imbalance between the usage and replacement rates of sand and gravel. While the legal mining on one hand features participants like government of nations, individuals, and organizations who genuinely extract sand for the benefit of the society, illegal miners are those that extract sand and gravel without an authority backing their action to indulge in such. These illegal miners are also called sand mafias who on extreme cases kill and maim people who oppose their self interest.

Policy Implication

In as much as mining of natural resources are seen as contributing to economic growth, they also have serious negative impacts on the environment such as reduced rate of tourism due to continuous disappearance of beach sand by sand mafias (Kondolf, 1997); reduced fishing activities for commercial and subsistence purposes (Cooper, 2013; Desprez, Pearce & Le Bot, 2010); reduced farming activities affected by continuous loss of land emanating from marine erosion (John, 2009); reduced presence of insurance companies as a result of floods (Kondolf, 1997); droughts (John, 2009); and storm spurt through ineffective protection of beach fronts (Thornton, Sallenger, Conforto, Egley, McGee, & Pearsons, 2006).

In developing countries, the establishment of aggregate mining is without clear understanding of projects consequences where proper environmental impact assessments ought to have been ascertained ab initio (Maya, Santhosh, Padmala & Kumar, 2012; Saviour, 2012). Before now, aggregate extraction was done in land quarries and riverbeds; however, navigation towards marine and coastal aggregates mining indicates a decline in the available inland resources which also means that aggregate mining has affected the provision, protection and regulation of ecosystem services (UNEP, 2014), and With construction boom currently being experienced in Africa and Asia over the past two decades, it thus means that further heavy aggregate mining may still be witnessed globally (Rachel, 2019). Unavailability of extraction information in developing countries is a mishap that has limited the regulation of aggregate mining activities (Sreebha & Padmalal, 2011), with an exception of the European Union, inadequate regulatory efforts have resorted to illegal mining which triggers serious damage to the environment and ecosystem alike (UNEP, 2014).

Man's ever increasing demand for sand now poses sustainability challenges in this 21st century, as addressing these challenges require improved governance of global resources which political leaders ought to be strongly involved in this course (Rachel, 2019). In curbing irresponsible and illegal mining of aggregate extraction, UN environment programme (2019) in a report suggests customizing of existing standards and best practices aimed towards investing in sand production and consumption measurements, through monitoring, planning, and establishing dialogue between players and stakeholders in sand value chain based on transparency and accountability.

According to the UNEP Global Environmental alert Service (2014), excessive aggregate mining can be regulated if the following can be adopted and strictly adhered to;

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1. Reducing pressure on sand utilization can be made possible through efficient use of existing building and infrastructure. Also, recycling old buildings on the other hand can be a major source of obtaining sand substitute. Quarry dust can stand in as sand substitute when producing concrete structure (Khamput, 2006). It has been reported that desert sands can be utilized when mixed with essential materials (Cisse , Tamba, Diop & Sissoko, 2012; Zhang , Song, Yang & Liu, 2006)

2. The belief that sand is everywhere prompts people to conveniently extract it for whatsoever the purpose maybe thereby neglecting the repercussion of their actions. In a bid to tackle this environmental degradation, it therefore behooves the government of countries to increase tax on aggregate extraction in order to make sand alternatives attractive.

3. The roles of political leaders in managing the environmental impact of aggregate mining can no longer be ignored as these leaders are of the opinion that aggregate mining is yet to qualify as an issue that makes up their political discourse. Reason for this could be because sand disappearance is yet to reach the level of economic scarcity.

CONCLUSION

Reviewing and analyzing the concept of aggregate mining, its economic gains, ethical issues, policy implication has been the focus of this study. Deliberate attempts were made by the researcher to render clear and simple explanation regarding the universe, the earth and its existing natural resources. Among the existing natural resources, sand was specifically singled out because it holds the status of being the only most utilized natural resources only next to water yet having its consumption rate below its renewal rate when compared to other resources. Having based this research on existing data, statistics of how sand mining has been contributing to economic development reviewed as well as the environmental impact of excessive and illegal mining activities. In-spite of the outcry of environmentalists on the continuous degradation of the environment, it is however important to achieve and sustain economic stability both on the long and short run. In paying attention to the environmental impact of excessive aggregate mining, one should also bear in mind that man was not made for the environment but rather, the environment and all that exists therein were made for man as this is the view of liberalism on which social, economic, and political structures are built on. Regardless of the economic gains of sand mining, government of countries ought to establish strict policies regarding aggregate mining which is likely to environmental harm on both land and sea.

Finally, a balance rather than a quagmire ought to be established and maintained between excessive mining which promotes economic development on one hand, and the safety of the environment to prevent environmental degradation.

The researcher stands against illegal practices of sand mining and the harmful activities of sand mafias which have caused serious damage to the environment and have failed in all ethical standards. I believe the motive behind their activities is not on the greater good for the greater number of persons, and then their activities should be abhorred.

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DOI URL: https://doi.org/10.52589/AJESD_OJMI5DWD

References

Adedeji, O., Adebayo, H., & Sotayo, E. (2014). Assessing environmental impact of inland sand mining in parts of Ogun state, Nigeria. *Ethiopian Journal of Environmental Studies and Management 7(5).*

Aiyar, S. (2013). Between rock, sand and a hard place. Times of India. https://timesofindia.indiatimes.com/blogs/Swaminomics/between-rock-sand-and-a-hard-place/

Amalie, E. (2020). Blog: its destroying infrastrure,degrading ecosystems and risking lives: the environmental threat you've never heard of. https://afralliance.org/knowledge-hub/afrialliance-blog/blog-its-destroying-infrastructre-degrading-ecosystems-and-risking

Amir, A. (2016). A Review on the Impact of River and Inland Sand Mining on Nigerian River Basins. Being A Preliminary PhD. Literature Review And Conceptual Framework Submitted To The Department Of Geography, Faculty Of Social Sciences, Federal University Dutsin-Ma.

Anthony, W. (2009). Earth as a Planet. GEOLOGY – Vol. I.

Aquaknow .(2014). Sand mining- the 'high volume – low value' paradox. Aquaknow. <http://www.aquaknow.net/en/news/sand-mining-high-volume-low-value-paradox/> (accessed 10.08.20).

Ashraf, M. A., Maah, J. M., Yusoff, I., Wadij, A., & Mahmood, K., (2011). Sand Mining Effects, Causes and Concerns: A Case study from Bestarijaya, Selangar Penisular. Malaysia. Scientific Research and Essays V6 (6), 1216-1231.

Atejioye, A.A. & Odeyemi, C.A. (2018). Analysing Impact of Sand Mining in Ekiti State, Nigeria Using GIS for Sustainable Development. World Journal of Research and Review (WJRR) Volume-6, Issue-2, Pages 26- 31. ISSN:2455-3956.

Au fait, (2011). Pillage et vol de sables de mer et des dunes du littoral : Le Conseil de gouvernement adopte un
projet de loi incriminant , 4 May 2011. Au fait. <http://www.aufaitmaroc.com/actualites/science environnement/2011/5/4/le-conseil-de-gouvernement-adopte-un-projet-de-loi-incriminant#.UvANMva5e2w> (accessed 10.08.20).

Barry, J. (2012). *The Politics of Actually Existing Unsustainability: Human Flourishing in a Climate Changed, Carbon-Constrained World*, (Oxford: Oxford University Press).

Barry, J. and Dobson, A. (2003), 'Green Political Theory: A Report', in Kukathas, C. & Gaus, G. (eds), (2003); *Handbook of Political Theory* (London: Sage).

BCNET . (2016). Concrete: The World's Most Widely Used Construction Material. February 2016. Available online: http://www.bostoncommons.net/concrete-the-worlds-most-widely-used-constructionmaterial/

Beiser, V.(2018). "Dramatic Photos Show How Sand Mining Threatens a Way of Life in Southeast Asia." National Geographic News. March 15, 2018. https://www.nationalgeographic.com/news/2018/03/vietnam-mekong-illegal-sand-mining/.

Article DOI: 10.52589/AJESD_OJMI5DWD
DOI URL: https://doi.org/10.52589/AJESD_OJMI5DWD

Churchill, N. (2016). Strange but True: The UAE Imports Its Sand. Edgardaily.com. May 2016 Available online: https://edgardaily.com/en/life/2016/strange-but-true-the-uae-imports-its-sand-31668

Cisse, A., Tamba, S., Lo, M.L., Diop, M.B., Sissoko, G., (2012). Contribution to Improving the Performance of Concrete: The Case of the Use of Desert Sand of the Region of Dakar. Research Journal of Environmental and Earth Sciences 4(12), 1071-1078.

Cooper, K.M. (2013). Setting limits for acceptable change in sediment particle size composition: Testing a new approach to managing marine aggregate dredging. Marine Pollution Bulletin 73, 86-97

Delestrac, D. (2013). *Sand Wars*. Rappi Productions & La Compagnie des Taxi-Brousse.

Delestrac, D.(2013). *Le Sable : enquête sur une disparition*, film documentary broadcast on Arte channel, May 28, 2013.

Desprez, M., Pearce, B., Le Bot, S. (2010). The biological impact of overflowing sands around a marine aggregate extraction site: Dieppe (eastern English Channel). ICES Journal of Marine Science 67(2), 270-277.

Diksha (2015).Difference between sand and soil. http://differencebetween.info/difference-between-sand-and-soil assessed date June, 28th, 2021

Draggan S .(2008). Encyclopedia of Earth. Sand and gravel. Washington DC

Dyer, H. (2018). Introducing Green Theory in International Relations. https://www.e-ir.info/2018/01/07/green-theory-in-international-relations/

Economiste .(2005) La guerre du sable, l'Economiste, edition N°2063, 15 July 2005. <http://www.leconomiste.com/article/safi-la-guerre-du-sable> (accessed 10.08.20).

Environmental Conservation Department (ECD) (2000). Environmental Impact Assessment (EIA) Guidelines for River Sand and Stone Mining. Sabah, Malaysia October 2000.

Fritts, R. (2017). "Sand Mining Ban Lifted on Beach in Suriname, Causing Public Backlash." Mongabay Environmental News. March 27, 2017. https://news.mongabay.com/2017/03/sandmining-ban-lifted-on-beach-in-suriname-causing-public-backlash/.

Gabriel, S .(2018). Neoclassical economic theory. Available online at: https://www.mtholyoke.edu/courses/sgabriel/neoclassical_theory.htm

Gareth, R. (2000). Contemporary Management. USA; McGraw-Hill Hiher (eds.).

Gavriletea, M.D. (2017). Environmental Impacts of Sand Exploitation. Analysis of Sand Market. *Sustainability*. 9, 1118; doi:10.3390/su9071118 www.mdpi.com/journal/sustainability

Gelabert, P.A. (2016) Environmental Effects of Sand Extraction Practices in Puerto Rico in Managing Beach Resources in the Smaller Caribbean Islands'. Avaliable online: http://nsgl.gso.uri.edu/pru/pruw96001/pruw96001_pt-b1.pdf.

Global Witness .(2010). Shifting sand — How Singapore's demand for Cambodian sand threatens ecosystems and undermines good governance. Global Witness, London. pp. 48

Goodin, R. (1992) *Green Political Theory* (Cambridge: Polity).

Gregory, S. (2017). Top 20 Sand Exporting Countries. Available online: https://www.google.com/amp/s/www.worldatlas.com/amp/articles/top-20-sand-exporting-countries.html

Guerin, B .(2003). The shifting sands of time — and Singapore, Asia Times online, 31 July 2003. <http://www.atimes.com/atimes/Southeast_Asia/EG31Ae01.html> (accessed 01.08.20).

Article DOI: 10.52589/AJESD_OJMI5DWD
DOI URL: https://doi.org/10.52589/AJESD_OJMI5DWD

Gurubachan Singh, K. K. Mehta., R.C. Sharma. K.L Chawla., P.K. Joshi., N.P. Yaduvanchi . (2005). Technical bulletin on Sand mining/no mining in Agricultural fields in Haryana.
Harris, N.(2003). Introduction. In Atlas of the World's Deserts; Fitzroy Dearborn: New York, NY, USA, 1–7.
Harrison, M. (2005). An Introduction to Business and Management Ethics.
Jan De Nul group. (2013). Land Reclamation and Beach Replenishment, project U.A.E., Palm Island II in Dubai, 2002-2008. Jan De Nul group. <http://www.jandenul.com/en/activities/dredging-and-marine-works/land-reclamation-and-beach-replenishment> (accessed 10.08.20).
John, E. (2009). The impacts of sand mining in Kallada river (Pathanapuram Taluk), Kerala, Journal of basic and applied biology, 3 (1&2), 108-113.
Jones, L .(2013). Dubai real estate market overview. Jones Lang LaSalle. <http://www.joneslanglasalle-mena.com/ResearchLevel1/JLL_DXBQ2%202013.pdf> (accessed 01.07.20).
Jose A. Ortega-Becerril, J., Garzón, G., Béjar-Pizarro, M., & Martínez-Díaz, J. (2016). Towards an increase of flash-flood geomorphic effects due to gravel mining and ground subsidence in Nogalte stream (SE Spain, Murcia). Nat. Hazards Earth Syst. Sci. Discuss.
Khamput, P. (2006). A study of compressive strength of concrete using quarry dust as fine aggregate and mixing with admixture Type E. Department of Civil Engineering, Rajamangala University of Technology, Thailand.
Khan, S. (2020). Sand Mafias: Impact on the Developing World and Biodiversity Case. SAGE Publications: SAGE Business Cases Originals
Khardijamal .(2011). Maroc – Safi : La menace de la "guerre des sables" continue. Aug. 9, 2011. Khardijamal. <http://khardijamal.wordpress.com/2011/08/09/maroc-safi-la-menace-de-la-guerre-des-sables-continue/> (accessed 10.08.20).
Kondolf, G.M. (1997). Hungry water: effects of dams and gravel mining on river channels. Environmental Management 21(4), 553-551.
Kori, E., & Mthanda, H., (2012). An Assessment of Environmental Impacts of Sand and Gravel Mining in Nzhelele valley, Limpopo Province, South Africa.3rd International Conference on Biological, Environmental and Chemistry. IPCBEE. V. 46.
Kowalska, A. & Sobczyk, W. (2014). Negative and Positive Effects of the Exploitation of Gravel-Sand. In˙zynieria Miner. 15, 105–109.
Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K-H., Haber, H., Fischer-Kowalski, M., 2009. Growth in global materials use, GDP and population during the 20th century. Ecological Economics 68, 2696-2705.
Madyise, T. (2013). Case studies of Environmental Impacts of Sand Mining and Gravel Extraction for Urban Development in Gaborone. Master's Thesis. University of South Africa.
Mattamana, B. A., Varghese, S., & Kichu, P. (2013). River Sand Inflow Assessment and Optimal Sand mining policy Development. International Journal of Emergency Technology and Advanced Engineering. V 3.
Maya, K., Santhosh, V., Padmalal, D. Aneesh Kumar, SR. (2012). Impact of mining and quarrying in Muvattupuzha river basin, Kerala – an overview on its environmental effects. Bonfring International Journal of Industrial Engineering and Management Science 2(1), 36-40.
McCombs Business School. (2021). Utilitarianism. https://ethicsunwrapped.utexas.edu/glossary/utilitarianism

Article DOI: 10.52589/AJESD_OJMI5DWD
DOI URL: https://doi.org/10.52589/AJESD_OJMI5DWD

Mngeni, A., Musampa, C. M., & Nakin, M. D. V. (2016). The effects of sand mining on rural communities. Sustainable Development and Planning VIII.

Ming-wang, H., Jyh-Jong, L., Yii-Wen,P., & Meng-Hsiung, C. (2014). Rapid channelization and incision into soft bedrock induced by human activity - Implications from the Bachang River in Taiwan. Engineering Geology Published by Elsevier

New York Times. (2010). Indonesia's Islands Are Buried Treasure for Gravel Pirates, March 28, 2010. The New York Times. <http://www.nytimes.com/2010/03/28/weekinreview/28grist.html?_r=0> (accessed 10.08.20).

Nurhasan, U. & Saputra, P.Y. (2018) Analysis of Sand Mining Areas in Lumajang Using WEBGIS . Advances in Economics, Business and Management Research, volume 59. International Conference on Energy and Mining Law (ICEML 2018).

OEC. (2021). Sand (Hs.2505)product Trade, Exporters, and Importers. Available online at; https://oec.world/en/profile/hs92/sand assessed June 30,2021.

Pereira, K. (2012). Sand Mining—The 'High Volume–Low Value' Paradox. Available online: http://www.aquaknow.net/en/news/sand-mining-high-volume-low-value-paradox/.

Rempel L.L. & Church M. (2009) Physical and ecological response to disturbance by gravel mining in a large alluvial river. Canadian Journal of Fisheries and Aquatic Sciences, 66, 52–71.

Rinkesh, (2020). List of top10+Resources in the world that you may not know about. https://www.conserve-energy-future.com/list-10-natural-resources.php

Rinaldi, M., Wyzga, B. & Surian, N. (2005). Sediment Mining in Alluvial Channels: Physical Effects and Management Perspectives. River Research and Applications, 21, 805–828.

Sada, R. & Shestha, A., (2013). Report of State of Sand Mining at Per-Urban Kathmandu. Case of Thavkhel VDC. Nepal.

Saviour, M. N & Stalin, P. (2012): Soil and Sand Mining: Causes, Consequences and Management. *IOSR Journal of Pharmacy (IOSRPHR) ISSN: 2250-3013, Vol. 2, Issue 4, PP 01-06. www.iosrphr.org*

Saviour, N., (2012). Environmental impact of soil and sand mining: a review. International Journal of Science, Environment and Technology 1(3), 125-134.

Schoof, J. Built on Sand: Is the Construction Boom Depleting Supplies? November 2014. Available online:http://www.detail-online.com/article/built-on-sand-is-the-construction-boom-depleting-supplies-16825/.

Shaffer, N. R. (2006). The Time of Sands: Quartz-rich Sand Deposits as a Renewable Resource. Electronic Green Journal, 1(24). **ISSN** 1076-7975. eScholarship.org. Powered by the California Digital Library. University of California

Siam, O. (2018). Importance of Ethics in Economics. https://www.academia.edu/39061354/importance_of_Ethics_in_Economics

South Carolina Geological Survey (2005). Earth's Natural Resources and Human Impacts. Department of Natural Resources.

Sreebha, S., Padmalal, D., (2011). Environmental impact assessment of sand mining from the small catchment rivers in the Southwestern Coast of India: a case study. Environmental Management 47, 130-140. DOI 10.1007/s00267-0109571-6.

Steinberger, JK., Krausmann, F., Eisenmenger, N. (2010). Global patterns of materials use: a socioeconomic and geophysical analysis, Ecological Economics, 69, 1148-1158.

Article DOI: 10.52589/AJESD_OJMI5DWD
DOI URL: https://doi.org/10.52589/AJESD_OJMI5DWD

Supriya. (2014). Neoclassical Theory of Economic Growth (Explained with Diagrams). https://www.yourarticlelibrary.com/economics/neoclassical-theory-of-economicgrowth-explained-with-diagrams/38321

Tariro., M. (2013). Case studies of Environmental impacts of sand Mining and Gravel Extraction for Urban Development in Gaborone. Master of Science in Environmental Management at the University of South Africa.

Tayler, L. (2018). Understanding the implications of sand mining: A livelihoods Analysis in Coastal Cambodia. A research paper presented to the faculty of graduate and postdoctoral studies. Faculty of Social Sciences, University of Ottawa.

Thornton, EB., Sallenger, A., Conforto Sesto, J., Egley, L., McGee, T., Parsons, R. (2006). Sand mining impacts on long-term dune erosion in southern Monterey Bay. Marine Geology 229, 45-58.

Tota, I & Shehu, H. (2012). The Dilemma of Business Ethics. Procedia Economics and Finance 3 (2012) 555 – 559.

Torres, A., Liu, J., Brandt, J., & Lear, K. (2017). A looming tragedy of the sand commons: Increasing sand extraction, trade, and consumption pose global sustainability challenges. sciencemag.org SCIENCE.

Tweedie, N. (2018, July 1). Is the world running out of sand? *The Guardian*. https://www.theguardian.com/global/2018/jul/01/riddle-of-the-sands-the-truth-behind-stolen-beaches-and-dredged-islands

UN Comtrade .(2014). Import of Natural sand except sand for mineral extraction as reported. United Nations Commodity Trade Statistics Database. <http://comtrade.un.org> (accessed 10.08.20).

UN environment programme (2019). Rising demand for sand calls for resource governance. https://www.Unep.org/news-and-stories/press-release/rising-demand-sand-calls-economic-governance.com

United Nations, Department of Economic and Social Affairs, Population Division. (2014).World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352). 2014. Available online: http://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf.

USGS .(2013b). Sand and gravel (construction) statistics, in: Kelly, T.D., Matos, G.R., (Eds.), Historical statistics for mineral and material commodities in the United States. U.S. Geological Survey Data Series 140, Reston.

USGS. (2013a). Cement, statistics and information. U.S. Geological Survey, Reston.

Villioth, J. (2014). Building an Economy on Quicksand. Available online: http://www.ejolt.org/2014/08/building-an-economy-on-quicksand/ (accessed on 10 June 2021).

Williams, M. (2017). The Universe. http://www.universetoday.com/36425/what-is-the-universe-3/amp/ Assessed on the 27th of June, 2021.

Workman, D. (2021). Top sand exporters by country. Available online at; https://www.worldtopexports.com/top-sand-exporters-by-country/

Zhang, G., Song, J., Yang, J., & Liu, X .(2006). Performance of mortar and concrete made with a fine aggregate of desert sand, Building and Environment. 41, 1478–1481.

Zhao, Q., Li, D., Zhuo, M., Guo, T., Liao, Y., & Xie, Z. (2014). Effects of rainfall intensity and slope gradient on erosion characteristics of the red soil slope. *Stochastic Environmental Research and Risk Assessment, 2*, 609–621.

Article DOI: 10.52589/AJESD_OJMI5DWD
DOI URL: https://doi.org/10.52589/AJESD_OJMI5DWD