

SAND MINING

Bachelor of Science (Marine Science) Year 2020



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Introduction

In the era where technology and development plays the biggest role in humankind, thousands of cities are seen to expand greatly at a fast pace. This growth causes sand to become the main resource obtained from the mining world. This is due to the sand dredged from riverbeds which is used as the core component in construction materials like cement while sand scooped up from the seabed is mostly used for land reclamation. On the other hand, as the grains of desert sand have usually been rounded by wind erosion, they cannot bind well in concrete making them useless in constructions at cities.

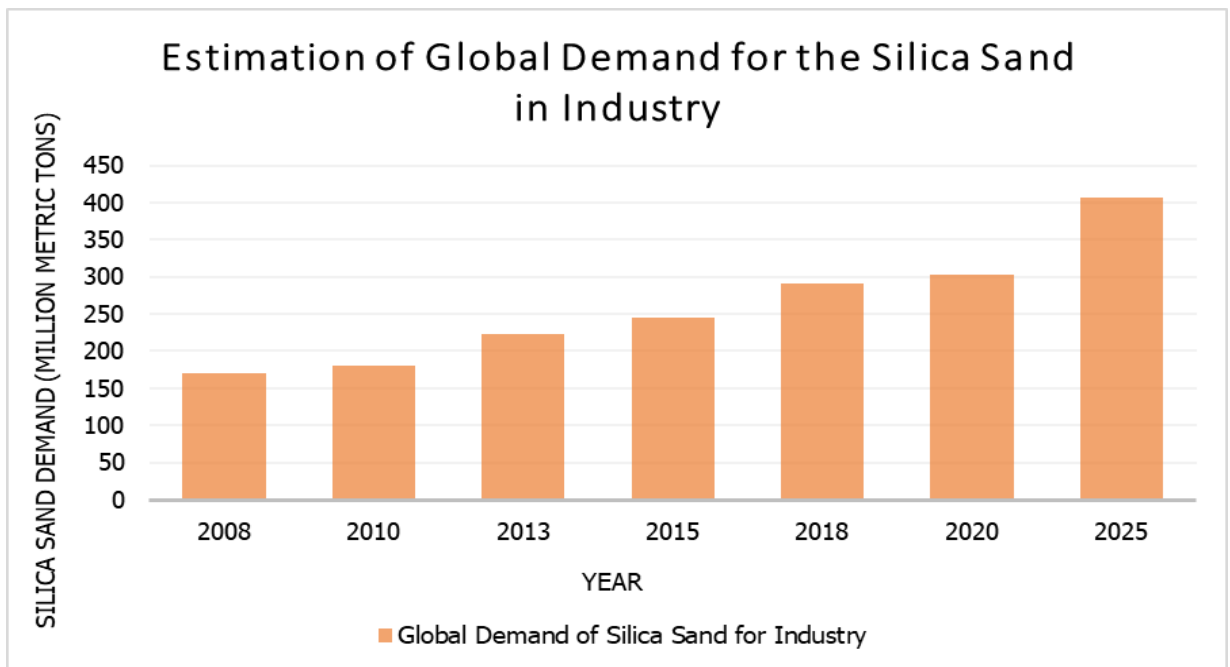


Figure 1: Global demand of silica sand is estimated to be increasing from 2008 to 2025.

Source: (The Freedonia Group, 2018)

It has been estimated by The United Nations Environment Programme (UNEP) that 85 percent of the resources mined on Earth is sand and gravel. Therefore, researchers have been paying more attention in finding the benefits from the activity as well as the problems caused by it. This book will explain all about the pros and cons of sand mining on the marine and riverine environment.

The usage of sand

Sand is often used in manufacturing, for example as an abrasive or in concrete. It is also used on icy and snowy roads usually mixed with salt, to lower the melting point temperature, on the road surface. Sand can replace eroded coastline. Some uses require higher purity than others; for example sand used in concrete must be free of seashell fragments.

Sand mining presents opportunities to extract rutile, ilmenite and zircon, which contain the industrially useful elements titanium and zirconium. Besides these minerals, beach sand may also contain garnet, leucoxene, sillimanite and monazite. These minerals typically are found in ordinary sand deposits and are separated by water elutriation.

The advantages to sand mining are massive in that it is absolutely key to our modern world. Sand is used in everything from cement to glass, Sand is used as an abrasive. Sand is used for casting metals. Sand is basically the most basic of tools of our modern world.



Figure 2: Cement is used as a binder in concrete.



Figure 3: Glass is used for packaging, tableware, building and so on.

Benefit of sand mining

Sand mining at the river and marine can give some benefits especially to the human and societies. It is often a source of local employment and may contribute to local and regional economies. This is because sand extraction can generate the income for both worker and companies. Besides, sand mining also indirectly provides economic benefits for the community around the mining area.

Furthermore, sand is a raw material that needed in construction materials like cement and glass. Strong and stable houses can be built by using cement and glass. Along with the increase of human population, many people are affording to build modern and strong houses with cheap cost if the sand are readily available.

Moreover, sand mining also believe to bring the positive impacts to environment (Didi Rukmana *et al.*, 2020). From the research conducted by Didi Rukmana and his partners, mining can disrupt the sediment supply and channel form, which can deepen the river depths. It is considered helpful for the community around that river because it will help to reduce flooding. For example, the researchers from Hasanuddin University, Indonesia find out that sand mining can help to restore the hydrological function of the Sadang River to prevent siltation of the river due to sedimentation so as not to cause the overflowing and flooding.

Impact of Sand Mining on the environment

Sand mining has been rapidly increasing as urban development and land reclamation becomes more rampant. Although it is useful in sectors like construction, however sand mining has become too frequent to the point where it has begun showing its disadvantages. Over mining of sand has caused a number of detrimental effects on the marine and riverine environments.

One of the main effects of sand mining is that it destroys the natural habitat of flora and fauna within the river. Removal of the sand causes the riverbed to change and be depleted of its sediments. This rapidly changes the population of river vegetation and will severely affect the aquatic ecosystem (Wajid *et al.*, 2011). The loss of river vegetation will cause the river fish and other animals to lose their habitat and the faunal population dies or is forced to find another habitat to reside.



Figure 4: Sand mining rampant in the Mekong river which damages the river's morphology.

Source: (Thibaut, 2016)

Another effect of sand mining is that this activity removes the flood protection at river areas. The reason why is because river sand is more preferred for construction purposes as it is comparatively higher in quality and needs lesser processing compared to beach sand (Moudgil, 2018). By removing the sand from the rivers, it causes a change in the river flow. The flow will cause the erosion to deviate from its natural position and erode the banks, which will cause flooding if the river overflows from heavy rain.



Figure 5: Dredger excavator is operating in Pantai Mek Mas, Kelantan.

In terms of environmental impact, the water quality of the river may be affected. Instream sand mining activities will have an impact on the river's water quality. Impacts include increased short-term turbidity at the mining site due to resuspension of sediment, sedimentation due to stockpiling and dumping of excess mining materials and organic particulate matter, and oil spills or leakage from excavation machinery and vehicles. Increased riverbed and bank erosion increase suspended solids in the water at the excavation site and downstream.

Next, sand and gravel mining in stream channels can damage public and private property. Channel incision caused by gravel mining can undermine bridge piers and expose buried pipelines and other infrastructure. This may lead to river bed erosion.



Figure 6: Sand mining in public and private area.

Physical disturbance of the habitat caused by dredging activities includes generation of noise, which can interrupt bird's breeding activities. Furthermore, sand mining led to mangrove depletion. Clear-felled corridor within the mangrove forest used for sand transport purpose. destruction of habitat for foraging and nesting, increased exposure to re-suspended toxicants, human disturbance from mining operations and increased predator use of recently dredged areas. This causes the mangrove fauna composition decline.

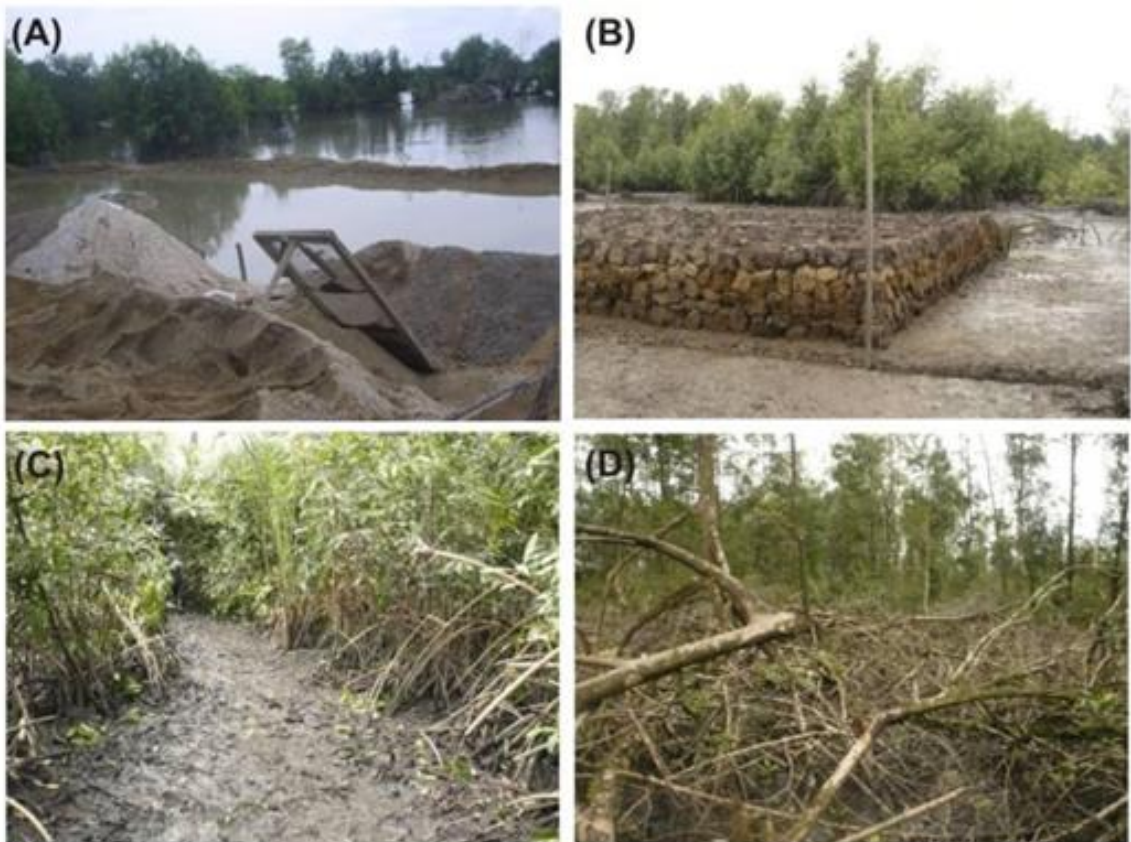


Figure 7: Mangrove land degradation in Cameroon.
Source: (Nfotabong-Atheull, 2011)

Solutions for overexploitation of sand

Sand mining can cause many environment problems. However, it can bring to some benefits to humans especially in the aspect of economy during this modern era if we extract it the right way. In order to prevent the illegal sand mining, the government strengthened the management of sand mining in rivers and ocean. There are some solutions to minimize the impacts of sand mining:

1. Strictly manage license approval and strengthen supervision during and after the event.

Sand mining in the river and offshore must be approved by the relevant authority such as Ministry of Natural Resources and Environment. Without approval, no sand mining activities in rivers or offshore are allowed.

2. Strengthen daily supervision and inspection, and the laws of mining.

Strengthen the supervision and inspections, and increase the frequency of inspections in river or sea section. Laws for sand mining are implemented by giving the punishment to them who are illegal sand mining. Expose laws of Malaysia (*Act 525 mineral development*) for the company which are going to operate mining. For example, company that want to operate mining process have to obey the article 19 (1) law in mineral development act 1994 which is state that Every person who undertakes fossicking, panning, exploration or mining shall take such measures as are reasonable to prevent or minimize the erosion of the land.

3. Reducing unnecessary consumption of sand.

There is the innovative solution to be tested to replace sand in construction of the building and the road. Alternative building materials are being used such as recycled plastic, bamboo, wood, straw and other materials to replace sand.



Figure 8: Researcher create the concrete for building that include ground up recycled plastic and trash instead of sand from mining.

Source: (Peckenham, 2016)

Conclusion

The rapid urban growth of this century has seen cities expanding at an unusual pace leading to the requirement of sand especially in the development sector. The pros listed shows how important sand mining is in producing cement and concrete for building purpose. However, the cons listed also emphasize that this activity can also be harmful to the environment, humans and creatures especially the ones in which their habitat is the river or the sea. Sand mining also gives huge impact towards the water quality, the stability of structures and even disturbing birds' habitat. As sand mining is still important for humankind, some solutions are provided which are for the responsible authority to strictly manage license approval and strengthen supervision of the the event as well as the laws of mining. Unnecessary consumption of sand should also be reduced in order to avoid over-mining. Therefore, everyone involved in sand mining whether directly or indirectly is responsible in making sure that this activity will give off more pros than cons.

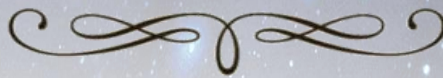
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TAN YEE ROU

- Earth provide enough to satisfy human's needs, but not every human greed.

—Mahamad Gandhi



CHONG WEI NI

- Don't let the ocean become the world's largest stinking ditch.



RAIHANAH BINTI SAIFULBAHRI

- Only with our blood, sweat and tears, the ocean will not turn into a scary desert.



LUQMAN HAKIM BIN AHMAD FADZLI SHAM

- Let's keep the ocean clean so that we can explore all of it's entirety.



KHOR RUI XIANG

- May the sea be clear and vast forever, and hope that mankind is better.



SITI ZULAIKHA BINTI ABDUL HARIS MAHAD

- Protect our oceans to protect our future.