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TITLE: A CRITICAL EXPLORATION OF THE ETHICAL IMPLICATIONS OF SAND MINING IN SOUTH AFRICA

BY

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DEDICATION

To everyone who dedicates themselves to safeguarding and nurturing our natural environment.

ACKNOWLEDGMENTS

Above all, I give thanks to God Almighty, who has led me on this journey. This would not have been achieved without his grace, strength, and wisdom.

I also want to express my deepest gratitude to my ancestors, whose spirits continue to protect me, offering strength, security, and guidance. Their sacrifices and insights made it possible for me to accomplish this goal, and I honor their legacy with this accomplishment.

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ABSTRACT

Sand mining is the extraction of sand primarily from open pits or sand pits, but it may also be dredged from beaches or inland dunes, the ocean, or riverbeds. Sand is commonly used in manufacturing. Sand mining, more specifically illegal sand mining, refers to the undiminished mining of sand from reservoirs, beaches, riverbeds, and lakes. Although sand mining is regulated by law, it is often illegal. Despite the direct impacts of illegal sand mining on ecosystems, it is an environmental problem that often takes a back seat to problems such as deforestation and water pollution.

The need for sand and gravel is currently growing. One of South Africa's most precious resources is the unprocessed sand that comes from estuaries and coastal areas. Yet, sand mining operations that are unregulated and illegal have dramatically increased recently in rivers, valleys, and estuaries across the nation. Small-scale sand mining regulations in South Africa are insufficient to effectively deter illegal activity, and they lack the necessary funding and human resources to promote improved environmental compliance. As a result, the industry has seen a surge of new entrants, creating a system that is plagued by social, environmental, regulatory, and structural challenges.

A bulldozer to clear vegetation and construct access roads, an excavator or front-end loader to remove sand deposits, and trucks for transportation are all that is needed for illegal alluvial sand extraction from beaches and inland dunes or the dredging of sand from riverbeds. The excavated sand is then brought a short distance and privately sold to local sand businesses and people. Entry barriers are low, and business operations are quite profitable. Most of the illegal operators in KwaZulu-Natal and the Eastern Cape collect sand directly from main river courses and neighboring sandbanks. Even though these operations seem tiny and localized, they remove crucial riparian vegetation that stabilizes the area and frequently switch locations, leaving behind unproductive and unrestored land.

Sand mining not only depletes resources but also harms neighboring riparian habitats by destroying wetlands, vegetation, and riverbanks, changing river currents, and severing ecological pathways. Moreover, unauthorized sites are not restored and typically become overrun by foreign invasive vegetation quickly. Unrestrained sand mining also causes significant disruptions from uncontrolled road access development, which frequently crosses floodplains, and from the dredging and use of mechanical diggers to destroy aquatic habitats.

Children are at risk of death from the deep holes that remain after excavation, which are frequently invisible. Besides the environmental repercussions of unregulated sand mining, there are also economic issues.

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CHAPTER ONE

HISTORICAL BACKGROUND

1.0 INTRODUCTION

It has been noted that it is difficult to determine the exact number of sand mining operations in South Africa, as some operations are not recognised by the government. Sand mining from the beaches and riverbeds has become a common practice in South Africa, despite its catastrophic implications for the ecosystem and the lives of the surrounding communities (Gavriletea, 2017:13). Undoubtedly, sand is one of the most important natural resources extracted from the environment that supports the nation's economy, and essential for construction purposes and the manufacturing of glass (Koehnken, et al., 2020:363 & Gavriletea, 2017:1).

Mining activities can have a positive impact on South Africa and the surrounding community where mining operations take place, providing them with a source of income (Musampa & Nakin, 2017:444-448). However, a similar activity (sand mining) can have a catastrophic implication, such as environmental degradation (Malebana, 2021:33). Environmental problems such as pollution, destruction, and seasonal catastrophes continue to exist and are worsening. This situation has a huge negative implication on people's physical and mental health. In addition to decreasing the standard of the surroundings, it can also have huge effects on society and the economy (Asabonga, Mpundu & Vincent, 2017:1-2).

Sand mining causes serious environmental damage in regions such as the Eastern Cape and KwaZulu-Natal (Chevalier, 2014:1). The likelihood of environmental damage depends on several mining-related factors and environmental conditions. Mining operations encompass various processes, including extraction, drilling, and mineral processing. On the other hand, environmental factors encompass elements such as hydrology, fauna, local flora, geographical features, and land morphology (Madyise, 2013:90-91; Gondo, Amponsoh-Dacosta, & Mathada, 2019:4).

The environment is affected by sand mining activities in various ways which has been mentioned above and by (Rentier & Cammeraat, 2022:5; Pitcaiah, 2017:4). The effects of these changes may vary significantly, depending on strengths and characteristics. Sand mining not only alters the natural environment but also changes the way people live, the culture, and the economy. Disposing of waste is not the only way sand mining activities affect the environment;

other environmental changes in the different components may change environmental functions and exert influence. Environmental effects related to sand mining are sometimes irreversible or cannot be restored to their prior state (Asabonga, Mpundu & Vincent, 2017:1-2).

Pitchaiah (2017:4) claims that the geography of the country changed during the mining era, which can cause changes to some natural features, such as the flow of the river and the shape of the lakes. Sand mining is believed to have direct and indirect implications on the rivers (Saviour, 2012:125). Saviour further stated that direct effects include the depletion of habitats in floodplains. For example, sand mining would be directly responsible for the environmental impacts that would occur. Saviour also notes that sand mining operations can cause physical changes in the river system, which, in turn, induce ecosystem alterations that can spread across the system and have an indirect effect. For example, removing materials from a specific river can alter its sediment budget, channel, and hydraulics, which can impact how ecosystems function and where their habitats are located. Since these kinds of effects may take some time to become apparent and can be caused by other interventions, it can be challenging to link sand mining directly to such changes.

It is crucial to remember that, although sand mining operations degrade the environment, the process is important to South Africa's economy because it contributes financially to both the private and public sectors through the payment of taxes and licensing fees for various types of mining, including sand mining. It also generates export customers, more especially for the higher-quality silica sand, which helps to strengthen the trade balance and foreign exchange benefits taxation (Hübler & Pothen, 2021:1).

Nonetheless, it is essential to note that although sand mining helps boost South Africa's economy by providing job opportunities to the needy and introducing new technology, the practice should be conducted ethically and sustainably to prevent environmental, societal, and economic damage. Therefore, this project intends to critically discuss the ethical implications of sand mining that South Africa has experienced so far, as well as look at the regulatory issues surrounding this concept. It was important to conduct this research to raise awareness of the implications of sand mining and its impact on various stakeholders. Consequently, this research may encourage the government or other concerned stakeholders to explore sustainable approaches to regulating sand mining.

This project focused on the implications of sand mining to determine what can be done to make South Africa an environmentally friendly country, while still meeting the need for sand through sustainable mining.

1.1. BACKGROUND AND MOTIVATION

Vander *et al*. (2022:8) argue that climate change, urbanization, economic growth, and population growth have contributed to sand becoming the second most mined resource in the world after water. Chevallier (2014:1) states that in KwaZulu-Natal and the Eastern Cape, illegal sand mining primarily occurs along adjacent sandbanks and large river systems. Although these operations may appear small-scale and localised, they frequently move from one place to another, removing important riparian vegetation that stabilises the area, leaving behind unproductive and unrestored land.

Sonna, Edewor, and Chuks (2022:120) say that sand mining is a long-standing activity that dates to ancient times. People and organisations have used sand throughout history, including building houses, bridges, and roads, as well as making glass and producing other products. Sona *et al.* (2022) further stated that despite its value, there is a criticism regarding the renewal rate, which is far lower than its consumption rate. Environmentalists such as Saviour (2012) have long warned that it adversely impacts the lifespan of infrastructure projects, especially those built near or on water, as well as the well-being of aquatic life and overall ecological balance. This issue is particularly challenging for countries like South Africa, which have abundant natural sand resources, as the rise in illegal mining activities accelerates land degradation to meet growing demand.

Scholars such as Asabonga, Mpundu, and Vincent (2017:1-2) believed that sand mining is considered unsustainable not only because it depletes natural resources but also because it adversely affects the economy, society, and environment, causing long-lasting, potentially irreversible damage. Chevallier (2014:1) also highlighted that:

> *Unauthorised and unregulated sand mining operations in rivers, valleys, and estuaries across South Africa have significantly increased in recent years. The current frameworks governing sand mining lack both the legal authority and human capacity required to enable improved environmental compliance, and the enforcement procedures that are supposed to effectively discourage illicit*

activity are also inadequate. As a result, the sector has experienced a rise in new miners, which has led to a system that is affected by structural, legal, social, and environmental difficulties. Therefore, this study also focused on the ethical and environmental impacts of sand mining in South Africa. Existing policies about sand mining in South Africa lack legal strength as well as the human resources needed to ensure improved environmental compliance. Furthermore, the enforcement mechanisms that are supposed to curb illegal activities are ineffective, contributing to the growth of new miners, thereby deepening the environmental, legal, social, and structural challenges in the industry.

From a researcher's perspective, the interest in exploring sand mining originated after learning that sand is a vital natural resource in South Africa, playing a significant role in environmental protection. However, sand mining is rapidly becoming an environmental crisis due to increasing demand, particularly from the construction industry (what about the unskilled builders who hoard sand for building houses? Or those who take advantage of the quarries and hoard sand?). Therefore, the researcher has chosen to study this topic and examine its impact on the environment, especially considering the ongoing global environmental challenges.

As someone who has studied Environmental Ethics and believes in moral principles and responsibilities, the researcher recognises that there is still much to be explored in the field of sand mining, particularly its implications. . Today, we are facing issues such as erosion, land degradation, and chemical pollution, all of which are linked to unsustainable sand mining practices. This contrast is what led the researcher to examine the topic in depth.

1.2 AIM OF THE STUDY

The primary objective of this research was to investigate the ethical implications of sand mining in South Africa. While sand plays a crucial role in supporting the construction industry, it also raises significant ethical concerns, particularly regarding social equity, economic parity, and the conservation of the environment. This study aimed to assess the extent to which present sand mining practices comply with established ethical principles and to highlight ethical challenges that exist within the sector.

Moreover, the researcher explored how sand mining affects various stakeholders, such as miners, community residents, government entities, and environmental organisations. While sand mining contributes to economic growth through the creation of jobs and infrastructure development, it often comes at an expense to people who may find themselves at risk of displacement, contamination of drinking water, and environmental degradation. This study critically evaluated these contrasting perspectives and assessed the fairness and ethical soundness of current mining practices.

The study also aimed to explore the ecological impacts of sand mining, which resulted in the destruction of the environment, including soil erosion and biodiversity decline due to the extraction of sand from coastal areas, rivers, and other natural ecosystems. From an ethical perspective, these environmental consequences raise concerns regarding the responsibilities of mining businesses and government authorities in promoting environmental sustainability.

This study further evaluated the regulatory and constitutional frameworks that regulate sand mining in South Africa. Hence, to address the ethical issues connected to the industry, the study evaluated whether present regulations are adequate.

Lastly, this study recommended moral principles and solutions for ethical sand mining. The study discussed methods for reducing detrimental impacts while simultaneously ensuring that mining promotes economic development in an ethical as well as sustainable way by referring to philosophical concepts and best practices in responsible resource management. To encourage a more sustainable approach to sand mining in South Africa, these recommendations might be useful to government officials, business stakeholders, miners, and environmental activists for the environment.

1.3 PROBLEM STATEMENT

Sand mining is significant to contemporary infrastructure because it offers raw construction materials, the manufacturing of glass, and other uses in different industries (Koehnken et al., 2020:363; Gavriletea, 2017:1). Governments have put regulatory structures in place to regulate extraction to minimise impacts on the environment, and ensuring responsible utilisation of resources in recognition of the environmental damage caused by unregulated and illegal sand mining. However, as seen in the Eastern Cape, a variety of moral and environmental problems still exist regardless of these laws. This raises questions concerning corporate responsibility, the effective functioning of governance systems, and the harmonious relationship between the preservation of the environment and economic expansion.

Despite regulation attempts to decrease the damage brought about by sand mining, it is regularly not put into action effectively, and the envisioned security measures are often weakened by corruption, mistakes, and competing economic interests (Chevallier, 2014:1-2). Chevallier also stats that many sand mining businesses do not get involved in meaningful interaction with local populations, overlooking their rights and traditional knowledge systems. In addition, the lack of accessibility in the permitting process raises questions about governance malfunctions and the participation of state authorities and business organisations in unethical extraction practices of sand from the natural environment.

The poor implementation of laws and regulations is one of the main problems with sand mining Muswaka, 2017:22). Although a range of legal frameworks exists on paper, they are often not strictly enforced, allowing destructive sand extraction to continue under the false guise of legality. As noted by Muswaka, regulatory bodies often lack the necessary resources or authority to effectively monitor and control sand mining operations, leading to widespread over-extraction beyond approved limits.

Ethical concerns about illegal sand mining leading to violence which has already been discussed previously have been reported in countries like India and Kenya, where illegal sand mining has resulted in severe environmental degradation and negative social impacts (Saviour & Stalin, 2012:2).

The social and economic impacts of sand mining highlight ethical dilemmas that are beyond environmental issues. For example, illegal sand mining in KZN along the Umngeni river has resulted to the collapse of riverbanks and the displacement of small-scale farmers. Although sand mining supports infrastructure and stimulates national economies, however, the benefits are rarely shared evenly. Traditional lands and ecosystems that provide food, water, and cultural significance are lost or displaced, affecting many local people. Conflicts arise between residents and corporations when land is bought or leased for mining operations, as affected populations often receive little or no compensation from these operations. Some of the examples here include environmental degradation and civil unrest, for example, residents would start conflicting with corporations because they believe the operations will not bring change for them.

The principle of social justice under the Mineral and Petroleum Resources Development Act in South Africa section 2 says *2c "promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa" 2d "Substantially and meaningfully expand opportunities for historically disadvantaged persons… and communities… to benefit from the exploitation of the nation's mineral and petroleum resources" 2i "Ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating"* which means that those who suffer the consequences of resource exploitation should also share the earnings. Another important ethical issue pertains to the role and responsibilities of corporations in sand mining, which is questionable. Some businesses uphold ethical standards and sustainable practices, but many prioritise profit ahead of sustainability, ignoring their social and environmental responsibilities through constitutional loopholes or political influence.

Environmental issues are likely to worsen if current ethical issues continue to go unaddressed, and this will further exacerbate economic inequality, environmental degradation, and civil unrest. Nonetheless, based on a literature search, the complete repercussions of sand mining have not been thoroughly researched, mainly from an ethical perspective. Hence, the study sought to evaluate the ethical and environmental challenges of sand mining by analysing how current policies fail to ensure long-lasting sustainability and social justice. By examining governance structures, corporate responsibility, and the long-term ecological impacts of regulated mining, this research seeks to provide insights into improving ethical mining practices. Without stronger regulatory enforcement, enhanced corporate accountability, and

inclusive policymaking, regulated sand mining will continue to threaten ecosystems, communities, and future generations.

Ethics concerns ideals of what is right and wrong. Therefore, having a clear understanding of one's values can help individuals recognise responsibilities in addressing both environmental sustainability and, consequently, the sustainability of human life on earth and society's ongoing economic growth (Stückelberger, 2015:14).

1.4 RESEARCH GAP

Sand mining, according to (Madyise, 2013:5) is an ancient practice that has existed for many years and has been growing, with ecological impacts, especially those emanating from illegal and unregulated extraction of rivers and coastal ecosystems, well established (Chevallier, 2014:1). However, there is limited documentation of the socio-economic effects on local communities relying on the land where these activities take place, as well as the lack of long-term sustainability of sand mining practices in different provinces. There is a lack of enforcement mechanisms and research on the effectiveness of policies regulating this industry, as well as an exploration of alternative materials or sustainable extraction methods to mitigate environmental degradation. It is evident from the material reviewed above that not much has been interrogated about sand mining from an environmental ethical standpoint. The goal of the research was to close this gap. This study contributed to the debates on sand mining by applying the ethical theory of consequentialism and sustainable development to inform the process of sand mining.

1.5 KEY RESEARCH QUESTION

1.5.1. What are the ethical implications of Sand mining?

1.6 RESEARCH SUB-QUESTIONS

1.6.1. What is the nature of sand mining in South Africa?

1.6.2. What are the ethical implications and consequences of sand mining?

1.6.3. How can the ethical theory of consequentialism inform the effects of sand mining?

1.7 KEY RESEARCH OBJECTIVES

1.7.1. To explore the nature of sand mining in South Africa.

1.7.2. To examine the ethical implications and consequences of sand mining

1.7.3. To explore how the ethical theory of consequentialism can inform sand mining in South Africa.

1.8 PREVIEW OF THE THEORETICAL FRAMEWORK

This research uses two ethical theories: The ethical theory of consequentialism and the ethical theory of sustainable development. Elliott and June (2018:159) stated that consequentialism is a theory that examines the outcomes or potential outcomes of conceivable actions to assess the morality of past, present, and future actions. It claims that acting in this way is morally right if the expected outcomes are positive; otherwise, the action is considered wrong.

Cummiskey (2013:2) added that we are unsure of the true, long-term impacts of the decisions we make and the things we do because good intentions do not always result in favourable outcomes. When making decisions, it is always advisable to go with the option that has the greatest potential to maximise the probability of favourable outcomes. Hence, some consequentialists, such as Jeremy Bentham, make a distinction between an action's actual and predicted outcomes.

It is believed that the ethical theory of consequentialism in general has been crucial to the advancement of ethical philosophy since Sidgwick's time, who is a philosopher mostly known for his work in ethics, moral psychology, and utilitarianism. Theoretically, Bergstrom (1996:4) claimed that it has been fruitful because ethicists have been motivated to clarify details and tackle difficult issues, and this has led to several interesting challenges and a great deal of scholarly discussion.

The ethical theory of consequentialism is most appropriate for this work since it promotes appropriate behaviour and the idea that something should be discouraged if it negatively affects

many people. This theory guided description of the phenomenon of illegal sand mining and its consequences on the Environment.

Also, the ethical theory of sustainable development has been deemed appropriate for this study, as it helped to investigate the development that comes with sand mining in South Africa.

1.9 PREVIEW OF RESEARCH METHODOLOGY

The research approach applied to carry out this research is explained in this section. This section covered important subjects, including research design, data collection, analysis techniques, and ethical considerations. It reviewed various methods and tactics that sand mining researchers utilise regularly. This study employed an exploratory research approach. Groundar (2012:6) stated that exploration research is conducted to fill in the gaps in knowledge about a subject or to determine whether a study is feasible. This study aimed to investigate the impacts of the environmental catastrophe created by sand mining in South Africa.

The research used the DECA, which stands for Describe, Evaluate, Consult, and Act. This is a method that is often used in decision-making and problem-solving situations (Kretzschmar & Bentley, 2013:5). Firstly, the researcher described what sand mining is and the environmental dilemmas caused by sand mining. Identify the nature of sand mining, which helped in formulating an understanding of what could be the best solution or response to the problem. Secondly, the researcher *evaluated* the positive and negative implications using the ethical theory of consequentialism and the sustainable development theory.

Thirdly, the researcher *consulted*. This is where the researcher reviewed many scholarly works about sand mining to explore different perspectives and ensure that what is brought or collected is not one-sided but a well-rounded perspective. Lastly, the researcher *acted*. This is where the researcher made the decisions based on the evaluation and consultation process.

The researcher believed that the exploratory design works best. Writing about sand mining was essential in understanding what is happening, the consequences of sand mining, and the steps necessary to prevent its negative effects on the environment. This research adopted a qualitative method, which, according to Kothari (2004:3:5), means being concerned with qualitative

phenomena; subjective evaluation of attitudes, views, and behaviours. The qualitative approach is more appropriate because it offers a better understanding of sand mining in greater depth and with better clarity.

Desktop research was conducted for this project to gather relevant literature and existing data to support the study's objectives and theoretical framework. This type of research is often referred to as secondary data collection. It mainly involves looking at sources that already exist, such as past studies, to build a better understanding of the topic at hand (Travis D, 2016:1). In this context, the researcher reviewed books, news articles, and online materials. Many of these are easily accessible through the internet. However, before selecting any of these materials, the researcher first verified whether each book, article, newspaper, or archive is suitable for academic use. Interestingly, some of the materials were also found in physical locations like the university library or archives. As for digital tools, search engines such as Microsoft Bing, Google, Google Scholar, and JSTOR were used throughout the process.

All the material used in this study originated from published and publicly accessible sources. After the information was reviewed, understood, and checked for accuracy, the data were broken down into different sections, then sorted and arranged into clear themes, with sub-themes developed based on the content of each section. Notably, the study of ethics deals with deciding what is right or wrong within a framework of accountability (Chippendale, 2001:1). In this context, the research was approached with integrity and guided by moral responsibility. Perhaps most importantly, no data was made up or falsely claimed to be from another person, because that goes against the foundation of ethical research.

1.10 LIMITATIONS

No limitations

1.11 OUTLINE OF CHAPTERS:

Chapter 1: Introduction

This chapter outlined the scope of the research project. It provided background information on the research problem, stated the main research question and sub-questions, and presented the primary and secondary research objectives.

Chapter 2: Literature Review

This chapter presented a critical review of the literature relevant to the research problem. It examined previous studies and showed how existing research contributed to and supported this study.

Chapter 3: Theoretical Framework

This chapter discussed the ethical theories and conceptual frameworks that informed the research. It explained their relevance to the problem under investigation and described how they were applied in the study. The chapter also outlined the methods and methodology that guided the research process.

Chapter 4: Research Methods and Methodology

This chapter described the research design, data sources, data collection methods, and ethical considerations that were used. It explained the procedures followed to ensure the validity and reliability of the research.

Chapter 5: Analysis, Interpretation, and Findings

This chapter presented the data collected during the research. It included an analysis and interpretation of the findings, focusing on the application of the selected theoretical framework.

Chapter 6: Summary, Conclusion, and Recommendations

This chapter summarised the key findings of the study. It presented the overall conclusions and offered recommendations for further research and practical application.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

The previous chapter introduced the research study, including its background and motivation, key objectives, sub-objectives, key research questions, and sub-questions. The current chapter is the literature review chapter, analyzing and exploring what has already been written on sand mining in the South African context, and linking it to ethical exploration. This includes defining sand mining, discussing the purpose of the sand mining process, as well as the economic/development side of sand mining, and the environment.

According to (Koehnken et al., 2020:362), sand mining is not just a South African activity but a global one that has drawn attention from the media due to its detrimental impacts on society and the environment. The discussions in this review included different themes, such as the definition of sand mining, the reasons for mining sand, sand mining and the environment, sand mining and the economy, implications of sustainable sand mining, and the overall advantages and disadvantages of sand mining. The discussions were also based on different types of sand mining, legal and regulatory frameworks in South Africa, such as the National Environmental Management Act 107 of 1998 and the Mineral and Petroleum Resources Development Act of 2002.

2.1 DEFINING SAND MINING

Saviour M Naveen (2012:125) defined sand mining as a process of extracting sand and gravel from the environment. He further explains that with the construction industry growing rapidly, the demand for sand keeps increasing. This growing need means more sand is being taken from natural areas, which is causing serious environmental problems. Sand mining is closely linked to land damage, especially in regions rich in minerals. When mining is done without proper care or science, it can lead to problems like sinking land, underground fires, and changes to the water table. These effects alter the natural shape of the land and upset the delicate balance of local ecosystems. As a result, the way land is used in and around mining areas is negatively affected. Overall, sand mining without proper control harms both the environment and the

communities nearby. This shows how important it is to manage sand extraction responsibly to protect nature and people.

Akankali et al. (2017:452) explained that sand mining is the removal of sand from natural places like riverbeds and beaches where it has settled over time. Akankali et al. (2017:452) also states that sand is essential for building homes, roads, and other infrastructure. As cities grow, the demand for sand increases rapidly. However, taking too much sand without care can harm the environment. Over-mining causes erosion, damages riverbanks, and destroys habitats for fish and wildlife. It can also lower underground water levels, making it harder for communities to access clean water. These impacts affect both nature and people's lives. That is why sustainable mining is crucial to protect the environment and resources for the future.

According to (Koehnken et al., 2020:363), rivers are a major source of sand and gravel because they naturally transport and deposit these materials along their banks and beds. They state that this abundance of resources is one reason many cities have historically been built near rivers; therefore, this location makes transporting the materials much cheaper and easier. Rivers naturally break down rocks into sand and gravel through their flowing energy, which saves the extra steps of mining, crushing, and sorting. The sand and gravel found in riverbeds usually have the sharp, angular shapes that builders prefer for construction projects. This combination of easy access and suitable material makes river-sourced sand and gravel very popular in the building industry.

Due to these benefits, rivers continue to be a key supplier for construction needs. However, this also means river environments often face heavy mining pressure. Therefore, it is important to consider how this affects both the environment and local communities (Koehnken et al., 2020:363).

2.2 THE REASONS FOR SAND MINING

Da and Le Billon (2022:1) state that there are many reasons why sand mining takes place, and this review focused on some of the main reasons for mining sand in South Africa. One of the primary reasons is to get sand for building purposes. Sand is an important ingredient in mortar and concrete, which are used to build roads, houses, and commercial buildings. Beyond

construction, sand is also used to make everyday items like ceramics, glass, and other industrial products (Da & Le Billon, 2022:1). Da and Le Billon also highlighted that sand plays a key role in restoring eroded beaches and protecting coastlines from rising sea levels. This not only helps preserve natural landscapes but also attracts tourists, which is an important source of income for many coastal communities. Additionally, adding sand to coastal areas can help the land recover so it can be used again for farming, business, or homes.

Sand is also important for improving soil by helping with drainage and air flow, especially in soils that do not drain well. It is often added to soil to make it better for growing plants. Besides gardening, sand is used in many filtering systems, such as water purification, industrial filters, and even swimming pool filters. Because of these qualities, sand is a key part of maintaining sports fields and landscaping projects like golf courses, which need regular care. Its ability to improve soil and filter water makes it a valuable resource in many areas of everyday life (Da & Le Billon, 2022:1).

Sand plays a huge role not only in construction but also in many other industries today. Gavriletea (2017:1) points out that sand is a key ingredient in materials like cement, mortar, bricks, tiles, glass, adhesives, and ceramics. In addition to building, sand is essential for filtering water, processing chemicals and metals, and producing plastics. The demand for sand has grown rapidly due to its many uses and is expected to keep rising as the population grows and living standards improve. Today, sand is considered the second most used natural resource on Earth, right after fresh water. This highlights how vital sand is in everyday life, from the houses we live in to the products we use daily.

2.3 THE PROCESS OF SAND MINING

Rangel-Buitrago et al. (2023:4) highlighted the importance of understanding the full cycle of sand, including how it forms, moves, settles, and is used, to better understand the environmental impact of sand mining, especially along coastlines. They compare the sand cycle to the rock cycle because both involve constant movement and change within natural systems. This cycle begins with sand forming from broken-down rocks, then continues through extraction, transportation, manufacturing into products, use, and eventual disposal. Human activity plays a major role throughout this process, as sand is essential for many purposes. The authors emphasised that knowing each step is crucial to developing effective strategies that manage sand mining

responsibly and reduce harm to ecosystems. Recognising sand as part of a dynamic natural system helps us protect the environment while fulfilling human needs.

The sand cycle originates within the rock cycle, a fundamental concept in geology that explains the changes over time among the three main types of rock: sedimentary, igneous, and metamorphic. This is where the cycle of sand begins. According to Rangel-Buitrago and colleagues, the rock cycle describes the relationships between these three types of rock and how the processes that affect them vary over time. When rocks are pushed deep beneath the Earth's surface, they melt into magma. If the conditions allow the magma to remain liquid, it eventually cools and hardens to form igneous rock. When this cooling happens slowly beneath the Earth's surface, the rock is called intrusive or plutonic. However, due to volcanic activity, magma can also cool quickly on the Earth's surface when exposed to the atmosphere, forming what is known as extrusive rock, sometimes referred to as volcanic rock.

When rocks are pushed deep inside the earth, they experience high heat and pressure that cause them to change both physically and chemically. This process is called metamorphism. During metamorphism, the minerals inside the rock can rearrange, or new minerals can form, creating a completely new type of rock with different features. Bhatawdekar et al. (2021:146) explain that this process changes the texture, structure, and makeup of the rock. When these rocks eventually reach the surface and are exposed to the atmosphere, they undergo weathering and erosion. These natural forces gradually break the rocks down into smaller pieces like gravel, sand, cobbles, silt, and clay. This breaking down can happen to any type of original rock and results in sediments. These sediments are then carried away by wind, water, or ice and deposited in various places, where over time they may be pressed and stuck together to form sedimentary rock (Bhatawdekar et al., 2021:146).

According to Rangel-Buitrago et al. (2023:4), sand and gravel are deposited after being carried by sediment transport, forming various underwater deposits and surface landforms. They explain that sand and gravel tend to gather and arrange themselves in places where there are changes in energy, such as the movement of wind, flowing water, or tides. These areas create ideal spots for mining. Owing to this, keeping beaches, dunes, and other related landforms like silts, deltas, tidal

flats, and sand bars healthy depends on a natural supply of sediment reaching the coast. Without this ongoing supply, these important coastal ecosystems cannot be sustained.

Rangel-Buitrago et al. (2023:4) continue to claim that any activity that changes the amount of sediment reaching a coastline can lead to significant changes in habitats. For example, rising sea levels can reduce the amount of sand that moves onshore, while also increasing flooding from coastal rivers and causing more sand to shift around. The biggest drop in the amount of sand reaching coastlines, along with the loss of beaches and dunes, has often been caused by human actions and changes to natural processes. One major factor is the construction of dams upstream on rivers, which trap sand before it can reach the coast. On top of this, the illegal harvesting of sand has become a serious and growing problem.

In coastal and riverine areas, sand is extracted in various ways and at different scales, which causes significant environmental damage both in the short and long term (Pilkey et al., 2022:139). On a large scale, entire beaches and dunes deteriorate as fleets of backhoes and dump trucks remove as many as two hundred truckloads of sand daily. Medium-scale extraction happens when sand trapped on the updraft sides of groins is taken, but this causes the downdrift sides of those groins to erode quickly, leaving those shores in urgent need of replacement sand. On a smaller scale, individual wagon drivers may enter these areas anytime, often at night, to clear vegetation and remove sand. They have free access to the sites until they exhaust the sand or finish their project. Each wagon driver can extract between fifteen and twenty-five cartloads of sand daily. Similar small-scale mining happens inland along riverbanks, where sediment is also taken for use (Rangel-Buitrago et al., 2023:5).

Rangel-Buitrago et al. (2023:5) explained that effective storage and transportation systems are essential to move sand from its source to where it is needed. Every day, sand is transported using ships, wagons, buckets, and carts. Sand markets operate at both regional and local levels, and these markets influence sand prices regardless of how it is transported. While sand itself is generally affordable by volume, the costs of transportation can be quite high, even when mining is properly regulated. They also highlighted that sand often needs to be screened to meet size requirements for use as aggregate, although sand used for landfill usually requires little processing.

Rangel-Buitrago et al. (2023:5) states that manufactured sand used in construction is made by crushing medium to coarse-sized rocks into smaller, sand-sized particles. These particles are then washed and carefully sorted by size. The resulting crushed sand has a roughly cubical shape with rounded edges, making it suitable for building purposes. The production process involves a few key steps: first, coarse and medium-sized rocks are broken down using shaft impact crushers; next, the crushed material is sifted to get the right grain size; and finally, the sand is washed and dried to remove any dust or debris, ensuring it is clean and ready to use.

Most of the sand we use goes into construction, with about three-quarters of it serving as concrete aggregate (Rangel-Buitrago et al., 2023:5). As a result, most extracted sand needs to be processed to meet the specific needs of the construction industry. Sand from the ocean, known as marine sand, is not great for concrete because it contains a lot of salt. Salt can weaken concrete, so it must be washed out before the sand can be used. This washing process removes salt and other impurities, making sure the sand performs well when mixed into concrete. Cleaning the sand properly is key to keeping the concrete strong and durable. In short, processing sand carefully is essential to producing good-quality materials for building projects.

As mentioned by (Rangel-Buitrago et al., 2023:5) moving huge amounts of sand has a big impact on the environment, raising important ethical questions, especially from a consequentialist point of view. Transporting sand by ships and heavy trucks produces a lot of carbon emissions, contributing to air pollution and climate change. The damage gets worse when large machines are used, fuel is burned, and new infrastructure is built to move the sand around. A consequentialist would say this practice is wrong if the environmental harm, like bigger carbon footprints, loss of habitats, and pollution, outweighs the economic and infrastructure benefits it provides. But consequentialism does not necessarily mean we should stop sand transportation altogether. Instead, it encourages finding ways to reduce harm while still gaining the benefits. That is why sustainable options like using electric vehicles, improving supply chains to cut down on unnecessary trips, and sourcing sand locally are seen as better choices. These methods help protect the environment while allowing economic progress to continue.

2.4 DATA DEFICIENCY OF SAND MINING IN SOUTH AFRICA

In spite of being the most exploited solid resource in the world, sand is still one of the least studied and controlled commodities, with South Africa serving as an example of many global flaws in data gathering and supervision. Due in part to the expanding infrastructure and building industries, sand mining, as already mentioned, is common in South Africa along riverbeds, floodplains, and coastal areas. But here is an astonishing lack of thorough national statistics regarding the amount of sand extracted, the number of active or informal mining sites, or the entire socio-environmental costs involved with this activity, despite the industry's scale and environmental impact (Gavriletea, 2017:13).

Sand is frequently included under the general "aggregates" by the Department of Mineral Resources and Energy (DMRE), which obscures the scope and patterns of extraction. Moreover, informal and illegal sand mining, especially in provinces like KwaZulu-Natal, Gauteng, and the Eastern Cape, is rampant and virtually unmonitored (Maphanga & Madonsela, 2023;253). These operations, often small-scale and community-based, operate outside the formal permitting system, meaning they do not report data, conduct environmental impact assessments, or follow rehabilitation guidelines.

The creation of sustainable resource management, efficient environmental policy, and enforcement mechanisms is significantly hampered by the lack of trustworthy, de-identified data. Authorities are unable to evaluate the cumulative effects on river systems, aquifers, and biodiversity if they do not have a clear picture of where, how much, and by whom sand is being mined (Koehnken et al., 2020:32). Furthermore, nothing is known about the long-term effects of continuous sand extraction on sediment movement, water quality, or coastline erosion in South Africa due to the lack of longitudinal studies (Gondo, Mathada & Amponsah-Dacosta 2019:6). Despite being essential to infrastructure and urban growth, sand extraction is still mostly ignored, in contrast to more regulated commodities like coal or gold. Additionally, this lack of data makes it difficult for the nation to meet global sustainability objectives, such as the Sustainable Development Goals (SDGs) of the UN, especially those about clean water, life on land, and sustainable cities.

Moreover, (Gondo, Mathada & Amponsah-Dacosta 2019:6) states that community opposition to unsustainable mining operations is weakened by the absence of detailed data. Because there isn't

"hard" evidence, populations in areas where sand mining has harmed infrastructure, depleted water supplies, or deteriorated ecosystems frequently have their complaints disregarded. This leads to a vicious cycle in which invisibility silences the social and environmental costs. Addressing the research and data gaps in sand mining becomes more than just a regulatory issue; it is also a critical issue of ecological justice and long-term national resilience as South Africa continues to urbanize and as climate change puts more strain on ecosystems.

2.5 THE GOVERNANCE OF SAND MINING IN SOUTH AFRICA

2.5.1 The role of traditional leaders in the South African sand mining sector

The role of traditional leaders in sand mining in South Africa is complex and deeply rooted in the intersection of customary land rights, local governance, economic opportunity, and environmental oversight. In many rural areas, especially in provinces like KwaZulu-Natal, where it has been reported that mining on communal grounds has been approved informally by traditional authority throughout the South Coast and in peri-urban regions like Inanda. Izinduna (headmen) and amakhosi (chiefs) who allegedly accepted cash or bribes in exchange for allowing access to river sand, circumventing formal mining permits, according to reports from environmental watchdogs and local media (Baleni & Minister of Mineral Resources, 2019:61). This shows that traditional leaders sometimes lacked awareness of their acts' violations of national mining rules, which reflects a lack of understanding of the official regulatory framework.

In Limpopo, where sand mining is common in Vhembe along the Limpopo River and its tributaries, traditional leaders frequently act as gatekeepers. According to local investigations, some traditional authorities grant "permission letters" for the extraction of sand, which miners use to defend their activities even though the Department of Mineral Resources and Energy (DMRE) does not recognize them legally. Conflicts between traditional councils and official government agencies have resulted from this, particularly in areas where environmental degradation has become apparent as well as the Eastern Cape (Aniyikaiye et al., 2021:17). The Department of Mineral Resources and Energy (DMRE) does not accept the "permission letters" that some traditional authorities give for sand extraction, yet miners use them to defend their operations, according to local investigations. Conflicts between official government agencies and traditional councils have resulted from this, particularly in areas where environmental degradation has become apparent.

Therefore, according to the above-mentioned, traditional leaders (such as chiefs and headmen) are the de facto custodians of communal land, including riverbeds and sand-rich areas. While they do not have full legal ownership under South African law, they wield significant influence over how land is accessed and used by local communities and external actors. This places them at the heart of both formal and informal sand mining dynamics.

2.5.2 The legal and policy framework

Sand mining comes in many forms, and the ways it is carried out can be either legal or illegal. According to Green (2012:3), sand mining can cause significant harm to ecosystems, particularly riparian environments, i.e., those areas along riverbanks and water bodies, which leads to their depletion over time. Beyond the visible effects on the environment, sand mining can damage soil quality, increase erosion, harm plant and animal life, destroy riverbanks, devastate wetlands, and even change how rivers flow. These serious consequences show why sand mining must be carefully monitored and controlled to protect natural resources. When sand mining is done following regulations and permits, it is considered legal sand mining. Unfortunately, unauthorised sand mining is common in many regions. This involves individuals or companies mining sand without the necessary permits or oversight. Such illegal activities often have negative impacts on both society and the environment because they are unregulated and unsustainable.

Chevallier (2014:1) explained that in South Africa, sand miners have little motivation to limit their extraction, given the current rate of permits and sand market prices. It is believed that sand prices will only rise once the resource becomes scarce, at which point alternative sources, like non-riverine land deposits or dredging operations, may come into play. Illegal sand mining disrupts the balance of sand supply, pushing prices up and increasing competition among miners. Chevallier further noted that in the KwaZulu-Natal province and the Eastern Cape, illegal sand mining mostly happens around sandbanks near rivers and within large river systems. While these activities might look small and localised, they frequently involve removing important riparian vegetation that plays a critical role in stabilising these areas.

Without this vegetation, the land is left unproductive, damaged, and rarely restored properly.

Madyise (2013:90-91) described riverbed mining as the process of extracting sand from the beds of rivers and streams. This method is popular because riverbeds often contain high-quality sand,

but it can cause serious environmental damage. Mining riverbeds can destroy habitats, cause erosion, and disrupt the natural flow of rivers, which can have cascading effects on the local ecosystem.

Beach sand mining is another type of mining, usually carried out on coastal beaches and dunes close to the shoreline. According to Widecast (2021:1), this activity is often done to support tourism, repair eroded beaches, or recover valuable minerals found in the sand. However, beach sand mining can accelerate beach erosion and cause harm to coastal systems. Offshore sand mining, where sand is removed from the ocean floor, is done to meet construction demands or for land reclamation projects. But this offshore activity can disturb marine life and damage underwater ecosystems.

Inland sand mining refers to sand extraction that takes place away from the coast, usually in open-pit mines or quarries. This form of mining is common for producing industrial sand and materials used in construction. Pit mining, which involves digging deep pits or quarries, is widely practiced for extracting sand for industrial purposes, including the manufacture of glass and silicon. Inland, mining is generally done on a larger scale and in more controlled environments; it can sometimes have less immediate impact on aquatic ecosystems but may still affect the surrounding land and water sources (Abdulazeez, 2016:7).

In South Africa, the legal framework governing sand mining is built on the foundation of the country's constitution. While the Constitution itself is not an ordinary piece of legislation, it is the highest law in the country. Any laws that contradict it are invalid. The constitution also sets out how responsibilities are divided between different branches of the government and explicitly guarantees the right to a healthy environment. This right is found in Section 24 of the Bill of Rights, which states that everyone has the right to live in an environment that is not harmful to their health or wellbeing (Muswaka, 2017:22).

It also states that the environment should be protected for the benefit of current and future generations through laws and other measures that prevent pollution, ecological damage, promote conservation, and encourage sustainable development. These principles guide how natural resources should be used in a way that balances environmental care with economic and social progress (Muswaka, 2017:23).

Two key pieces of legislation that regulate sand mining in South Africa are the Mineral and Petroleum Resources Development Act of 2002 and the National Environmental Management Act No. 107 of 1998. Both laws work together to ensure that mining activities, including sand mining, are carried out responsibly, with proper oversight and consideration for the environment. The Mineral and Petroleum Resources Development Act (MPRDA) focuses on regulating mining activities by controlling the granting of licenses and permits. This law requires anyone who wants to mine sand to obtain the proper permissions and follow certain environmental and safety standards. The goal is to make sure mining is done in a sustainable manner that minimises harm to the environment and communities.

The National Environmental Management Act (NEMA) provides a framework for environmental governance more broadly. It emphasises the need for integrated environmental management, meaning that all mining projects must consider their potential impacts on ecosystems, water quality, air pollution, and social well-being. NEMA also requires environmental impact assessments before mining projects can begin, making sure that all possible consequences are evaluated and managed.

Together, these laws create a system where legal sand mining can take place under strict conditions designed to protect the environment and public health. However, enforcing these laws remains a challenge, especially in areas where illegal sand mining is widespread.

- **The Mineral and Petroleum Resources Development Act of 2002**

The Mineral and Petroleum Resources Development Act of 2002 plays a crucial role in regulating sand mining in South Africa. It requires anyone wishing to mine sand to apply for permits through the Department of Mineral Resources and to follow specific rules designed to manage mining activities responsibly. However, Maphanga and Madonsela (2023:252) pointed out that government intervention when it comes to illegal sand mining is often lacking. They explain that sand mining tends to receive less attention compared to the mining of high-value minerals like diamonds and gold. Even though the Act covers sand mining, illegal sand extraction continues largely unchecked and has increased in recent years. This reflects poorly on the government's ability to enforce the law effectively.

For example, in the agricultural region of Philippi municipality in the Western Cape, extensive illegal sand mining has been reported. This activity has negatively impacted crop production and even put the safety of agricultural workers at risk, showing how unregulated mining can have serious social and economic consequences.

Maphanga and Madonsela (2023:253) also highlighted that small-scale sand mining regulations, which might aim to ensure environmental compliance, are difficult to enforce in South Africa. This is mainly because there is insufficient funding and not enough trained personnel to monitor and control illegal mining activities properly.

Muswaka (2017:31) emphasised that the Mineral and Petroleum Resources Development Act is the primary legislation governing various types of mining in South Africa. One of the key aims of this law is to uphold Section 24 of the South African Constitution, which guarantees everyone the right to live in an environment that does not harm their health or wellbeing. Theil (2019:7) explained that this section of the Constitution requires minerals and petroleum to be developed in ways that are economically, socially, and environmentally sustainable. The Act is thus an important tool for translating this constitutional right into practical regulations.

Theil (2019:7) says since the act promotes sustainable development of the country's mineral and petroleum resources while encouraging economic growth and social progress, it also requires that all mining activities comply with the National Environmental Management Act No. 107 of 1998. This environmental law provides guidelines on how to implement and interpret the environmental aspects of mining regulation. Under this framework, anyone holding mining rights or permits must:

- Thoroughly assess and communicate the environmental impacts of their activities.
- As much as possible, rehabilitate damaged environments to their natural state or to a land use that aligns with sustainable development principles.
- Take responsibility for any environmental damage, pollution, or ecological harm caused by their mining operations, whether it happens inside or outside their licensed area.
- Ensure their activities are carried out according to national environmental policies, standards, and norms.

In summary, the Mineral and Petroleum Resources Development Act of 2002 is designed to balance economic development with environmental protection, but challenges remain in enforcing these rules, especially in curbing illegal sand mining. Stronger government action and better resource allocation could help reduce the environmental damage caused by unsanctioned mining and support more sustainable practices.

- **National Environmental Management Act 107 of 1998**

Muswaka (2017:34) explained that the National Environmental Management Act (NEMA) serves as the foundation for South Africa's approach to environmental governance. The NEMA introduces a range of forward-thinking regulatory tools designed to ensure the sustainable use of both renewable and non-renewable natural resources. It clearly emphasises that development must be sustainable in economic, social, and ecological terms. One of the key mechanisms currently guiding development under NEMA is the Environmental Impact Assessment (EIA) regulations, which require that any proposed activity must undergo a basic environmental assessment before any environmental authorisation is granted. This process helps to ensure that potential environmental impacts are properly considered and managed.

Muswaka further notes that NEMA makes it illegal to begin any mining activity without securing the necessary environmental permits. If someone violates this rule and starts mining without authorization, they risk facing severe legal consequences. The penalty could be as harsh as a prison sentence of up to ten years, a fine of up to ten million rands, or both. The Act also imposes a statutory duty of care, meaning anyone who causes pollution or environmental harm must take responsibility for it.

Beyond promoting sustainable development, NEMA strongly supports the "polluter pays" principle. This principle is closely aligned with Section 24 of the South African Constitution, which guarantees everyone the right to an environment that does not harm their health or wellbeing. According to Nabileyo (2009:8), Section 24 also requires that the environment be protected for the benefit of current and future generations by adopting reasonable legislative and other measures. These measures should aim to prevent pollution and ecological degradation, promote conservation, and ensure ecologically sustainable development and use of natural resources, all while supporting economically and socially justifiable development.

Nabileyo (2009:8 9) further explained that the core purpose of the polluter pays principle is to preserve and protect the environment by holding those responsible for pollution accountable for the costs of preventing and repairing environmental damage. Section 24 directs the government to take action to repair environmental harm and places the financial burden for these efforts on those who caused the damage. Specifically, NEMA states that "the costs of remedying pollution, environmental degradation and consequent health effects must be paid for by those responsible for harming the environment" (Nabileyo, 2009:9). This means that mining companies or individuals involved in activities like sand mining are responsible for paying to restore any environmental damage they cause.

Nabileyo also highlighted that the polluter pays principle is a fundamental pillar of environmental law worldwide. It was formally recognised in the 1992 Rio Declaration on Environment and Development, which calls on polluters to compensate society for the environmental costs they impose. This principle is widely accepted as an economic tool that helps protect consumers and society by internalising the environmental costs of production.

Moreover, the polluter pays principle serves not only as a financial responsibility but also as a deterrent and enforcement mechanism. It encourages polluters to adopt practices that prevent damage and restore the environment to its original state before harm occurs. By guiding the behavior of potential polluters, the principle creates incentives for more environmentally responsible development. Nabileyo noted that Section 24 of NEMA allows for new developments to incorporate ecological and social costs into production processes and manufacturing, reflecting a more comprehensive approach to environmental stewardship. However, the principle's application depends on the specific characteristics of the environmental harm and the context in which it occurs.

The Organisation for Economic Co-operation and Development (OECD) was one of the first groups, back in 1972, to advocate for the polluter pays principle (Nabileyo, 2009:10). Despite its global acceptance, the principle can be controversial, especially in developing countries like South Africa. Here, the internalisation of environmental costs is sometimes seen as an unfair burden on struggling industries and economies. Nevertheless, the polluter pays principle remains an essential guide for developing effective national environmental policies, helping balance environmental protection with economic development. Principle 16 of the Rio Declaration

reinforces this by encouraging countries to incorporate environmental costs into economic decisions while considering public interests and ensuring that international trade and investment remain fair. While the principle clearly states that polluters should bear the financial consequences of pollution, there remains some debate and interpretation about how exactly this applies in specific cases, such as illegal sand mining (Luppi, Parisi & Rajagopalan, 2012:135).

Luppi, Parisi, and Rajagopalan (2012:135) further stated that the polluter pays principle holds that those responsible for causing pollution must bear the full cost of managing it, including measures to prevent, control, and clean up environmental damage. These costs may come in the form of taxes, fees, or other economic mechanisms aimed at reducing pollution. To achieve ecological effectiveness, those who cause pollution should be financially responsible for the damage. Importantly, the principle encourages a financial commitment to environmental responsibility but also distinguishes between identifying who caused pollution and allocating costs for broad preventative measures.

Soltau (1999:43) indicated that this principle is embedded within Sections 2 and 28 of NEMA. Section 2(4) specifically reinforces that those responsible for pollution must bear the costs of restoring the environment and addressing any related health effects. The polluter pays principle thus internalises the costs of environmental damage into market activities. By ensuring that prices reflect the true ecological and social costs of pollution and degradation, the principle encourages consumers to choose products and services that are less harmful to the environment. This creates incentives for sustainable resource use and environmental protection.

Sections 28 and 30 of NEMA provide a practical expression of this principle. Section 28 establishes a general duty of care, making individuals and companies responsible for preventing environmental harm. It also details liabilities if this responsibility is neglected. Those responsible must face consequences for environmental damage caused by their actions under Section 30.

Specifically, Section 28 of NEMA states that every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise

and rectify such pollution or degradation" (Soltau, 1999:43). This means that reasonable and proactive steps must be taken to avoid pollution, and when pollution happens, efforts must be made to repair the damage.

Furthermore, this section allows authorities to recover costs when they must take action under this provision. It identifies a broad and non-exhaustive group of liable parties, including the polluter, landowners, those controlling or using the land, or anyone negligent in preventing pollution (Nabileyo, 2009:13). This comprehensive approach ensures accountability across all possible contributors to environmental harm.

Nabileyo (2009:14) pointed out that Section 28 recognises three main groups potentially liable for environmental damage: the property owner, the person in control of the property, and the person granted rights to use the land where the harmful activity occurred. All these parties must undertake various measures like investigating, monitoring, and assessing environmental impacts. They must also ensure their employees understand the environmental risks related to their work and how to manage them responsibly.

Given the significant environmental, social, and economic harm caused by sand mining, the polluter pays principle is especially relevant. From the researchers' perspective, the principle can be applied in various ways to address sand mining's detrimental effects. These include ecosystem degradation, lower groundwater levels, erosion of riverbanks, destruction of aquatic habitats, and loss of biodiversity, where plants, fish, and other organisms suffer due to mining activities. Sand mining also increases vulnerability to natural disasters, such as coastal erosion and flooding, by removing sand from riverbeds and beaches. Furthermore, water quality deteriorates through increased sedimentation and pollution. Mining companies should, therefore, be held financially responsible for restoring damaged habitats and mitigating these negative effects according to the polluter pays principle.

The researchers believe that mining companies should cover costs related to rebuilding riverbanks, restoring vegetation through reforestation, and reconstructing damaged ecosystems. The government might also levy fees on sand extraction to fund environmental restoration efforts. If communities lose access to resources or are displaced because of mining activities, polluters

should compensate those affected, ensuring social as well as environmental justice. Despite its importance, the polluter pays principle faces many challenges in practice.

Barthakur (2021:276) explained that although it is widely accepted as a tool to promote ecological accountability and sustainable development, political, legal, and economic difficulties often hinder its application. Many developing countries, including South Africa and India, struggle with outdated or weak environmental laws and ineffective enforcement mechanisms. It can be difficult to hold polluters accountable when multiple parties are involved in causing environmental harm. Government inefficiencies, corruption, and lack of resources also weaken enforcement efforts.

Luppi, Parisi, and Rajagopalan (2012:135) warned that the polluter pays principle can sometimes lead to unintended consequences, such as placing heavy financial burdens on polluters. In some cases, companies might pass these costs onto consumers, which raises questions of fairness. Restoring environmental damage can be extremely costly, especially when addressing complex problems like erosion, climate change, or biodiversity loss. Smaller sand mining operators may lack the financial means to meet these responsibilities, potentially creating inequitable outcomes.

The researchers noted that practical issues further complicate implementing the polluter pays principle. It can be difficult to accurately value environmental damage, and there is often debate about the appropriate penalties or compensation. In areas with limited resources, monitoring and enforcement are challenging, making it hard to ensure polluters comply with regulations. Illegal and unregulated sand mining often goes unchecked, undermining the principle's effectiveness.

In summary, while the polluter pays principle is a cornerstone of environmental law in South Africa and essential for managing sand mining impacts, its full realisation depends on overcoming political, economic, and enforcement barriers. Stronger legal frameworks, better monitoring, and dedicated resources are needed to ensure polluters are held accountable and the environment is protected for current and future generations.

According to Barthakur (2021:276), enforcing the polluter pays principle is not an easy task, largely because of political and governmental challenges. The article explains that one major

hurdle is the lack of political will, especially in places where economic growth is prioritised over environmental sustainability. This means that pressure from businesses and lawmakers often weakens the principle by pushing for reduced fines or relaxed environmental regulations.

Barthakur also points out that enforcing this principle can stir up social problems. For example, if companies have to pay hefty fines, these costs might be passed on to consumers, making resources like sand more expensive. This can lead to public protests, especially if the fines cause job losses in communities dependent on these industries. Another unintended consequence is that strict enforcement might push polluters, such as sand miners, to relocate to areas with looser regulations, creating pollution "havens" and worsening environmental problems globally.

The researcher also highlighted technological barriers. Many countries, including South Africa and other developing nations, might lack the advanced tools needed to accurately measure environmental damage or monitor pollution levels. On top of that, those responsible for pollution might not have access to affordable technologies that could reduce their environmental impact, making it harder and more costly to comply with regulations.

2.5.3 Illegal Sand Mining in South Africa

Illegal sand mining is the extraction of sand without proper permits, a common issue in many places, and it often leads to harmful and unregulated activities that damage both the environment and local communities. Chevallier (2014:2) noted that South African sand miners have little motivation to limit how much sand they extract, since market prices do not rise until the resource becomes noticeably scarce. When that happens, alternatives like non-riverine land sources or dredging come into play. To protect sand availability and fair competition, stronger controls are needed to combat illegal mining. Both private sector groups and legitimate sand miners agree that regulations targeting illegal mining must be tightened.

Maphanga and Madonsela (2023:251) observed that sand mining has become popular in rural areas. South African communities, driven by the demand for construction materials and the opportunity to earn income. This increased reliance has led to more unregulated sand mining operations. They also mention that the link between environmental concerns and sand mining

remains controversial in South Africa, partly because of limited research, though some mining operators are becoming more environmentally conscious.

In Limpopo Province, illegal sand mining has been particularly widespread. Rapholo, Ramapedi, and Sengani (2023) reported numerous illegal mining sites across several river systems, including the Molotosi, Letsitele, Nzhele, Mvudi, Dwars, Turfloop, and Mokolo rivers. For example, the Mvudi River alone had twenty-three illegal mining locations, mostly active from 2012 to 2022, with some going back even further. The Nzhele River had twentyseven such sites, affecting almost every section of the river, including areas around Makhado. Other rivers had numerous illegal mining points, often driven by the high demand for building materials. Unfortunately, these activities have led to degraded vegetation, poor land quality, and adverse effects on local communities.

The South African Sand Mining Association (ASPASA) warns about the dangers of illegal sand mining, especially the unguarded pits left behind. These pits pose serious drowning risks to people and animals, especially when they fill with rainwater during the summer. Geldenhuys (2023) highlighted how law enforcement has struggled to respond effectively, allowing illegal operations to grow more complex and widespread. Community activist Moipone Tabi from Marikana shared how some rural communities near Hammanskraal live dangerously close to large, open pits created by illegal miners, with children risking their safety walking near them on their way to school (Ledwaba, 2019).

Maphanga and Madonsela (2023:252-253) emphasised that while illegal mining related to gold and diamonds often gets more attention, illegal sand mining is more widespread and damaging. Despite being regulated under the Mineral and Petroleum Resources Development Act of 2002, illegal sand mining continues unchecked. It causes serious environmental problems like soil erosion, sinkholes, loss of biodiversity, and contamination of soil and water sources. When the water table is high, it can also harm grazing and croplands.

In the Western Cape's Philippi municipality, illegal sand mining threatens thousands of farm workers' livelihoods and reduces crop yields by destroying important plants that stabilise riverbanks and filter pollutants. Water security in South Africa is a growing concern, with limited rainfall, pollution, and rising consumption putting pressure on rivers and our main

inland water sources. Illegal sand mining contributes to this by accelerating erosion and damaging ecosystems (Madyise, 2013:5).

In Limpopo's Sand River basin, a key agricultural area, illegal artisanal and small-scale mining (ASM) has led to significant environmental damage. Mining companies and environmental practitioners sometimes try to skirt regulations by applying for multiple small permits that collectively cover large areas, avoiding proper water use licenses. This leads to land loss, reduced water tables, and harm to fishing and agriculture, with little to no public consultation about the impacts (Maphanga and Madonsela, 2023:253).

Although illegal sand mining provides some unstable jobs for a small number of people, it also seriously harms the environment. Sengani and Zvarivadza (2019:70) noted that sand mining accounts for about a third of the industry's total earnings, showing its economic importance in South Africa. However, many mining activities operate without official approval, meaning miners do not pay taxes, while large construction companies drive most of the strip-mining operations. Illegal mines are found wherever land meets the ocean; some are set up for housing, others for tourism.

Globally, illicit river sand mining is a major environmental problem in countries like China, Bangladesh, India, Kenya, Nigeria, South Africa, and Botswana (Rapholo, Rampedi, & Sengani, 2023). This activity is driven by socioeconomic needs and often falls under the category of Artisanal Small Scale Sand Mining (ASM), which many governments struggle to regulate effectively. ASM is characterised by simple tools and informal practices without strict protocols (Zvarivadza).

In Limpopo, previous research on illicit river sand mining focused on certain rivers like Nzhelele and Mokolo, but large parts of the province, including key rivers like Lephalale, Letaba, and Lepelle, have not yet been thoroughly studied.

- **Artisanal Sand Mining**

Artisanal sand mining refers to the traditional and customary ways of extracting sand using rudimentary tools and techniques, often passed down through generations. According to Adonisi-Kgame, Sitefane et al. (2022:1), this form of mining involves minimal mechanisation and is rooted in community practices. Typically, the equipment used includes basic tools such as spades

or shovels handled by a few individuals, and in some cases, an excavator or bulldozer is used to assist with vegetation clearing and sand loading (Green, 2012:10).

Ngcobo (2023:64) explained that this form of sand extraction often takes place in communal areas, such as beaches, inland dunes, and rivers are under the jurisdiction of traditional leadership. This makes artisanal sand mining closely tied to land rights and land use disputes. South African mineral resources legislation stipulates that all minerals belong to the state. Therefore, anyone wishing to mine must obtain a license and negotiate with the land's custodians, often traditional leaders who manage land use and redistribution in communal areas. In this way, traditional leaders become key players in decisions around sand mining.

Ngcobo (2023:64) further explains that despite its historical and local significance, artisanal sand mining is not legally recognised in South Africa. Communities, especially in rural areas, are prohibited from freely using sand resources in their own environments. Instead, anyone needing sand must purchase it from licensed miners, usually well-established companies that can afford the high costs of obtaining mining permits. This legal barrier effectively excludes many rural dwellers from benefiting from the natural resources around them. It has been argued that this situation enriches long-standing mining enterprises while marginalising poorer, local communities, thereby reinforcing existing inequalities and creating tensions over control and access. This is a core feature of the sand mining economic structure in South Africa.

Ngcobo (2023:65) further noted that with widespread poverty and unemployment in rural areas, communities cannot afford to wait for formal mining companies to seek licenses to operate in their territories. As a result, artisanal sand mining persists even in the face of restrictive laws because it provides a source of immediate income. The ongoing expansion of the construction industry has only increased the demand for sand, prompting a rise in both artisanal and illegal mining activities. However, professional or licensed sand miners view these informal operators as unfair competition.

The South African government tends to view artisanal sand mining as an informal entrepreneurial activity, often driven by individuals seeking quick profits (Ngcobo, 2023:67). Due to a lack of formal regulation, those involved without permits are labelled “criminal entrepreneurs.” The

country's mineral policy does not distinguish between small-scale, informal miners and large-scale commercial operations (Hilson, 2016:7–8). Nevertheless, the reality is that many people turn to artisanal sand mining out of economic desperation, using simple tools to earn a basic living.

Ngcobo further highlighted the ongoing debate around artisanal sand mining. Some regard it as a harmful practice, while others see it as a necessary means of survival. Critics, mainly business stakeholders, argue that unlicensed sand miners disrupt formal economic goals and pose risks to regulated sectors. Because artisanal sand mining often operates outside the law, it is classified as an economic crime, contributing to negative perceptions of its role in society. Concerns have also been raised about its impact on other industries, including agriculture, fishing, tourism, and legal sand mining ventures.

In addition, Ngcobo (2013:70) pointed out growing apprehension about the sustainability of illegal sand mining. One of the main criticisms is that the low barriers to entry, requiring only basic equipment and no licensing, make it highly profitable for those willing to take the risk. Since illegal miners do not pay taxes, royalties, or environmental restoration costs, their sand can be sold at much lower prices than that of legal operators. This creates a pricing problem, especially in construction and infrastructure projects.

Ngcobo also highlights the broader economic impact of sand mining, particularly on other vital sources of income like fishing, tourism, and agriculture. Agricultural organisations such as AgriSA and *Food for Mzansi* have voiced strong concerns, arguing that uncontrolled sand mining threatens the country's food security. They warn that it compromises both water resource management and agricultural productivity. According to Gondo et al. (2019:2), excessive sand extraction lowers the water table, which in turn disrupts irrigation systems and depletes farm wells. Unlawful sand miners are also known to encroach on farmland, often damaging or destroying small-scale agricultural operations.

Tourism is another sector negatively affected by sand mining. The removal of sand alters scenic landscapes, leaving behind unattractive, damaged land that reduces the area's visual appeal. Moreover, the constant noise, dust, and traffic from mining operations disturb the peace and

tranquillity that tourists often seek. Advocates for tighter regulations argue that illegal sand miners operate recklessly, damaging vital infrastructure such as roads, rivers, and bridges. For example, a 2022 *Cape Times* report noted that seven bridges and multiple sand roads in the City of Cape Town were severely damaged due to illegal sand mining activities. Critics highlighted that although these miners do not pay taxes or royalties, government funds must still be used to repair the destruction caused by their heavy vehicles.

> One of the strongest arguments against artisanal sand mining is its harmful impact on the environment. These include ecosystem degradation, infrastructure destruction, and water scarcity. To legally mine sand, applicants must submit an environmental management plan outlining how they will reduce harm to the natural environment. Yet, even licensed sand miners are frequently accused of ignoring these regulations, enabled by weak law enforcement and poor oversight (Green, 2012:91).

Water sources are particularly vulnerable. Sand mining can contaminate rivers and streams, disrupt the supply of clean drinking water, and reduce water availability for surrounding communities. In mechanised operations, spills of gasoline and hydraulic oil into waterways are common, further polluting ecosystems (Gondo et al., 2019:2).

While sand is a crucial resource for human development, it also plays an essential ecological role. As Chevallier (2014:3) noted, sand acts like a sponge, helping to replenish groundwater levels. Ignoring these environmental functions has serious consequences. For instance, in 2015, the Umvoti River dried up due to over-extraction of sand, and this problem was worsened by an ongoing drought (Subban, 2015:1). These examples underscore how the unchecked exploitation of sand can create a ripple effect of environmental and socio-economic damage in vulnerable communities.

Informal or artisanal sand miners frequently fail to rehabilitate their mining sites. They often leave behind open barrow pits that pose serious hazards to both residents and their livestock.

> Community members have raised additional concerns about the relentless flow of heavy trucks associated with sand mining. These trucks not only degrade gravel roads but also endanger pedestrians and farm animals. Moreover, they frequently operate at night, contributing to noise

pollution and creating a sense of insecurity among residents as sand is stolen under the cover of darkness.

Additional issues arise when illegal miners encroach on land suitable for agriculture or human settlement. Sand mining is not limited to rivers alone, and people living in rural areas often lack sufficient legal knowledge to respond effectively. For example, in communities outside Hammanskraal in Mpumalanga, residents were unaware that removing sand from its natural setting is a regulated activity and that they had the right to intervene to prevent such exploitation (Ledwaba, 2019:1).

A lack of awareness about legal protections leaves vulnerable and underprivileged communities exposed to the negative consequences of artisanal sand mining. In many cases, these same communities find themselves purchasing sand from artisanal miners, despite receiving no direct benefits from any sand mining activities, formal or informal, taking place in their regions. A poignant example of this occurred in Vhembe, Limpopo Province, where elderly nomadic farmers were driven to financial ruin after illegal sand miners took over their land (Tshikhudo, 2022:1).

Without government support, affected communities were forced to hire lawyers in a desperate attempt to reclaim their territory. Similarly, in Coffee Bay on the Wild Coast, residents have called for an end to illegal sand mining, viewing it as a destructive practice that benefits only a few, typically outsiders with no connection to the community. Workers involved in illegal sand mining often face extremely dangerous conditions. South Africa's high unemployment rate pushes many into exploitative environments within this unregulated sector. These workers lack formal employment protections and are excluded from national health and safety regulations. According to the Aggregates and Sand Producers Association of South Africa (ASPASA), government officials who ignore these operations are complicit in violating human rights and the Basic Conditions of Employment Act (O'Reilly, 2022:1).

The lack of government enforcement and failure to prosecute offenders has been identified as a key driver of the rise in illegal sand mining. The Department of Mineral Resources (DMR) has been widely criticised for its inaction. Despite years of media investigations, academic

warnings, and calls from conservationists, the DMR's delays have allowed illegal mining to persist, turning sand extraction into a virtually unregulated "free-for-all." While the Green Scorpions, the national environmental inspectorate, conducted high-profile sting operations in 2014, such interventions have been inconsistent and limited in impact. Equipment seized during these raids is often returned to communities without proper explanation, reinforcing the perception that enforcement disproportionately targets large-scale mining operations, while small-scale, artisanal miners are rarely held accountable.

The ASPASA has highlighted this inconsistency, noting that enforcement efforts often spare artisanal miners, despite their significant contributions to environmental degradation (O'Reilly, 2022:1). Shutting down illegal operations is further complicated by the mobile nature of these miners. Many relocate quickly or operate under the cover of night, making it difficult for authorities to track or stop them.

The situation is exacerbated by strained relationships among key regulatory bodies, including the Department of Mineral Resources (DMR), the Department of Environmental Affairs (DEA), and the Department of Water and Sanitation (DWS). These departments often engage in power struggles and demonstrate poor interdepartmental coordination. According to Green (2012:95,106) and Carnie (2015:1), the DMR has developed a defensive stance, viewing mining as essential to national economic growth and resisting interference from other government entities. This is affirmed by Green (2012:88 89), who highlighted that the DMR officials reiterated that the Mineral and Petroleum Resources Development Act (MPRDA) contains sufficient provisions for environmental protection, and therefore other departments, such as Environmental Affairs, need not intervene.

This disconnect between departments creates legal uncertainty and weakens enforcement. Community members often do not know which authority to contact when they witness illegal sand mining. In one case, a legal sand supplier from Ga-Mphahlele in Limpopo, whose licensed mining area was being invaded by illegal miners, was forced to seek assistance from the Office of the Public Protector after receiving no help from the relevant authorities (Ledwaba, 2019:1). In an attempt to resolve such confusion, South Africa's mineral resources policy has undergone two revisions aimed at clarifying institutional responsibilities. According to Chevallier (2014:4),

the policy was first amended in 2008 to bring mining practices in line with the environmental principles outlined in the National Environmental Management Act (NEMA), thus establishing a single, unified system for environmental oversight in the mining sector. A second revision in 2012 granted the DMR authority to issue environmental authorisations and water permits concurrently, in hopes of simplifying the permitting process.

Despite these reforms, illegal sand mining remains a persistent challenge. Weak enforcement, limited community awareness, and interdepartmental rivalries continue to undermine efforts to regulate this sector, leaving many communities to deal with the social, environmental, and economic consequences on their own. Despite the numerous concerns associated with sand mining, the core argument presented by some researchers and community advocates is that artisanal sand mining, in and of itself, is not inherently destructive. The real problem lies in outdated or inadequate legislative frameworks that fail to recognise and regulate natural resources, like sand, as vital sources of livelihood for marginalised and economically disadvantaged populations.

Scholars such as Gondo et al. (2019:2) and Green (2012:93&94) argued that the current legal structures neglect to properly define sand as a managed resource. These frameworks often fall short of promoting sustainable use, fostering peaceful and responsible mining practices, and reducing the environmental harm associated with sand extraction.

From this perspective, the criticism is not aimed directly at artisanal miners, but rather at systems that exclude them from formal economic participation while offering them no realistic alternatives. In fact, the tone of this analysis is empathetic toward artisanal sand miners. It emphasises the importance of creating enabling environments that allow small-scale miners to operate within legal and regulated systems, thus becoming part of the formal economy rather than being criminalised or marginalised.

On the Wild Coast, law enforcement operations targeting artisanal miners were suspended after the Minister of Environmental Affairs acknowledged mounting complaints from local communities. These communities stated that they depend on sand mining for their day-to-day survival and income (Davis, 2015:1; Mngeni et al., 2016:451). In another instance along the Illovo River in KwaZulu-Natal, local community members directly challenged the authorities, leading to a halt in anti-mining operations. This incident underscored the state's tendency to

take a more lenient approach when faced with vocal opposition from communities. Authorities appeared to relent to community pressure and tacitly allowed unauthorised miners to continue operating, even as they exposed and disturbed rivers across the country (Baillache, 2019:1).

In many rural areas, community members rely heavily on sand mining as one of the few available economic activities that provide income and employment. Advocates of artisanal sand mining argue that this form of extraction helps communities sustain themselves and, in some cases, even fund collective development efforts. For example, some communities on the Wild Coast reportedly pool the proceeds from sand sales to finance local infrastructure and services (Davis, 2015:1; Mngeni et al., 2016:449).

However, this reliance on informal mining also exposes communities to exploitation by opportunistic middlemen and traders. Reports indicate that local miners are often paid as little as R150 for an eight-ton load of sand, which is then resold for more than R1,000. Residents of Cwebeni village on the Wild Coast have expressed awareness of this exploitation but feel powerless to raise their prices. The fear is that doing so might push miners to relocate to other areas, leaving communities with no income at all (Stone & Fuzile, 2014:1).
Such situations highlight the absence of formal regulation as a key contributor to the exploitation of poor rural areas. Instead of helping communities benefit from their natural resources, the lack of oversight enables predatory behavior and deepens poverty. Properly managed, sand mining could become a sustainable source of local development and economic growth rather than a trigger for environmental degradation and social injustice.

There are also increasing calls for traditional leaders and landowners who collaborate with illegal mining operations to be held responsible. Scholars and activists argue that sand mining should be properly monitored, and those who facilitate its unlawful aspects must face accountability (Amponsah-Dacosta & Mathada, 2017:1261). However, there is an important counterargument from defenders of artisanal sand miners. They maintain that traditional leaders allocate land according to customary law, and that such acts do not constitute land invasion in the legal sense. In contrast to illegal commercial miners who often disregard local customs and ownership rights, artisanal sand miners tend to work within accepted community frameworks.

This perspective suggests that informal community-based sand mining should not be immediately criminalised, but rather formalised, guided, and regulated in a manner that ensures both environmental sustainability and economic benefit. The argument here is not to dismiss the real damage caused by uncontrolled mining, but to differentiate between types of sand mining, particularly between community-driven artisanal efforts and profit-driven illegal operations that often ignore both community welfare and environmental laws (Nhlengethwa, 2016:1).

Therefore, the debate calls for a more nuanced and inclusive regulatory approach, one that distinguishes between artisanal and illegal mining, acknowledges the socio-economic realities of rural populations, and empowers communities to manage their own natural resources responsibly and lawfully.

- **The case of Illegal Sand Mining on the Wild Coast and its Governance**

Most sand mining activities on the Wild Coast take place approximately one kilometre inland from the coastline, with operations typically concentrated on dunes, beaches, and the easily accessible stretches of estuaries. While it remains difficult to obtain precise data on the total number of unregistered or illegal sand mining operations in the area, reports from 2023 indicate that there were around 250 active illegal sand mines. Mngeni et al. (2016) further noted that every day, hundreds of trucks leave the Wild Coast loaded with sand extracted from riverbeds and beaches.

Though each mining site may appear small, ranging between one and two hectares in size and often scattered across the landscape, the cumulative environmental damage over time is significant. These sand mining activities have serious long-term consequences for local ecosystems, particularly river systems and wetlands, as well as for the well-being of the communities that depend on them (Bisht, 2021:7; DEDEAT, 2012:1).

Since the mid-1990s, the number of illegal sand mining operations along the Wild Coast has steadily increased. This growth is partly driven by rising demand from local communities, many of whom have transitioned to building homes using brick and mortar. At the same time, the construction of public infrastructure, such as government schools, housing developments, water supply projects, and other community service facilities, has led to further demand for sand. This

surge in demand has opened up new opportunities for building and transport companies to supply sand to these state-led developments (CES et al., 2004:1). Some relatively privileged individuals within these communities have viewed the growing sand demand as an opportunity to stimulate the local economy. Financial benefits from the mining and sale of sand are often concentrated in areas surrounding the mines, although these benefits are not always distributed equitably among all community members.

> According to Manona and Kepe (2024:3), a system of "gate fees" was introduced in various parts of the Wild Coast, wherein truck operators were charged fees by community representatives for transporting sand. These fees were morally and culturally justified under traditional chieftaincy structures and were presented as contributions meant to benefit the broader community. However, in practice, these so-called community fees often only benefited a small group of privileged individuals.

Despite the absence of formal gates or checkpoints to monitor vehicle movements, designated community members were tasked with collecting these gate fees. Truck drivers were expected to pay the agreed-upon amounts either at specific points along the roads or directly at the illegal mining sites. The fees varied depending on the load capacity of the vehicles. Stone and Fuzile (2014:1) reported that truck drivers typically paid around R150 for an eight-ton load of sand. This same load would later be sold to buyers for more than R1,000, highlighting the significant mark-up and the potential for profit at the expense of both the environment and community equity.

Phaliso (2020) reported that in certain areas of the Eastern Cape province, individuals were granted access rights to mine sand for a fee ranging between R30,000 and R35,000, depending on the length of the agreement. Although traditional leaders in these communities often emphasise that sand mining operations should bring benefits to the local population, the reality on the ground paints a different picture. In most cases, the few local people who did manage to secure employment from these operations received only minimal compensation, typically low wages for physically demanding tasks such as loading sand onto trucks. This evidence challenges the earlier claims made by Mngeni et al. (2016:449), who suggested that sand mining can stimulate local economic development and raise living standards in affected communities. In

truth, the benefits are often limited, unequally distributed, and fail to translate into meaningful improvements for the broader population.

Moreover, the researcher has observed that sand mining is sometimes imposed upon communities without proper consultation or consent. One striking example comes from the Wild Coast in the Eastern Cape, where video footage revealed community members openly opposing a speech by the King of the AmaMpondo. During a heated exchange, the king responded to hecklings from the crowd by stating, *"You can boo all you want. The development will happen. We are not here to ask for your permission. We have a program for the AmaMpondo kingdom. As the government and together with you, the people. Nothing will stop us. We can't be stopped by three or two people. I don't mind being booed by you"* (eNCA, 2019). This public confrontation highlights a critical issue: decision-makers in positions of power may push forward with sand mining initiatives regardless of opposition from residents, thereby silencing the voices of those who will be directly impacted. It underscores how some authorities may fail to engage meaningfully with the very communities they claim to represent.

In addition, chieftaincy structures responsible for regulating sand sales in the Mkhambathi area have openly acknowledged that they are aware that mining permits are required for legal sand extraction. However, they also stated that they operate without such permits, citing a lack of response from the Department of Mineral Resources and Energy (DMRE) when attempts are made to schedule meetings or submit permit requests.

De Villiers (2021) further explained that sand mining activities in and around the Mkhambathi Nature Reserve have grown significantly over the past two decades. What was once a minimal concern has now evolved into widespread extraction along streams and wetlands. These areas are not only ecologically sensitive but are also known for their abundance of traditional medicinal plant species, which further elevate the environmental and cultural stakes associated with unchecked sand mining.

- **Environmental Ethics Related to Illegal Sand Mining in South Africa**

Maphanga and Madonsela (2023:252) explained that illegal sand mining poses a wide range of environmental threats. Among the most pressing concerns are soil erosion, contamination of both

surface and groundwater, loss of biodiversity, and the formation of dangerous sinkholes. These consequences can significantly damage productive grazing lands and croplands, while also polluting natural water bodies, particularly in areas where the water table is high. Such environmental degradation inevitably invites reflection from those who view these issues through the lens of environmental ethics, prompting critical questions about our collective responsibility to protect the ecosystems we depend on, and whether we are honouring the right of both current and future generations to live in a clean and healthy environment.

From the perspective of environmental ethics, the rise of illegal sand mining in South Africa presents several deeply troubling moral dilemmas. Central among these are concerns around sustainability, ecological justice, and intergenerational responsibility. Environmental ethics focuses on the moral relationship between human beings and the natural world. It emphasises that decisions made today must support long-term ecological balance and ensure justice for all forms of life, human and non-human alike, as well as for generations yet to come. Illegal sand mining often prioritises short-term economic gain at the expense of long-term sustainability, environmental well-being, and social justice, thereby breaching fundamental ethical principles.

Ecological justice argues that the natural environment has intrinsic value and should not be regarded merely as a resource for human exploitation (Fang, Hassan, and LePageso, 202:153). Illegal sand mining severely disrupts ecosystems that support a wide variety of life forms. It destroys aquatic habitats, reduces biodiversity, and leads to the death of plant and fish species. Such destruction violates the core ethical principle that nature has rights and must be protected from unchecked human interference.

Furthermore, ecological justice extends its concern to human communities that rely directly on healthy natural ecosystems for their livelihoods. Rivers and wetlands, for instance, are vital to many rural populations for farming, fishing, and accessing clean water. However, illegal sand mining pollutes these waterways, degrades water quality, and intensifies erosion, all of which threaten the health, stability, and economic resilience of these communities (Yamashiki et al., 2006:1273; Sonna et al., 2022:128–129). In doing so, it undermines justice not only for the environment but also for the people who depend on it most.

The most vulnerable communities, often those already economically disadvantaged, are typically the hardest hit. Their farmlands are stripped, their homes are threatened by increased risks of natural disasters, and their connection to essential water sources is jeopardised. As a result, people are displaced, agricultural yields drop, and long-term community stability is put in danger. These consequences make it painfully clear that the continuation of illegal sand mining is not just an environmental issue; it is also a moral one, requiring urgent action grounded in ethical responsibility and ecological awareness.

From the perspective of environmental justice, this situation is deeply unfair. It is the poorest and most vulnerable communities that end up facing the harsh environmental and social fallout of illegal sand mining, while only a small group of people reap the financial benefits. Powerful mafias often run these illicit operations, leaving local communities to deal with damaged land, polluted water sources, and a weakened ability to cope with climate change. The burden falls heavily on those least equipped to handle it, highlighting a clear injustice that demands attention.

- **Social Justice in Relation to Illegal Sand Mining in South Africa**

Social justice is about creating a fair and just society where everyone can thrive. Illegal sand mining hits local communities hard, especially those who rely on natural resources to survive. As this chapter highlights, illegal sand mining can lead to serious consequences, like losing valuable topsoil, displacing people from their homes, and polluting water sources, all of which deepen existing social injustices. This means these communities often must bear the brunt of these negative impacts.

> Ledwaba (2019:1) narrated the story of a community in the Northwest province where activist Moipone Tabi discovered people living near a dangerous open pit left behind by illegal sand miners, a pit so hazardous it could cause death. Shockingly, the community had come to accept this as part of their everyday reality. Children walk past these pits daily on their way to school, and during the rainy season, the holes fill with water. Farmers also lose livestock when animals fall into these pits.

What stands out most is how vulnerable groups suffer the most from illegal sand mining, while a small group of wealthy individuals and companies' profit. This is a core social justice issue. Environmental damage caused by illegal mining disproportionately affects low-income

communities living near rivers, wetlands, and coastal areas. These people struggle to maintain their livelihoods because erosion, flooding, and loss of farmland threaten their survival. In urban areas, uncontrolled sand mining can result in poor-quality construction, putting low-income housing at risk of collapse. This uneven distribution of harm is a clear violation of social justice, with those least able to cope carrying the greatest burden while corrupt officials, rich developers, and mining mafias continue to benefit without facing consequences.

Illegal sand mining often involves exploitative labour practices. Unemployed and impoverished individuals, sometimes even children, are recruited to work in dangerous conditions (O'Reilly, 2022:1). These workers receive very low pay for physically demanding and risky jobs. There are no safety measures, so accidents, illnesses, and even deaths from collapsing pits or polluted water are common. Without better economic opportunities, many workers are trapped in this exploitative cycle, forced to continue despite the dangers. From a social justice perspective, this is a gross violation of human rights and labour dignity. It is crucial that the government steps in with ethical responsibility to regulate labour practices, provide safer and alternative livelihoods, and break the cycle of poverty and exploitation that fuels illegal sand mining (Chevallier, 2014:1).

For a truly just society, governments and corporations must act with integrity and take responsibility for managing natural resources fairly. This means cracking down harder on illegal mining through stronger enforcement of environmental laws, promoting transparency and fighting corruption to keep politics out of the process, and supporting eco-friendly mining methods that also create jobs for local people. It is just as important to involve communities directly in decision-making, making sure their voices are heard and respected when policies about sand mining are being developed. When authorities fail to act, it only deepens existing inequalities in South Africa, allows environmental harm to continue unchecked, and keeps disadvantaged communities trapped in the cycle of injustice.

2.6 ENVIRONMENTAL EFFECTS OF SAND MINING IN SOUTH AFRICA

Sand mining, especially in rivers, lakes, and along coasts, is a major cause of water pollution (Asabonga et al., 2017:2). When sand is mined, it stirs up the riverbeds and nearby farmland, making the water cloudy or murky, a process known as increased turbidity (Pitchaiah, 2017:4).

This muddiness blocks sunlight from reaching underwater plants because the silt and fine particles that usually settle at the bottom get mixed up. As a result, the marine food chain is disrupted, and photosynthesis in aquatic plants slows down.

Pitchaiah (2017:4) also pointed out that heavy machinery and vehicles used near water bodes often cause accidental spills of oil, gas, and lubricants, which pollute the water. These substances can linger for a long time and seriously harm aquatic life. On top of that, erosion caused by intense mining can wash sediment into rivers and streams, which clogs waterways and damages fish habitats. This sediment can smother fish eggs and larvae or destroy their breeding grounds, causing harm or even death to many aquatic plants and animals.

If pollution is another major issue linked to sand mining. The process of digging up, loading, transporting, and piling sand creates a lot of dust and tiny particles (Madyise, 2013:59-60). These particles can travel for miles, especially on windy and dry days, spreading far beyond the mining site. This does not just lower air quality; it also puts nearby residents and workers at serious risk. Breathing in fine dust over time can lead to health problems like asthma, bronchitis, and other lung diseases (Hassan and Rahmat, 2016:29). On top of that, the machines used for mining release harmful chemicals such as carbon monoxide, sulphur dioxide, and nitrogen oxides. These pollutants add to air pollution and can threaten both the environment and human health (Poonia, Kansara, & Choudhary, 2024:313).

Sand mining causes serious damage to the soil, along with polluting the air and water. Fuel and oil spills from mining equipment and vehicles often seep into the soil, making the land unsuitable for growing plants or farming. This contamination also harms the soil's structure and reduces its nutrient content. On top of that, valuable topsoil, the richest, most nutrient-packed layer, is often washed away during mining. As Pitchaiah (2017:4) explained, losing this top layer leaves the ground exposed and more vulnerable to erosion. Over time, this kind of damage can lead to the loss of farmland and force people who rely on agriculture to find new ways to support themselves (Malebana, 2021:33).

One often overlooked effect of sand mining is noise pollution. The constant use of heavy machinery like excavators, dump trucks, and crushers creates a lot of noise (Madyise, 2013:59 60). According to Peng, Zhao, and Liu (2015:12305) and Rangel-Buitrago et al. (2022:106294), this noise does not just disturb the workers on the site; it also affects nearby communities and

wildlife. Animals can have their communication, migration, and mating behaviors disrupted by the ongoing noise. For people living close to mining operations, long-term exposure to loud sounds can lead to hearing problems, increased stress, and trouble sleeping.

Saviour (2012:125) explained that the impacts of sand mining on rivers and the environment can be both direct and indirect. He further explained that Direct impacts happen when the actual removal of materials from the land immediately disrupts ecosystems, for example, when floodplain habitats are destroyed. Indirect impacts, on the other hand, occur because of changes in the river system itself caused by sand extraction. These might include alterations in the river's flow, its shape, or the balance of sediments, all of which can shift how ecosystems function and where plants and animals can live.

Malebana (2021:33) highlighted that sand mining often leads to serious environmental problems like land degradation, erosion that eats away at valuable farmland, and the loss of biodiversity. Green (2012:45) adds to this by pointing out that sand mining can degrade aquatic habitats by stripping away the gravel bed material and exposing underlying sediments, which can harm fish and other wildlife. It can also weaken the foundations of important infrastructure like bridges and pipelines by changing the riverbed's structure.

When considering these issues through the lens of ethics, Zhang (2017:1) defined ethics as a system of moral values that guide us in determining what is right and wrong. One ethical approach, utilitarianism, looks at the consequences of actions and supports those that bring the greatest good to the greatest number of people (McCombs Business School, 2021:1; Elliott and June, 2018:159). However, a challenge with this approach is that it is often hard to predict whether the outcomes will be mostly positive or negative.

Historically, economists have prioritised economic growth and stability, sometimes overlooking environmental concerns. Tota and Shehu (2012:1) suggested that if economists had a stronger grasp of ethics, they could create policies that better balance economic needs with moral responsibilities.

The debate over sand mining is a classic ethical dilemma, where conflicting interests collide. Figar and Đorđević (2016:345) described an ethical dilemma as having to choose between two or more competing options. On one hand, economists argue that sand mining boosts local economies by creating jobs and improving infrastructure like roads and buildings (Sonna et al., 2022:124). On the other hand, environmentalists warn that sand mining leads to coastal erosion and destroys property, putting the livelihoods of coastal communities at risk (Pitchaiah, 2017:3). This ongoing tension between economic development and environmental protection highlights the difficult balance society must strike when managing natural resources like sand. Sand mining has serious negative effects on both the environment and local communities. As Malebana (2021:33) pointed out, these operations lead to deforestation and the loss of biodiversity. Similarly, Gondo, Amponsoh-Dacosta, and Mathada (2019:4) explained that ongoing sand mining removes vegetation, valuable topsoil, and subsoil, which in turn causes a decline in animal populations.

People living near river basins are particularly affected by sand mining. It raises concerns about the quality and availability of groundwater, damages infrastructure, and accelerates soil erosion on farmland (Lowe, 2018:12). This also means that bridges and other structures near rivers face serious long-term damage due to these mining activities. Sand is everywhere, and it is mined daily by companies, individuals, and communities, both legally and illegally. Unfortunately, little attention is paid to the environmental damage caused by this activity. This brings us to the issue of sand mafias, organised criminal groups that illegally extract and sell sand for profit.

According to Mahadevan (2019:4), these mafias harm the country's economy and environment through their destructive practices. Tweedie (2018:1) added that because legally sourced sand can be expensive, many construction companies turn to these illegal sources, mining sand unlawfully in remote areas or even stealing it from beaches.

One of the major consequences of illegal sand mining and the activities of sand mafias is the loss of agricultural land. The depletion of natural resources makes large areas unsuitable for farming, which hits local farmers hard and disrupts the local economy (Rapholo, Ramapedi & Sengani, 2023:17; Torres et al., 2017:971).

Interestingly, sand mafias may employ more people than government projects or legitimate companies, which helps them maintain corrupt networks that further encourage sand theft. This situation presents a complex ethical dilemma. On one side are economists who argue that sand mining is essential for economic growth, providing materials like glass and silicon necessary for construction. On the other side are environmentalists who warn us about the damaging effects of sand mining and stress the importance of protecting our environment for current and future generations. They also highlight the risks linked to illegal sand mining and advocate for strategies to reduce its environmental impact.

2.6.1 The Effects on Water

According to Pitchaiah (2017:4), sand mining can have serious impacts on aquatic ecosystems. It can reduce the photosynthesis of plants by affecting light penetration and oxygen levels in the water. These changes can disrupt the feeding habits of many aquatic animals and alter the composition of phytoplankton, which is essential for the aquatic food chain. Such disturbances can affect the reproduction and development of aquatic species, leading to breathing difficulties, increased disease risks, and a decline in fish populations, sometimes resulting in significant losses. Pitchaiah also highlighted that sand mining contributes to coastal and soil erosion. This erosion can lead to seawater intrusion into freshwater areas and damage important infrastructure projects. Additionally, water quality often worsens due to pollution from mining, which raises water treatment costs and negatively impacts biodiversity.

Riverbeds and banks may become unstable or sink because of sand mining. This can dry up nearby wells, cause erosion along river channels, and harm groundwater reserves. The shape and stability of slopes and levees may also be compromised. Pitchaiah further notes that these changes can disrupt natural water flow, marine currents, and flood patterns. Another serious effect is the lowering of water tables around mining sites, which impacts drinking water availability since aquifers play a key role in replenishing groundwater. The deep pits created in riverbeds by sand mining cause groundwater levels to drop, often drying up wells that communities rely on for water. Moreover, mining sites experience increased water turbidity due to sediments from stockpiles, oil leaks, organic debris, and heavy vehicle traffic. Toxic metals like cadmium, silver, gold, mercury, and copper released by acid mine drainage pose a serious threat even at low concentrations. If this contamination enters groundwater or rivers unchecked, it can make these waters uninhabitable for fish, plants, and animals.

According to Poonia, Kansara, and Choudhary (2024:313), sand mining often releases polluted and sediment-filled water into rivers and nearby water bodies. The sediment stirred up during mining increases turbidity, making the water cloudy and reducing its quality by lowering oxygen levels and blocking sunlight. This harms aquatic life and threatens water supplies used for irrigation and drinking.

To meet the high demand for building materials, sand is extracted from rivers, beaches, and floodplains. But this process often causes sediment-heavy water to flow back into these ecosystems, making the problem worse (Lindha et al., 2023:1). Sedimentation happens when particles settle at the bottom of a river or lake. This can change the natural shape of these water bodies, harm aquatic plants, and suffocate habitats on the riverbed or lake floor. It also blocks sunlight from reaching algae and aquatic plants, which need it to photosynthesise. Since these plants form the base of the food chain, their decline affects the entire aquatic ecosystem (Kumar et al., 2023).

Turbidity, the cloudiness caused by suspended particles like silt and organic matter, can disrupt fish spawning, damage developing eggs, and make it hard for fish to find food or navigate. Sediment in the water can clog the gills of fish and other aquatic creatures, affecting their breathing and overall health. Together, sedimentation and turbidity reduce oxygen and light in the water, triggering a chain reaction of harm to aquatic life. Poonia, Kansara, and Choudhary (2024:313) also pointed out that low oxygen levels from these conditions can create “dead zones” where aquatic life struggles to survive. This often results in sharp declines in biodiversity and massive fish kills.

Moreover, the large machinery and chemicals used in sand mining add to the problem. Heavy equipment like excavators and dredgers physically damage riverbeds and beaches, stirring up even more sediment and increasing turbidity. Chemicals such as flocculants, used to clear suspended particles, can introduce pollutants like hydrocarbons from fuel leaks and heavy metals from corroded equipment into the environment, posing further risks to both ecosystems and human health.

Poonia and colleagues highlight that when toxins like heavy metals enter our water bodies, both human health and the entire ecosystem are at serious risk. Metals such as lead, mercury, and arsenic can accumulate in fish and other aquatic life, then move up the food chain to levels that can be harmful to people who consume them. Hydrocarbons, another pollutant from mining, can weaken aquatic animals' immune systems and affect their growth and reproduction. Overall, rivers, lakes, and coastal areas suffer greatly from the pollution and sediment-heavy water released by sand mining. This results in threats to human health, damage to habitats, loss of biodiversity, and poorer water quality. Because of these serious impacts, it is crucial to adopt sustainable management and enforce regulations that protect aquatic environments over the long term.

Rentier and Cammeraat (2022:3) explained that indiscriminate sand mining directly damages riverbeds, which then causes erosion and sedimentation in other parts of the river. They note that when silt is removed from the riverbed, sediment supply shifts upstream as the river tries to compensate. This leads to faster erosion of riverbanks and beds upstream, disrupting the natural balance and accelerating riverbank collapse in places that normally would be more stable. Dry riverbeds are home to many species that rely on groundwater at different levels, but sand removal can cause these water sources to dry up, threatening the survival of these species and impacting the broader ecosystem.

Pitchaiah (2017:4) also pointed out that dust from trucks working near rivers can block sunlight and make it harder for plants to photosynthesise. Additionally, the flow of water after mining can cause further bank erosion, leaving isolated islands of trees behind as the soil structure is damaged. Fish and other aquatic animals may be forced to migrate during low water flows because their habitats become limited when the riverbed is exposed and no longer fully covered by water. Operating heavy machinery in sand mining can destroy important habitats where fish and small aquatic creatures breed in the riverbed. This disturbance often stirs up sediments, increasing turbidity and suspended silt downstream. Pitchaiah further explained that during heavy water flows, stockpiles of sand and leftover soil on floodplains can change the natural flow of the river channel. The suspended silt blocks sunlight, reducing photosynthesis in tiny and larger aquatic plants, which in turn lowers the available food and overall plant growth.

Rentier and Cammeraat (2022:5) added that sand mining can lead to habitat loss, which often results in an increase in weed infestations and changes in fish populations. Physical damage to habitats can harm aquatic life and reduce the number of species living in these environments. Vegetation near the mining sites can also be destroyed, leading to less farmland and grazing land for livestock.

Coastal sand mining has long-term impacts on coastal erosion, the gradual wearing away of land by natural forces like waves and currents (Ratter, Petzold, and Sinane, 2016:113). When thinking about coastal erosion and mining from a broader perspective, it is clear that the environmental, social, and economic effects must be carefully considered to understand the ethical implications. Although coastal erosion is a natural process, human activities like sand mining accelerate it. Sand and gravel removed from beaches and riverbeds normally help protect coastlines by replenishing the sediment that keeps beaches stable. People living along the coast are often at risk wherever sand mining occurs. Coastal erosion can destroy homes and property, leading to social problems in affected communities. Pitchaiah (2017:3) points out that removing sand from beaches leaves coastal areas vulnerable to damage from waves and storms.

One example of sand mining's impact is on the Umngeni River in Durban, KwaZulu-Natal, South Africa (Rimayi et al., 2018:1009). The river starts in a small farming area called Dargle near Howick and flows 232 km into the Indian Ocean at Durban. It also features famous waterfalls like Howick Falls. There have been concerns that pollution from nearby agricultural activities is harming the health of the Umngeni River.

In his article, Hay (2017:25) pointed out that it is no secret that some industries illegally release their wastewater directly into sewer systems, which then flows straight into rivers and streams. Similarly, some farmers take water unlawfully for irrigation and farm within sensitive riparian and wetland areas. Illegal dumping of waste into rivers and streams is also common. Along the lower stretches of the uMngeni River, sand mining companies often operate without approval, and water authorities frequently ignore discharge regulations. This widespread non-compliance shows a general lack of commitment and enforcement. What is more, both public and private sectors seem reluctant to take the lead in regulating themselves or enforcing rules within their own groups.

According to Nomcebo Myeza (2020:6), most of the sand mined in the uMngeni catchment area comes from illegal operations. A recent study mapping sand mining along the uMngeni and uMsunduzi rivers revealed that sand mining activities have tripled over the past 14 years (from 2004/2005 to 2018/2019). The controversy around sand mining is not surprising; it is damaging to the environment. Sand mining is a key part of supporting South Africa's booming construction industry, but those legally licensed by the Department of Mineral Resources and Energy (DMRE) are required to rehabilitate mined areas once mining stops.

However, illegal miners do not follow this rule, leaving the environment, communities, and economy to suffer. The severe erosion of riverbanks and riverbeds increases sediment in the water, making it unsuitable for many aquatic species. Higher sediment loads also mean that people downstream can no longer use the river water for everyday needs. When riparian vegetation. i.e., the plants that grow between the river and the land are removed and access roads are built, the soil becomes compacted, water infiltration decreases, and erosion speeds up. Without this natural buffer, invasive alien plant species often take over.

Nomcebo also points out that while sand mining may seem important for local economic growth, most illegal miners are outsiders, not members of the local community. A few people profit from illegal sand mining, but it is at the expense of residents, legitimate miners, and government revenues. One of the biggest economic losses comes from missed taxes and royalties since illegal miners do not pay these fees. On top of that, abandoned illegal mining sites often need to be rehabilitated using government funds, which puts an extra financial burden on the state. Nomcebo also points out that district roads are not built to handle heavy trucks, yet these large vehicles are often used to transport sand, causing significant damage to the roads. Constant repairs are needed, which means extra funding must be spent time and again.

Sand extraction from the riverbed changes the river's depth and flow, creating dangerous conditions that have, unfortunately, led to the drowning of children and livestock. In addition, oil spills, equipment leaks, and on-site machinery maintenance all contribute to the pollution and degradation of the river's water quality.

Perhaps the most alarming issue in the catchment area is the widespread disregard for rules. This blatant non-compliance has even led to the creation of an illegal network of sand miners operating outside the law.

2.6.2 The Effects on the Land

Landscape disturbance from sand mining can significantly alter the natural environment. It can lead to deforestation and the loss of bathing beaches, which are important because they help protect the coast during storms by acting as natural barriers. Additionally, the depletion of sand reserves on beaches reduces this protective effect. Nearby properties can also suffer damage as a result of these changes (Pitchaiah, 2017:3).

Bradley (2020:5) highlighted that habitat destruction often follows the construction of mining sites, including those for sand mining. Indigenous species live in balance with each other within their ecosystem, which includes the soil and local climate. But sand mining disrupts this balance through activities like excavation and the noise generated. This destruction of local habitats does not just harm wildlife; it can also pose health risks to people because mining waste contaminates the soil.

Contaminated soil can lead to increased erosion, which may pollute nearby lakes and wetlands. Over time, this reduces soil quality and fertility by lowering groundwater levels. Changes in soil chemistry may also occur, increasing harmful substances like mercury and lead, further impacting the environment and human health.

2.6.3 The Release of Chemicals

Rentier and Cammeraat (2022:5) explained that river sand mining changes the quality of local and downstream water, even though the chemical makeup of the sand itself stays the same. When sand is removed from wet mining pits, it stirs up the water, creating clouds of fine organic and inorganic particles. These particles carry minerals and nutrients downstream, where they are released into marine habitats. As sand is extracted from the river, nutrients attached to the sediments are pulled away, leaving behind stirred-up particles that settle on sandbars downstream. While these sandbars cannot support plants on their own, once they get covered with a fresh layer of nutrients and minerals, they can turn into lush, green floodplains. These

green sandbars might not seem harmful, but they show how nutrients are being taken out of the river and carried into the marine environment, reducing the nutrients available to the land around the river.

The authors also highlighted that fuel or oil spills, along with exhaust fumes from excavation and transport machinery, seriously damage the quality of both air and water. This pollution affects humans, plants, animals, and aquatic life alike (Rentier and Cammeraat, 2022:5).

2.6.4 Sand Mining and Anthropogenic Activities

Rentier and Cammeraat (2022:5) described the anthropogenic environment as the world people create around themselves, including communities, infrastructure, culture, and the economy. When sand mining causes the riverbed to deepen and widen, it makes the riverbanks unstable both horizontally and vertically. This erosion can expose buildings, roads, bridges, and even underground pipelines. The loss of riparian and aquatic vegetation only makes things worse. As the groundwater table drops and banks collapse, agricultural land may be lost because irrigation systems can no longer reach water.

Mkpuma, Okeke, and Abraham (2015:15) highlighted another common complaint from the public about the sand mining industry: blasting. People often report disturbances from blasting noise, vibrations, air shocks, pollution, and even flying rocks. How often and how intensely blasting happens depends on several factors, like geology, the shape of the land, and weather conditions. The closer you are to the blast, the louder and more intense the noise and effects tend to be.

2.7 SAND MINING AND THE LOCAL ECONOMY

Sand mining plays a role in South Africa's economy because it provides financial benefits to some communities. Mngeni, Musampa, and Nakin (2017:444-448) explained that sand mining creates jobs, especially for local people living near mining sites. For example, in one area where sand mining takes place, interviews revealed that locals see it as an important source of income. They shared that the money earned from sand mining helped them build a community centre and support their families, and they would not want to stop mining even if nature itself asked them

to. The community also mentioned that sand mining improved their road network, upgrading roads from gravel to tar.

Interestingly, sand mining can sometimes create new aquatic habitats that support fish populations. Excavation can lead to deeper pools, water-filled pits, or altered riverbeds that provide suitable environments for aquatic life (Gavriletea, 2017:16). Gavriletea added that lagoons or mining pits filling with water may become important fish spawning grounds. These calm, shallow areas, often with plenty of vegetation and fewer predators, offer ideal spots for fish to lay their eggs and reproduce. Additionally, sand from mining can be used sustainably to build structures like groins and breakwaters, which help protect coastlines by preventing erosion and shielding coastal towns.

Madyise (2013:59-60) looked at the situation in the Gaborone area and found that local people were very aware of the negative effects of sand mining. When asked about how sand mining impacted their lives, many shared serious concerns. Some said illegal miners can be dangerous; they often bring sharp tools and spades and sometimes get into fights with police or community watch groups, especially at night (3.7%). Trucks coming from Gaborone dump waste like used diapers, building rubble, and empty bottles in open areas and abandoned mining pits, which leaves villages messy and pollutes the land (21.2%).

The abandoned deep pits become filled with rainwater during the wet season, creating hazards for people and livestock. These water-filled holes also become breeding grounds for mosquitoes that spread malaria (5%). Many locals said sand and gravel mining has led to increased crime in their villages. Young people, both locals and outsiders, wait for trucks to hire them as manual loaders, but when they do not get hired, some end up stealing at night (12.9%). Mining has also caused erosion, destroyed grazing land, and wiped out vegetation (5.4%). Water shortages in rivers make it harder to water livestock, and mining disrupts recreational activities like fishing and swimming (4.6%).

The constant noise from about 60 tipper trucks, mostly operating at night between 6 pm and 6 am when police presence is low, is a major problem. It causes noise pollution, cracks in nearby houses and buildings, and general disturbance (10.4%). Dust kicked up by the trucks creates air pollution (11.2%), and their heavy movement damages gravel roads (4.1%). Flooding during the rainy season is another issue linked to mining (3.3%), and the activity causes rivers to deepen and riverbanks to widen (5.8%). Slow-moving tipper trucks are also blamed for many road accidents and traffic congestion (5%), and small stones that fly off uncovered sand and gravel

piles often break car windscreens (2.9%). Some people worry that mined riverbeds may collapse, which poses dangers to both people and animals (4.6%). All of this showed clearly that in some communities, sand mining causes a lot of unhappiness and serious concerns.

In the Gaborone community, it became clear that many residents were unhappy with the sand mining activities happening around them, especially because of the accidents linked to these operations. When asked about their feelings, several responded strongly: “Residents are furious and want illegal miners to be jailed” (18.9%). Many expressed frustrations, saying the sand and gravel mining is destroying their agricultural land and causing numerous accidents, some fatal, within the community (31.7%). They believe miners should first get permission from village leaders and only be allowed to mine in designated, controlled areas (20.1%). Villagers also said they have reported these problems to village leaders and the police, hoping the authorities will put a stop to the illegal activities (14%). Complaints have been made to regional officials, and some residents have even threatened to protest by blocking roads with stones and tree branches to stop the trucks from passing through (8.5%). Sand and gravel trucks also sometimes block main roads when accidents force them to unload their cargo (6.8%) (Madyise, 2013:63). Also,. his research showed that, in some parts of South Africa, sand mining has caused more harm than good.

2.8 RESEARCH GAP

From the literature reviewed, it is clear that many scholars recognised sand mining as an important activity, supporting development through supplying sand for construction, glass-making, and other industries. However, it is also clear that sand mining can severely damage the environment. This raises important questions about how sustainable development and consequentialist ethical theories apply to sand mining. If sustainable development is prioritised, do we risk overlooking the harmful consequences for the sake of economic gain? If so, what will future generations inherit? And if sustainable development is only a minor consideration, what steps should be taken? Is it possible to reduce the negative impacts of sand mining? How can sand extraction continue without causing significant environmental damage? What actions is the government taking to address illegal sand mining and enforce regulations?

2.9 CONCLUSION

This literature review covered the basics of sand mining, extracting sand typically from open pits, and explored its significant environmental impacts, including loss of biodiversity, habitat

destruction, coastal erosion, and removal of important topsoil. While sand mining clearly has negative effects on the environment, it also offers economic benefits such as job creation for local communities and improvements to infrastructure like roads and buildings. Sand remains an essential resource for construction, glass manufacturing, and silicon production. The review also discussed the ethical dilemmas sand mining raises and examined South Africa's legal frameworks aimed at regulating the industry, including the Mineral and Petroleum Resources Development Act of 2002 and the National Environmental Management Act of 2002. The next chapter will focus on the theoretical framework, exploring consequentialism and sustainable development as lenses through which to understand the ethics of sand mining.

CHAPTER THREE

THEORETICAL FRAMEWORK

3.0 INTRODUCTION

The previous chapter was a literature review, exploring what has been written about sand mining in South Africa. Now, this chapter focuses on the theoretical framework, which is divided into two main ethical theories. First, it examined consequentialism, starting with its definition, followed by arguments both for and against it, and then how this theory connects to and guides the study. Secondly, it explored the ethical theory of sustainable development, including its key principles. Hence, this chapter aimed to present the theories shaping the analysis of this work, drawing on the insights of scholars like Deni Elliott and Kaitlyn June (2018), David Cummiskey (2013), Donald A. Brown (1995), and Walter Sinnott-Armstrong (2003).

3.1 The Ethical Theory of Consequentialism

The ethical theory that this study will use to assess sand mining is consequentialism. Since this research aims to explore the ethical implications of sand mining in South Africa, focusing on the consequences of sand mining activities on the environment, society, and development is the most suitable approach.

According to Elliott and June (2018:159), consequentialism is a theory that judges the morality of actions based on their actual or potential outcomes, whether past, present, or future. They explain that an action is considered morally right if its expected outcomes are positive; if not, it is wrong. Cummiskey (2013:2) added that, as humans, we can never be fully certain about the long-term effects of our actions. Good intentions do not always lead to good results, so when making decisions, it is wise to choose the option that is most likely to maximise positive outcomes. For this reason, some consequentialists, like Jeremy Bentham, differentiate between an action's actual results and what is predicted to happen. Meanwhile, Brown (1995:41) argued that "no act is to be judged as good or bad in itself, but its wrongness or goodness depends on

the consequences," meaning the right choice is always the one that leads to the best overall results.

3.1.1 Defining the Ethical Theory of Consequentialism

According to ethicists like Sinnott-Armstrong, consequentialism is an ethical framework with classical roots in thinkers such as Jeremy Bentham (1748-1832), John Stuart Mill (1806-1873), and Henry Sidgwick (Sinnott-Armstrong, 2003:13). The main idea behind consequentialism is that the morality of any action is determined by its outcomes, whether the results are good or bad decides if the action itself is right or wrong.

There are several different types of consequentialism, including full-rule consequentialism, act consequentialism, ethical egoism (sometimes called egoistic consequentialism), and universal consequentialism. Full-rule consequentialism argues that an action is morally wrong only if it breaks rules that are themselves justified by the positive consequences they produce. It also holds that people should base their moral decisions on these consequence-based rules, and that rules determine when moral punishments should apply (Hooker, 2003:1).

For example, the National Environmental Management Act (NEMA) in South Africa aims to protect the environment and prevent land degradation (Muswaka, 2017:34). From a full-rule consequentialist perspective, if sand mining harms the environment, then, according to the rules set out by NEMA, that mining would be considered morally wrong. Only if the rules allow for some environmental harm could such mining be seen as morally acceptable.

Act consequentialism takes a slightly different view. Sinnott-Armstrong (2003:1) explained that this approach says an action is morally right if and only if it maximises the overall good, meaning the total good created minus the bad is greater than any other option available at that moment. So, if sand mining leads to the greatest overall benefit, perhaps by providing jobs, supporting development, or helping communities, then it could be seen as morally acceptable. If the negative consequences outweigh the benefits, or most people are unhappy with how the sand mining is done, then the act would be considered immoral.

Ethical egoism, on the other hand, focuses on self-interest (Rachels, 2012:194). When applied to sand mining, ethical egoism looks at how the activity affects different stakeholders, such as

the local community, private individuals hoping to profit, the mining companies, and the government. This theory would weigh how sand mining benefits or harms each group, often prioritising the interests of the individual or group involved. When it comes to people who extract sand for profit and the mining companies involved, the researcher believes that from an ethical egoism perspective, sand mining would be considered acceptable if it maximises their own benefits or profits.

Ethical egoism focuses on self-interest, and as James Rachels explains, an egoist might argue that sand mining is morally justified even if it causes environmental harm or negatively impacts others, so long as it leads to economic growth, financial gain, or infrastructure development that benefits the company or individual miner. However, the researcher also thinks that an ethical egoist would need to consider the possible consequences of their self-interest. For example, if excessive sand extraction causes serious environmental damage or leads to costly legal fines, it could ultimately harm their own long-term interests.

According to (Rachels, 2012:194) mentioned, From the perspective of the local community, ethical egoism would suggest that people might oppose sand mining if it damages the environment, washes away valuable topsoil, or harms their quality of life. If sand mining threatens their well-being, such as by reducing access to clean water or degrading their living conditions, then it goes against their self-interest, and they would likely resist it. On the other hand, some community members might support sand mining if it creates jobs, brings economic benefits, or improves local infrastructure, even if it has some negative environmental impact. In this way, individuals weigh the pros and cons based on how it affects them personally.

Universal consequentialism, as Sinnott-Armstrong (2003:1) explained, holds that what makes an action morally right depends on the consequences for everyone affected, not just the individual doing the action, their immediate community, or any limited group. In other words, this theory treats the interests and well-being of all people (and sentient beings) as equally important. It does not give priority to the happiness or benefit of one person, company, or community over another.

When we apply universal consequentialism to sand mining, it means carefully looking at how the practice affects all parties involved. Since the goal of this theory is to promote the greatest

overall good while minimising harm, stakeholders, like local communities, industries, and the natural environment, should all be considered. Both the short-term and long-term impacts need to be weighed.

For example, to decide whether sand mining is ethically acceptable, a universal consequentialist would weigh the pros and cons. On the positive side, there are economic benefits and infrastructure improvements that can come from sand mining. On the downside, there may be disruptions to daily life and health risks for residents. If the negative consequences outweigh the positive ones, then sand mining would be seen as morally problematic. But if the benefits are widely shared and the harms carefully managed, then it could be considered morally acceptable.

3.1.2 Arguments Against the Ethical Theory of Consequentialism

Grisez (1978:22-24) argued that consequentialism, the idea that an action's morality depends solely on its outcomes, can lead to a loss of moral integrity. Critics worry that this mindset might justify wrong actions just because they produce desirable results, potentially making morality seem relative and less important. Consequentialism does not provide clear rules or limits on behavior, which can make it hard to know what to do in tricky situations. This lack of guidance can cause moral confusion and uncertainty. Additionally, critics say consequentialism tends to focus only on results and overlooks other key moral aspects like a person's character, intentions, or the intrinsic value of certain things. They believe that to fully understand ethics, we need to look deeper than just outcomes.

Another criticism, as Wolff (2006:7) pointed out, is that consequentialism is often anthropocentric, centered mainly on humans or sentient beings, and ignores the rights and inherent value of other species and ecosystems. Because of this, it can justify environmental harm by focusing moral concern only on beings that can feel pain, rather than on the health of entire species or habitats. This has meant that many environmental laws influenced by consequentialism prioritise human interests over the environment itself.

Elinor Mason (2009:20) also criticised consequentialism for focusing solely on the effects of actions and not on the actions themselves. An act might produce good results but still be morally

wrong. Similarly, Marc Ruegger (2005:3) described consequentialism as a demanding and intrusive moral theory, forcing people to prioritise outcomes over their personal responsibilities.

Critics such as Elinor also believe that consequentialism is unethically incompetent for assessing the long-term consequences of sand mining in South Africa, in addition to issues with anthropocentrism, lack of direction, and the concept of moral relativism. One major problem is its tendency to ignore long-term ecological damage, such as a shortage of water, soil erosion, and decline in biodiversity, in favor of short-term economic or social advantages, such as infrastructural growth or job creation. By justifying activities that damage subsequent generations' ability to meet their own requirements, this short-term focus runs the risk of violating intergenerational fairness ideals. Furthermore, the effects of complicated environmental issues like sand mining are sometimes not clear, indirect, or only visible over time, despite consequentialism's heavy reliance on accurate prediction of results.

Furthermore, consequentialism was brought under attack for focusing only on consequences while ignoring procedural equity, or the equity of the decision-making process. For instance, even if the extraction of sand improves the national economy, it is still immoral if those affected are left out of decision-making processes or if the advantages are not distributed appropriately. As long as the overall value is raised, this focused on outcomes reasoning may also be used to argue for the abuse of marginalized or vulnerable people. This strategy may worsen systemic harm and prolong unfairness in a place like South Africa, where environmental injustice and economic inequalities are pervasive. Lastly, consequentialism frequently disregards the inherent, cultural, or spiritual worth of nature, particularly in African worldviews where ecosystems, rivers, and land are viewed as more than just resources, but as holy and connected to the identity and prosperity of the community merely lowering nature to serve human needs runs the risk of losing moral principles entrenched in culture, which are crucial for responsible and sustainable environmental stewardship.

3.1.3 Arguments in Favour of the Ethical Theory of Consequentialism

On the other hand, ethicists like Sinnott (2003:13) defended consequentialism by highlighting that every action leads to some sort of outcome, good or bad, immediate or long-term. For example, sand mining may be morally positive if it creates jobs and supports the community,

but if it damages the environment and causes more harm than good, it becomes wrong. To judge whether an action is justified, we need to look at the overall results and motivation. In this way, acting ethically means choosing actions that benefit the broader community.

Consequentialism has played a key role in developing ethical philosophy, especially since the time of Sidgwick. Bergstrom (1996:4) noted that the theory's strength lies in pushing philosophers to clarify difficult questions and engage in meaningful debates.

Sidgwick (2022:40-41) identified different types of consequentialism. Egoistic consequentialism considers how actions affect the individual or a small group, while universal consequentialism looks at the effects on everyone impacted. For instance, the positive economic outcomes of sand mining in South Africa illustrate how egoistic interests can sometimes lead to environmental problems. Universal consequentialism, by contrast, judges morality based on the consequences for all affected people.

Brown (1995:41) highlighted that no act is to be judged as good or bad in itself, but its wrongness or goodness is dependent on the consequences of the action. In other words, the right action is the one that produces the best overall outcomes. Additionally, utilitarianism, a form of consequentialism, suggests an action is morally right if it benefits the greatest number of people. The researcher believes this aligns well with the African philosophy of common good and promoting harmony within communities.

Furthermore, Brown continues to say that consequentialism tends to be recognized for its practicality, especially in the areas of managing the environment and public policy. When considering whether to allow sand mining, both governments and companies already use outcome-based techniques such as ecological impact evaluations and cost-benefit evaluations.

According to this perspective, consequentialism presents a useful framework for ethics that is consistent with the manner in which judgments are in fact made. Also, it provides versatility, permitting decision-makers to assess each situation according to its unique social, economic, and ecological environment. This is an important benefit in a nation like South Africa, which has major regional disparities and inequities. Furthermore, consequentialism supports choosing

the course of conduct that results in the least amount of destruction overall when faced with morally challenging decisions where no option is ideal Sinnott, 2003:13).

Lastly, consequentialism builds up the concept of transparency. If the effects of sand mining cause notable harm either through pollution, displacement, or inequality, then those accountable can be ethically assessed not only based on what they were doing but also on their failure to produce advantageous results for society. This framework also encourages innovation by encouraging industries to minimize undesirable consequences through cleaner technologies and more environmentally friendly practices.

3.1.4 The Role of the Ethical Theory of Consequentialism in Guiding This Study

By concentrating on the outcomes of sand mining activities for everyone involved, consequentialism offers a clear ethical framework to guide this study's examination of the ethical implications of sand mining in South Africa. According to Sosa (1993:101), consequentialism holds that the morality of an action depends on its results. In this context, this theory can help analyse whether sand mining benefits people, the environment, and future generations more than it causes harm. Firstly, consequentialism can steer this work by evaluating the impacts on all affected parties. These include local communities, South Africa's economy, businesses, the environment, and future generations, all of which need to be considered when assessing sand mining's ethical standing.

On the positive side, Sonna et al. (2022:124) pointed out that sand mining can stimulate the economy and create job opportunities in areas where alternative employment is limited. However, sand mining can also lead to environmental damage, disrupt local communities, and threaten groundwater availability. In some cases, excessive mining causes soil erosion and other problems. Consequentialism would weigh these effects carefully; if the harm to communities outweighs the economic benefits, then sand mining would be considered unethical.

Environmental impacts are especially significant when sand mining is poorly regulated. It can lead to loss of biodiversity, riverbank erosion, habitat destruction, depletion of fertile soil, and long-term degradation (Sonna et al., 2022:128-129). These harms do not just affect wildlife, but also the people who depend on these ecosystems for their survival. A consequentialist perspective would highlight that both present and future generations suffer from environmental

harm. The long-term consequences are particularly unethical if they negatively affect future generations who have no say in today's mining decisions. Therefore, consequentialism would support efforts to reduce or mitigate environmental damage as part of an ethical approach to sand mining.

Sand mining is also essential for construction and development projects, such as building roads, houses, schools, and hospitals that contribute to South Africa's economic growth and improve living standards (Asabonga et al., 2017:1). However, if the economic benefits only serve a small group, like private companies, while the broader society bears the environmental and social costs, the fairness of such gains comes into question.

From a consequentialist viewpoint, the benefits of sand mining should be shared fairly and broadly, not concentrated in the hands of a few. Ensuring that the income supports the well-being of all stakeholders, especially local communities, is crucial for sand mining to be ethically justifiable.

Sand mining is widely recognised for depleting natural resources (Gavriletea, 2017:13), which could leave future generations without the essential materials needed for development and construction. Beyond that, the environmental damage happening today might have lasting effects on the climate, biodiversity, and water systems, impacting the well-being of those who come after us.

Consequentialists, therefore, place great importance on the welfare of all affected parties, including future generations. From their point of view, sand mining would be considered unethical if it leads to the depletion of resources or causes long-term environmental harm that negatively affects those yet to come, unless sustainable practices are put in place to reduce such impacts.

Additionally, consequentialism can guide this study by carefully balancing the benefits against the harms. In the South African context, if sand mining delivers short-term economic growth but causes lasting environmental damage and social injustice, such as degradation of the land and harm to communities, the overall harm may outweigh any benefits. Conversely, sand mining

could be seen as morally acceptable if it minimises environmental damage, fairly shares economic benefits with local communities, and is sustainable for future generations.

This ethical theory is particularly fitting for this research because sand mining inherently involves protecting the environment and practicing responsible resource use, which aligns with the idea of promoting the common good. Consequentialism helps evaluate and prioritise the greatest outcomes, both positive and negative, resulting from sand mining activities, making it a valuable framework for this study.

3.2 THE ETHICAL THEORY OF SUSTAINABLE DEVELOPMENT

According to Shi et al. (2019:4), the concept of Sustainable Development emerged from practical experience, and they argue that studying Sustainable Development cannot be separated from applying relevant laws and regulations. They explain that as new ideas about sustainability have developed, so too have various practices, one of the most notable being the United Nations Sustainable Development Summit. Over time, Sustainable Development has evolved significantly; it has grown beyond just tackling environmental problems to addressing broader global strategic issues. Although Shi and colleagues note that the terms "sustainable" and "sustainability" only appeared in the 20th century, they highlighted that these concepts had actually been used by many generations long before.

Shi et al. (2019:5) further highlighted that even the rulers of the Western Zhou Dynasty understood the importance of using natural resources, like mountains, forests, and rivers, carefully and in harmony with nature's laws, rather than exploiting them recklessly. Since then, many efforts have been made to protect natural resources, including setting up specialised management agencies, enforcing state control over resources, introducing taxes related to land and forests, and banning harmful practices. Similarly, ancient civilisations such as those in Egypt, Mesopotamia, Greece, and Rome studied the causes of environmental damage caused by activities like farming, logging, and mining, and they implemented various measures to address these issues.

The modern global focus on sustainability really took shape after the United Nations held an international conference in Stockholm, Sweden, in 1972. This event, often seen as the beginning of the sustainable development movement, highlighted the urgent need to manage the environment responsibly while also pursuing economic growth. At the conference, countries

were encouraged to strengthen their environmental laws alongside efforts to grow their economies. Since then, progress has been made in developing institutions focused on environmental protection and improving pollution control measures. However, the summit also revealed a major divide: developing countries from the Global South prioritised poverty reduction, while developed countries in the North placed greater emphasis on environmental concerns.

The term sustainable development was first clearly and systematically defined in the 1987 report called *Our Common Future*, prepared by the World Commission on Environment and Development. They described sustainable development as *"meeting the needs of the present without compromising the ability of future generations to meet their own needs."* It is a complex and broad concept that covers economic, ecological, social, and cultural sustainability all at once.

The World Commission on Environment and Development (Brundtland, 1987:41-42), explained:

> *The satisfaction of human needs and aspirations is the major objective of development. The essential needs of vast numbers of people in developing countries for food, clothing, shelter, and jobs are not being met, and beyond their basic needs, these people have legitimate aspirations for an improved quality of life. A world in which poverty and inequity are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to everyone the opportunity to satisfy their aspirations for a better life. Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere consider long-term sustainability. Yet many of us live beyond the world's ecological means, for instance, in our patterns of energy use. Perceived needs are socially and culturally determined, and sustainable development requires the promotion of values that encourage consumption standards within the bounds of what is ecologically possible and to which all can reasonably aspire. Meeting essential needs depends in part on achieving full growth potential, and sustainable development clearly requires economic growth in places where such needs are not being met. Elsewhere, it can be consistent with economic growth, provided the content of growth reflects the broad principles of sustainability and non-exploitation of others. But growth by itself is not enough. High levels of productive activity and widespread poverty can coexist and endanger the environment. Hence, sustainable development requires that societies meet human needs*

both by increasing productive potential and by ensuring equitable opportunities for all. An expansion in numbers can increase pressure on resources and slow the rise in living standards in areas where deprivation is widespread. Though the issue is not merely one of population size but of the distribution of resources, sustainable development can only be pursued if demographic developments are in harmony with the changing productive potential of the ecosystem.

The above quote claimed that development is meant to help people live more comfortable lives, especially those from disadvantaged backgrounds who lack shelter, food, and employment. It also states that we are responsible for protecting our environment to ensure future generations can also live well.

3.2.1 Principles of Sustainable Development

In 1992, the United Nations held a major conference on environment and development in Rio de Janeiro. Leaders from 178 countries attended, and the event resulted in a declaration known as Agenda 21, which set out principles for sustainable development across different regions (UNCED Rio Declaration, 1992:79).

✞ **Principle One**

"Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature" (1992:81).

This principle emphasises that people's well-being should be the main focus of development. In the context of this study, it means that development projects, like sand mining, must not harm local communities or compromise their health and dignity. It also highlights the deep connection between humans and nature, and if nature is damaged, people suffer too. Therefore, protecting the environment through strong policies and regulations is essential to safeguard the well-being of both the environment and the people depending on it.

✞ **Principle Two**

This principle states:

"States have the sovereign right to exploit their own resources according to their environmental and developmental policies, but also bear the responsibility to ensure that activities within their

control do not cause damage to the environment" (1992:81).

In other words, countries have the right to use their natural resources, like minerals, but they must manage them responsibly. Governments should create and enforce laws that prevent environmental damage caused by activities such as mining, both within their borders and beyond.

✞ **Principle Three**

This principle says:

"The right to development must be fulfilled to equitably meet development and environmental needs of present and future generations" (1992:81).

It stresses that development today should not come at the cost of harming the environment for future generations. Activities like sand mining must be done carefully to avoid lasting damage. Metz (2020:118) critiqued early post-independence development in Africa for neglecting environmental concerns, people's health, and wealth. Today, however, there is greater awareness of the need for environmentally sustainable development that also improves the lives of surrounding communities. This principle calls for continuing and monitoring those positive changes.

✞ **Principle Ten**

"Environmental issues are best handled with the participation of all concerned citizens at the relevant level" (Rio Declaration, 1992:81).

This principle encourages everyone to take responsibility for protecting the environment because everyone is affected by it. It is not just about government officials or developers making decisions; local communities and other stakeholders should be actively involved. Including diverse voices promotes democracy and leads to better policies that truly reflect the needs and concerns of all those impacted by development projects. When multiple companies and community members contribute their perspectives, governments can create fairer, more balanced environmental regulations.

✞ **Principle Fifteen**

This principle states:

"In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (1992:82).

Gilbert (2020:1) described this precautionary approach as a major shift in how we regulate the environment. Instead of asking "How much harm is acceptable?" it asks "How can we prevent harm from happening in the first place?" This principle urges that even if there is no conclusive proof linking mining activities to environmental damage, governments should still put preventative measures in place to protect the land and ecosystems from potential harm caused by sand mining or other developments.

3.2.2 Arguments in favour of Sustainable Development

The benefits of sustainable development come from its broad, ethical framework that seeks to balance equality, environmental protection, and economic growth, all aimed at ensuring lasting global prosperity. One of its greatest strengths is its focus on intergenerational justice. As Brundtland (1987:41) articulated, sustainable development means *"meeting the needs of the present without compromising the ability of future generations to meet their own needs."* This idea reminds us of our moral responsibility to leave future generations a planet that can support their lives and well-being. By encouraging societies to think beyond immediate gains and consider long-term environmental and human interests, sustainable development provides a guiding principle for international environmental policies.

When it comes to mining, sustainable development means fulfilling today's needs without jeopardising the ability of future generations to meet theirs. It emphasises inclusive, fair, and environmentally responsible economic growth (Waas et al., 2011:1639). According to Waas and colleagues (2011:1645), countries can open up new economic opportunities, reduce dependence on limited resources, and become more resilient to challenges like resource shortages and climate change by investing in renewable energy, green technologies, and sustainable infrastructure related to sand mining. A key part of sustainable mining is social justice; it aims to make sure the benefits of development reach everyone fairly. By addressing

inequalities in access to resources and income, sustainable mining helps build stronger, more connected communities, which in turn reduces social tensions and conflicts.

Sustainable development also improves quality of life for all, providing job opportunities for young people and adults alike, and enhancing public infrastructure such as roads (Sonna et al., 2022:124). Legal, sustainable sand mining respects the intrinsic value of biodiversity and recognises the need to protect ecosystems and species diversity (Waas et al., 2011:1646). By protecting natural habitats, promoting sustainable land-use practices, and preventing habitat destruction and deforestation, sustainable mining supports the preservation of biodiversity and ecosystem services that are essential for human health and well-being.

In addition, Waas and colleagues (2011:1645) state that adopting sustainable development principles into the oversight of sand mining can encourage democratic decision-making while enhancing accountability from institutions. Sustainability principles guarantee that development is both ecologically and socially acceptable by ensuring open and honest ecological evaluations, consultation with the public, and fair benefit-sharing. By allowing local stakeholders to influence the results of extraction operations, sustainable development supports the empowerment of communities in places like South Africa, where natural resource management has traditionally silenced disadvantaged voices.

By fostering trust between the government, business community, and the general public, this participative approach lessens the possibility of resource-driven conflicts. Furthermore, by conserving the reliability of coastal zones, wetlands, and riverbanks, all of which serve as natural barriers against erosion and flooding, sustainable methods of mining assist in reducing the likelihood of disasters. In this sense, sustainable development is an achievable plan to foster social cohesion, safety for the environment, and resilience over time in resource-dependent areas rather than merely offering an idealized ethical vision.

3.2.3 Arguments Against Sustainable Development

Sustainable mining development can be viewed from two different angles: critics who question its effectiveness, and supporters who praise its potential. Critics argue that the idea of

sustainability is often vague and open to different interpretations, which leads to confusion and inconsistent policies (Gasparatos, El-Haram & Horner, 2009:245). While sustainable development tries to balance social, environmental, and economic goals, opponents say these goals often conflict with one another, making true sustainability hard to achieve. For example, pursuing economic efficiency might come at the expense of social equality, or economic growth could harm environmental protection.

Critics also highlighted that focusing heavily on environmental preservation and economic progress can sometimes overlook the unique cultural, social, and economic realities of developing countries. This can result in policies and interventions that do not fit local needs and end up being ineffective. Sustainable mining development often puts a lot of faith in technology as a solution for social and environmental problems, but this reliance can backfire, causing issues like land degradation, soil erosion, and loss of biodiversity (Van Arragon, 2021:26).

Heiling (1997:11) noted that critics see this “technology optimism” as misguided because it ignores deeper causes of unsustainability, such as social injustice and environmental harm. They argue that technology alone cannot achieve sustainable mining development. Another common criticism is that sustainable mining development leans too heavily on the idea of continuous economic growth to drive progress. Critics warn that this focus on endless growth is unrealistic given our planet’s limited resources and could worsen social inequalities and environmental damage over time.

Gasparatos, El-Haram & Horner continue to claim that, beyond issues with conceptual confusion and contrasting goals, additional criticisms of sustainable development point out how insufficiently it tackles inequality of power in environmental decision-making processes. Large mining companies and influential politicians usually have an outsized impact on the development of policies, while local communities that bear the greatest burden of environmental damage are left out of significant involvement. This brings up moral questions about informed permission and the administration of procedural justice. Furthermore, sustainable rhetoric is being used in increasing numbers as a kind of "greenwashing," which allows businesses to portray their business practices as environmentally mindful in public without actually bringing about significant changes in the real world. Accountability and

transparency are further weakened by the absence of accurate, legally binding guidelines for what qualifies as "sustainable mining".

Another issue raised by critics such as Heiling (1997:11) is the one-size-fits-all character of sustainable development models, which are frequently drawn from Global North ideologies and reject indigenous environmental principles or regional expertise systems. Most importantly, the paradigm rarely addresses the destructive logic of extractivism itself, rather focusing on restructuring extractive industries. In this way, under the disguise of progress, sustainable development may indirectly justify ongoing damage to the environment.

3.2.4 Components of Sustainable Development

✞ The Economy

One key goal of economic development is to use resources efficiently, especially those that are limited, to generate growth. Achieving this requires changes not only in how people behave and think but also in how technology is applied, and economies are structured (Becker, 2001:4). While rapid economic growth can place a heavy strain on the environment, particularly in developing countries, this pressure cannot be ignored. In contrast, sustainable development stresses that economic growth must respect environmental limits and consider social and institutional factors as well (Krajnc and Glavič, 2005:6).

Economic progress should not simply focus on increasing wealth but also aim to reduce poverty and inequality. A truly sustainable economy produces balanced goods and services, minimises debt, and supports industries through ongoing investment. However, global economic instability and crises often make achieving this difficult (Ștefănescu et al., 2009:1). To overcome these challenges, countries should invest more in science, education for everyone, smart use of technology, and careful management of natural resources, all vital for long-term economic sustainability.

✞ The Environment

Environmental development focuses on maintaining the environment's essential roles: managing waste, providing direct benefits to people, and supplying natural resources (Wardle and Giller,

1996:1550). It goes beyond just managing how the economy affects nature; it calls for overall development that respects the delicate balance of the environment. Wheeler (2004:3) notes a shift from focusing solely on economic factors to including environmental concerns as well.

This part of sustainable development aims for long-term progress that works in harmony with nature, rather than just targeting a single industry or short-term goal. It emphasises protecting and renewing natural resources, adapting to environmental changes, and not simply trying to preserve things exactly as they have always been (Bran, 1991:5). Effective environmental development relies on knowledge, thoughtful planning, and approaches that fit local conditions.

✞ **The Society**

To improve living conditions, work environments, and overall social well-being, society needs to use raw materials responsibly and ethically, especially when sustainable alternatives exist to help maintain ecological balance. Human sustainability also involves how people connect, build relationships, preserve cultural diversity, and uphold shared values (Dempsey et al., 2011:4). It addresses modern challenges like job dissatisfaction, uncertainty about the future, loneliness, and a lack of meaning in work. The goal is to achieve cultural and social stability, fairness, and a strong sense of purpose while avoiding negative effects like confusion over values. It is important to recognise that environmental protection and social progress must go hand in hand.

3.2.5 Sustainable Development Theory as a Framework for This Research

The theory of sustainable development provides a valuable framework to assess the ethical considerations of sand mining in South Africa. It stresses the importance of balancing social justice, environmental protection, and economic growth to meet today's needs without compromising the ability of future generations to meet theirs.

From an ethical standpoint, sand mining should not harm ecosystems, pollute water sources, or cause lasting environmental damage because that would violate the principle of intergenerational justice. Sustainable development also promotes social justice and encourages community involvement in decision-making.

Ethically, it is wrong for sand mining to continue without proper consultation with affected communities, respect for people's health and well-being, and fair sharing of benefits. The

theory also emphasises transparency and accountability, meaning all stakeholders should have access to information and a voice in decisions that impact their environment and quality of life. Following the principles of sustainable development is crucial to preventing the misuse of sand resources.

Because it gives an extensive structure that takes into consideration ecological, social, and economic factors all at once, the theory of sustainable development is particularly appropriate for assessing the ethical consequences of sand mining in South Africa. Sustainable development promotes the needs as well as rights of future generations, as well as the present, while resolving long-term effects, in contrast to limited environmental or economic models. The theory permits an in-depth examination of equitable justice, asking who benefits from sand mining while determining who pays for it in countries such as South Africa, where previous inequalities still impact patterns of access to resources and damage to the environment.

Additionally, it is consistent with constitutional ideals like equal access to natural resources, participatory government, and rights regarding the environment. By promoting concepts like inclusive development, prudence, and intergenerational equality, sustainable development is promoted. The sustainable development framework aims to make sure that ethical evaluation goes beyond compliance or economic viability by focusing on concepts like equitable distribution of wealth between generations, caution, and equitable development. And also asks whether present procedures actually contribute to social justice, ecological resilience, and happiness for humans over time.

3.3 CONCLUSION

This chapter focused on the ethical theory of consequentialism and the concept of sustainable development. Consequentialism helps guide this research by examining the outcomes of sand mining activities in South Africa, evaluating whether these actions are morally right based on their consequences. Both the strengths and weaknesses of this theory were discussed. Sustainable development was defined as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.” The chapter explored its key principles, components, approaches, advantages, and criticisms. The next chapter will outline the methods and methodology used to collect data for this study.

CHAPTER FOUR
RESEARCH METHODS AND METHODOLOGY

4.0 INTRODUCTION

The previous chapter presented the theoretical framework of this study, exploring the nature of the ethical theory of consequentialism, arguments for and against it, and its connection to sand mining. This chapter focuses on the research methodology, design, sources of data, and the ethical considerations guiding the study.

4.1 RESEARCH METHODOLOGY

Bertram and Christiansen (2020:25) defined methodology as the process by which researchers gather and manage information. Depending on the study's needs and the researcher's preference, methodologies can be quantitative, qualitative, or a combination of both. These approaches are applicable across different research types. Kothari (2004:4-5) noted that qualitative research focuses on understanding subjective experiences, such as beliefs, attitudes, and behaviours.

This study adopts a qualitative research method to explore the implications of sand mining in South Africa. This approach was considered appropriate because it allows the collection of contextual data from secondary sources, such as academic literature, reports, and media. Through qualitative methods, the study interprets the views, experiences, and concerns expressed by various scholars, organisations, and stakeholders.

Sand mining is a complex issue, involving social, environmental, and economic dimensions. Using qualitative methods like content and discourse analysis, the study investigates how different parties, such as government bodies and local communities, frame and debate the issue.

This approach helped the researcher gain insight into the social, environmental, and economic effects of sand mining.

Qualitative analysis also enables comparison of differing perspectives. For example, government reports often highlight economic benefits, while environmental NGOs emphasise ecological harm. This method facilitates a deeper understanding of biases, power relations, and conflicting interests. Applying thematic analysis, the researcher identified key recurring themes in sand mining discourse, including regulatory gaps, illegal mining, and coastal erosion, which are crucial to comprehending the problem.

Additionally, Kretzschmar's DECA method was applied (Williams and Bentley, 2016:14). DECA stands for Describe, Evaluate, Consult, and Act. '*Describe*' involves outlining the issue and explaining why it is an ethical dilemma. '*Evaluate*' assesses the situation using a theoretical framework, in this case, consequentialism. '*Consult*' gathers and assesses existing academic work to support or challenge prior findings, while '*Act*' proposes recommendations moving forward.

In the 'Describe' stage, this study focused on sand extraction methods, such as coastal mining and river dredging, and identified the geographic areas where sand mining occurs. It also discussed the demand for sand, primarily for construction and manufacturing, and highlighted short- and long-term social and environmental impacts, including community displacement, riverbank erosion, and environmental degradation.

The 'Evaluate' step critically examined the sustainability, efficacy, and ethical implications of sand mining using consequentialism, which seeks to maximise overall good. This involved analysing ecological impacts like water pollution, coastal erosion, biodiversity loss, and land degradation, as well as social implications, including effects on local communities and potential conflicts. Policy effectiveness and regulation were also reviewed to assess how well adverse effects are managed.

During 'Consult', the study reviewed academic articles, books, reports, and case studies on sand mining, drawing on expert insights regarding its environmental, economic, and social consequences. This phase included evaluating South African case studies that report fieldwork, local impacts, and regulatory outcomes, often incorporating primary data from interviews. Consulting this literature provided valuable expert perspectives and helped validate the study's findings.

Finally, in the 'Act' stage, recommendations aimed at improving sand mining practices were developed. Suggestions for stricter regulatory frameworks and enhanced legislation will be discussed in the next chapter.

4.2 RESEARCH DESIGN

This study used an exploratory research design. According to Gounder (2012:6), an exploratory design is employed when researchers want to investigate a problem or subject that is not yet well understood or where clear answers are lacking. It is flexible and open-ended, aiming to gather initial insights that help uncover underlying intentions, ideas, and hypotheses. Gounder also highlights that exploratory research is useful for identifying trends, developing concepts, and laying the groundwork for more conclusive studies in the future.

Swedberg (2020:36) described an exploratory approach as "an attempt to discover something new and interesting by working your way through a research topic." In this context, thorough research using an exploratory method can reveal new information. Since this study aims to explore sand mining in South Africa, its ethical implications, and consequences, an exploratory design was considered most appropriate. Given the complexity of moral issues involved, such as environmental justice, community rights, and impacts on local populations, this approach enables the identification of diverse viewpoints and key themes.

4.3 SOURCES OF DATA

This study relied on secondary data collection. Pederson et al. (2020:58) defined secondary data as information originally gathered by others for purposes other than the current research. Such data can be advantageous because it has already been examined, reducing the need for researchers to collect or generate new data themselves (Bertram & Christiansen, 2020:114). The secondary data for this study were drawn from a variety of reliable sources, including journals, articles, case studies, books, government reports, and data from academic institutions and international organisations.

Using secondary data provided a broad range of information, historical context, and allowed comparison with findings from other studies. Industry reports and other sources were utilised to identify trends and deepen understanding of the topic. To meet the research objectives and explore the ethical implications of sand mining in South Africa, the data were analysed thematically.

Search engines such as Google Scholar, the UKZN online library, and ResearchGate were used to locate relevant sources.

4.4 ETHICAL CONSIDERATIONS

All research must follow ethical principles, and this study was no exception. Although no direct participants were involved, ethical standards were strictly observed in accordance with the University of KwaZulu-Natal's guidelines. Throughout the research process, confidentiality and data integrity were prioritised. All secondary data sources were handled with respect for confidentiality and intellectual property rights; these included publicly available datasets and previously analysed data. Reflexivity was applied to maintain objectivity and accuracy, helping to minimise bias during data interpretation. Ethical approval for the study was granted.

4.5 CONCLUSION

This chapter has outlined the exploratory research design employed, highlighting its flexibility and suitability for investigating the ethical and environmental implications of sand mining in South Africa. Without involving participants directly, this approach allowed for the identification of key themes, impacts, and recommendations through an in-depth analysis of existing information. The chapter also emphasised the adherence to ethical standards, ensuring transparency and laying a solid foundation for future research in this area. The next chapter will present the summary, recommendations, and conclusion of the entire study.

CHAPTER FIVE

ANALYSIS, INTERPRETATION, AND DISCUSSION OF FINDINGS THROUGH THE LENS OF TWO ETHICAL THEORIES

5.0 INTRODUCTION

The previous chapter discussed the research methods and methodology used in this study. This chapter focused on the analysis and interpretation of the findings. It examines the ethical implications of sand mining on the South African environment through the ethical theory of consequentialism and the framework of Sustainable Development. Using consequentialism, the consequences of sand extraction on South Africa's ecology and society are analysed. The chapter's focus was on the impacts of sand mining on the environment, the economy, and local communities. Viewed through the lens of consequentialism and Sustainable Development, key moral issues surrounding sand mining emerge.

5.1 ANALYSIS OF SOUTH AFRICA'S SAND MINING IMPLICATIONS USING THE ETHICAL THEORY OF CONSEQUENTIALISM

Through the perspective of consequentialism, the following issues become evident:

5.1.1 Sand Mining Increases Employment Opportunities for the Unemployed

According to Anne Stubbs (1981:497), consequentialism considers that good actions benefit many people. While sand mining carries risks, its benefits should not be overlooked. Umngeni, Musampa, and Nakin (2017:444–448) argued that buying and selling sand offers a viable route to financial independence. They highlight that sand mining generates job opportunities, particularly for local communities, and supports regional economies where the activity takes place. Sometimes, sand mining can even create or improve habitats, for example, by transforming old mine pits into wetlands that provide new homes for wildlife.

When managed responsibly, sand mining can yield several positive outcomes for communities and society (Musampa & Nakin, 2017:444-448). It can significantly contribute to employment development in areas lacking industry, employing a broad range of workers from manual labourers to skilled professionals, thus sustaining local livelihoods. Additionally, governments

benefit from revenues generated through taxes, licensing fees, and royalties related to sand mining operations (Hübler & Pothen, 2021:1). These funds can be reinvested in infrastructure, fostering further local economic growth.

Musampa and Nakin (2017:445) also highlighted that sand mining stimulates the development of regional supply chains, creates secondary employment, and supports associated businesses such as equipment suppliers and transport services. Moreover, sand extraction is vital for construction companies, accelerating economic growth in South Africa and other countries by providing essential materials for infrastructure projects that improve living standards.

Corporate Social Responsibility (CSR) initiatives linked to sand mining can enhance social and economic development (Sonna, Edewor & Chuks, 2022:120). Companies abiding by strict regulations often invest in local communities by funding infrastructure, healthcare facilities, and schools where these are lacking, thereby empowering the community.

Another important benefit of sand mining is its role in infrastructure development. As Sonna, Edewor, and Chuks (2022:120) explained, sand is a key raw material for producing glass and asphalt, which are essential for building roads, bridges, schools, and other constructions. This is especially crucial in rapidly urbanising areas where housing demand is high. By providing affordable construction materials, sand mining helps reduce housing shortages and raises living standards in many communities.

5.1.2 Job Opportunities and the Exploitation of Labour

Sand mining, particularly unregulated or illegal operations, can cause severe environmental damage (Asabonga et al., 2017:2). Ethical concerns arise when mining companies disregard long-term ecological harm, such as water pollution, biodiversity loss, and soil erosion caused by excessive sand extraction. The destruction of rivers and coastal areas impacts local wildlife and communities that depend on these ecosystems for their livelihoods.

Although sand mining often provides employment, especially in rural areas like the Eastern Cape (Xolobeni and Chwebeni), many workers face exploitation. Mining operations may offer minimal financial returns despite extracting vast resources. For example, the Chwebeni site was unregulated, yet the local community supported the mining activities (Mngeni, Musampa & Nakin, 2017:451

However, workers frequently endure unsafe conditions, low wages, and a lack of legal protection in illegal operations (Hassan & Rahmat, 2016:29). These communities also suffer displacement, loss of traditional livelihoods such as fishing and farming, and health risks due to pollution caused by mining. When mining companies prioritise profits over community welfare, ethical concerns arise, exacerbating social inequalities. If the jobs created involve exploitation or poor working conditions, the harm to workers undermines any moral justification for sand mining.

Chevallier (2014:1-2) highlighted that sand mining is often linked to illegal activities, raising serious ethical issues. Such practices flourish in environments of weak regulation, poor enforcement, and corruption. Illegal operators typically evade labour laws and environmental assessments, resulting in unsafe workplaces, exploitation, and irreversible environmental damage. Corruption weakens justice and fairness, enabling unethical sand mining activities that prioritise short-term economic gain over sustainable resource management. Depleting sand at catastrophic rates threatens future generations' access to essential natural resources needed for construction, environmental stability, and habitat restoration (Gavriletea, 2017:13). The erosion of governance and the spread of corruption undermine the social good, rendering such sand mining morally indefensible.

Sand is a critical resource for construction, with demand continuing to rise (Koehnken et al., 2020:363). Ethical concerns emerge when financial gains from sand mining are unevenly distributed. Often, profits flow to large corporations or international stakeholders, while local communities bear the health and environmental risks. This imbalance raises important questions about the fair distribution of natural resources and distributive justice.

5.1.3 Using Sand for Restoration Purposes

Leah Filho et al. (2021:1) stated that sand mining can play a vital role in efforts to reduce flooding and restore land in areas vulnerable to coastal erosion. Mined sand is often used to repair damaged coastlines or build defences against storm surges and sea level rise. By protecting ecosystems and communities, sand used in conservation projects can help mitigate the impacts of climate change. In some cases, responsible sand mining supports wetland restoration initiatives. Wetlands, as crucial habitats for biodiversity, act as natural barriers that

reduce flooding and filter water. Extracted sand can be used to create new wetlands or rehabilitate damaged ones, restoring habitats for a variety of plant and animal species. These restoration efforts contribute to broader conservation goals and enhance regional biodiversity. Gavriletea (2017:16) added that since sand mining can contribute to rising sea levels, which in turn pose economic risks for coastal communities, it is ethically important to balance economic benefits with the need to protect natural ecosystems for present and future generations.

Yamashiki et al. (2006:1273) explained that sediment accumulation in natural systems can disrupt ecological balance. For instance, sediment buildup in rivers, often caused by upstream erosion, deforestation, or poor agricultural management, can reduce water quality, lower water flow, and harm aquatic ecosystems. In such cases, regulated sand mining can aid in restoring water quality and ecological balance by removing excess sediment. The authors also note that careful sediment removal can maintain diverse aquatic habitats and improve water flow, which supports the migration of aquatic animals. Clearing silt from dams and water bodies prevents a decline in their functionality, ensuring they continue to serve important environmental and economic roles.

According to Yamashiki et al. (2006:1274), strategic sand mining in flood-prone areas can be beneficial. Sediment build-up in riverbeds over time raises river levels, increasing flood risk during heavy rains. Selectively mining sand from riverbeds can deepen the channels, increasing their capacity to hold water and reducing the chance of floodwaters spilling into surrounding ecosystems and communities. Similarly, sand extraction can help address localised erosion problems.

Sand mining can also help maintain the functionality of water infrastructure such as canals and reservoirs (Gavriletea, 2017:16). Sediment accumulation reduces the water available for domestic, agricultural, and commercial use by obstructing irrigation systems, rivers, and lakes (Gavriletea, 2017:14). Removing sediments through regulated sand mining can restore these systems' efficiency, providing environmental and economic benefits. Additionally, sand extraction aids the rehabilitation of groundwater recharge zones, as deepened riverbeds or restored wetlands allow more water to seep into aquifers. This is particularly valuable in regions facing water scarcity and drought.

5.1.4 Destruction of Coastal Ecosystems and Tourism

Although sand mining can have positive impacts on the environment, economy, and society, it can also cause significant harm. A consequentialist perspective stresses the importance of carefully analysing the overall negative effects of sand mining on society, the economy, and the environment before deciding whether to permit or restrict such activities. According to the ethical theory of consequentialism, actions should minimise harm and promote the greatest good for all parties involved (Sinnot Armstrong, 2003:10). Chapter Two of this project discussed the various ways sand mining affects the South African economy. Malebane (2021:33) highlighted that frequent sand mining can lead to environmental problems such as land degradation, coastal erosion, loss of agricultural land, and reduced biodiversity.

Beyond economic loss, sand mining can impose irreversible social costs on communities. These impacts reduce the ability to responsibly use riverine and coastal environments for economic or recreational purposes. Bangel-Buitrago et al. (2023:9) divide socioeconomic impacts into direct and indirect effects. Direct impacts arise from harm or changes to industries or specific operations, for example, mining beaches and coastal dunes have destroyed economies reliant on these environments. The costs of damage caused by coastal hazards like storms, tidal surges, and tsunamis, exacerbated by the loss of protective dunes and beaches, far outweigh the value of the extracted sand. Indirect impacts include the loss of tourism potential when sand mining diminishes the aesthetic and recreational value of coastal areas, harming communities that depend on this income.

Indigenous and disadvantaged groups relying on coastal ecosystems for livelihoods, such as fishing and tourism, are often disproportionately affected by sand mining (Rangel-Buitrago, 2018:32). This raises ethical concerns around participation, fair compensation, and consent, as many such communities have limited influence over mining decisions. Commercial sand extraction tends to benefit developers and private companies, while local people bear the costs, including depleted fish stocks, increased vulnerability to natural disasters, and loss of land. Viewed through the lens of consequentialism, this unequal distribution of benefits and burdens renders sand mining ethically problematic.

Sand mining also negatively affects tourism and recreational opportunities. Contamination related to sand mining damages scenic areas, which depend on a mix of natural and human factors for their quality and appeal (Rangel-Buitrago et al., 2018:32; Williams, 2019:45). Many

communities have long valued the coastal landscape's beauty, which is now threatened. Coastal scenery is a vital and unique resource for tourism, yet mining erodes this very asset, harming the sector's growth (Rangel-Buitrago, 2018:32). Financial losses hit local municipalities reliant on tourism as declining recreational quality, noise pollution, beach disappearance, and habitat loss all degrade the scenery. Durban's beaches, a popular tourist destination, suffer erosion and loss of attractiveness due to sand mining, deterring visitors (Rangel-Buitrago, 2018:32). The resulting economic losses from reduced tourism, which supports jobs and revenue, often exceed the short-term gains from sand extraction.

Sand mining can also damage coastal infrastructure such as breakwaters and groins (Rangel-Buitrago, 2023:9). While these structures protect property, they interfere with natural beach processes, causing increased erosion and endangering coastal land and tourism potential. The degradation of such infrastructure raises serious ethical issues, including long-term sustainability, corporate and government responsibility, human rights, and accountability. Sand mining threatens not only the economy but also public safety and social equity by weakening vital infrastructure such as buildings, bridges, and highways.

The immediate risk to public safety is among the most serious ethical concerns. Sand mining damages roads, bridges, and riverbanks, increasing vulnerability to landslides, floods, and structural failure (Leah Filho et al., 2021:11). Fatalities from avoidable infrastructure collapse highlight negligence and moral failure. Governments, businesses, and stakeholders have a moral duty to ensure mining operations do not endanger lives or public welfare. Basic human rights, such as safety, shelter, and mobility, are violated when infrastructure fails due to sand mining damage.

Marginalised communities, especially in rural and underdeveloped areas with limited public services, suffer disproportionately from infrastructure loss caused by sand mining. Damage to roads, schools, and hospitals restricts mobility, access to healthcare and education, and increases the financial burden on already vulnerable populations. While wealthy mining companies and urban developers profit, it is unjust for disadvantaged communities to bear the costs. Equitable policies that protect public infrastructure and fairly distribute economic benefits are essential for inclusive development.

Sand mining-related infrastructural damage is part of wider environmental degradation. Excessive sand removal causes river and beach erosion, harming infrastructure and ecosystems

with long-term consequences for future generations. This raises issues of intergenerational justice, the ethical responsibility to safeguard resources and public assets for the benefit of those yet to come. Allowing sand mining to destroy infrastructure without mitigation or alternatives reflects a short-sighted focus on immediate profits at the expense of sustainable development (Rentier & Cammeraat, 2022:3).

5.1.5 Ethical Issues of Coastal Sand Mining

According to Bangel-Buitrago et al. (2023:7), sand mining is one of the most destructive activities that can take place along riverine or coastal areas. Beyond causing irreversible damage to the water, land, and biotic components of coastal systems, mining operations can destroy ecosystems such as beaches and dunes. The most obvious impacts include disturbed topography and loss of vegetation cover, but many effects are gradual and less visible, like disruptions in trophic webs. Since coastal sand mining disrupts vital ecosystems and causes shoreline erosion, it raises ethical questions about humanity's responsibility towards nature, especially from a consequentialist perspective.

They also highlighted that beaches and dunes are dynamic environments, where geomorphological changes caused by sand mining occur rapidly and may persist long after mining ceases. Sand extraction disrupts the natural sediment equilibrium, affecting geological processes such as sediment transport and accumulation. The severity of these effects depends on multiple factors, including the type and amount of sand extracted, the coastal environment, sediment supply, hydrodynamics, and land use in the area.

From a geomorphological standpoint, sand mining alters sedimentary processes and disrupts the natural growth of beaches and dunes. Reduced sediment supply results in rapid beach erosion and changes to coastal topography, transforming healthy, sloping landscapes into flatter, lower ones (Pilkey et al., 2023:165).

Mining near the shoreline can have serious long-term environmental consequences, including accelerated coastal erosion caused by natural forces like waves and currents (Ratter, Petzold & Sinane, 2016:113). While coastal erosion is a natural process, human activities such as sand mining often exacerbate it. The removal of sand and silt from riverbeds and coastal systems weakens natural barriers that protect against erosion (Bangel-Buitrago et al., 2015:129;

2018:31). Disruption of river flows further compounds these effects, increasing the risk of significant coastal erosion when beaches and dunes are depleted.

Sand mining also impacts the local climate. Vimpere et al. (2021:1 & 8) explained that mining alters topography and leads to loss of vegetation, both of which influence the microclimate of dune areas, affecting temperature, wind patterns, sunlight exposure, and humidity. Compared to undisturbed, vegetated slopes, mined areas tend to be lower, barren, and more exposed, resulting in drier conditions, stronger winds, higher temperatures, and increased sunlight. From a consequentialist viewpoint, it is vital to weigh these long-term climate effects against any short-term economic benefits.

On the biotic front, Bangel-Buitrago et al. (2023:8) highlighted that sand mining destroys biotic communities. Extraction directly removes habitats, causing the disappearance of plants, fungi, insects, reptiles, birds, and mammals that depend on these coastal environments. Mining also raises turbidity levels, which severely harm aquatic life. Restoration efforts are rarely complete, and the loss of foundational species like mycobionts (fungi) and plants disrupts entire food webs. Important nesting and spawning sites for sea birds, turtles, and mammals are also damaged by beach and dune mining (Gracia et al., 2019:603). Furthermore, upstream sand extraction reduces the supply of sediment reaching coastal areas, threatening both the riverine and marine ecosystems.

Species composition changes significantly following sand mining. Altered sunlight, humidity, temperature, and wind exposure, coupled with vegetation loss, lead to shifts in plant and animal communities around mined areas. Native species may disappear and be replaced by others, often less diverse or less specialised (Bangel-Buitrago et al., 2023:8). This results in habitat loss, reduced biodiversity, and the possible extinction of species adapted to dune micro-environments.

All these environmental changes affect the entire food chain. Zou et al. (2019:4) reported that sand mining causes a significant decline in macroinvertebrate populations, which form the base of many food chains. Reduced populations of these species can have cascading effects on higher trophic levels, including fish, whose movements and populations are disrupted (Bangel-Buitrago et al., 2023:8). Moreover, ecosystem imbalances caused by mining may favour the invasion of non-native species, further threatening biodiversity (Gracia et al., 2019:604).

5.1.6 Increase in Illegal Mining and Sand Mafia

Pilkey et al. (2023:85, 194; Rangel-Buitrago, 2023:9) highlighted that sand exploitation has led to widespread human exploitation globally, not just in South Africa. As sand becomes scarcer, its price per cubic metre rises, which fuels illegal sand mining. Unlike other natural resources, sand is abundant and easily accessible, making it a common-pool resource that is difficult to protect from unlawful extraction. This illegal activity is often linked to corruption and the abuse of power, which undermines representative governance, destroys public trust, stifles economic growth, and exacerbates social divisions, poverty, inequality, and environmental crises both in extraction zones and downstream industries.

South Africa faces significant challenges with illegal sand mining, particularly in Durban and along the Eastern Cape coast, where criminal networks frequently control these operations (Mngeni, Musampa & Nakin, 2017:451; Chevallier, 2014:1). Such corruption has given rise to local sand mafias and criminal groups involved in sand trafficking (Rangel-Buitrago, 2023:9). In areas affected by these illegal activities, violence and regional conflicts may occur (Chevallier, 2014:1). The widespread exploitation, especially of vulnerable groups such as women and children, threatens people's health and safety by limiting access to basic needs like food and water. The resulting increase in crime and social instability undermines public trust and raises serious ethical concerns, despite any short-term economic gains.

5.1.7 Negative Effects on Agricultural Productivity

One of the most significant socio-economic consequences of sand mining is the displacement of local communities (Hassan & Rahmat, 2016:29). In provinces such as KwaZulu-Natal, sand mining along riverbanks contributes to soil erosion and the degradation of farmland, negatively impacting crops and food security (Chevallier, 2014:1). Large-scale sand mining often takes over land previously used for agriculture or local livelihoods, depriving communities of their primary income sources and forcing many into poverty or relocation in search of better opportunities.

Aniyikaiye et al. (2021:17) noted that sand is also used in brickmaking, which, if not managed sustainably, can cause riverbank collapses. In rural South African areas like Vhembe District, some residents depend on brickmaking using mined sand, and the loss of land due to mining can have devastating consequences. This includes the loss of valuable topsoil, reduced water retention capacity, decreased agricultural productivity, and rising food prices. From a

consequentialist perspective, the decline in farm productivity and increased food costs will likely impact far more people than those who benefit economically from sand mining.

Sand mining, in addition to causing relocation and soil degradation, it also interacts with important hydrological systems that preserve output from agriculture. Particularly in semi-arid regions where farmers primarily depend on shallow wells and boreholes, extensive river exploitation lowers the water table and reduces the amount of groundwater readily accessible for irrigation (Koehnken et al., 2020:28). This interruption of the natural flow of water may ultimately result in wetlands reducing and rivers drying up, which additionally decreases the total quantity of water available for the production of crops. Additionally, the natural nutrient cycles that restore soil fertility undergo changes when sand is removed, weakening floodplains and the banks of streams.

This ultimately decreases biological material, impairs the soil's form, and lowers yields (Chevallier, 2014:2). The safety and reliability of agricultural goods may also be adversely affected by pollution from dust and drainage tainted with fuel, oils, or additional chemical products in locations near to sand extraction activities (Beiser, 2017:5). Small-scale farmers are frequently forced to limit crop variety, sell off livestock, or quit farming completely as lucrative land becomes not ideal or less effective. The long-term food independence in areas of concern is at risk because of the accumulated impact of local food systems dissipating rural livelihoods declining, and an increasing reliance on food that has been imported from the point of view of sustainable development, this is an incapability to strike an appropriate equilibrium between protecting the environment, social justice, and economic growth an unbalance that compromises agricultural sustainability in the short and long term.

Sand mining's overall consequences on all parties involved must be the primary objective of any ethical analysis from a consequentialist approach.

In areas like KwaZulu-Natal's eThekwini Municipality where illegal sand mining is prevalent, sand mining may provide short-term financial advantages like earnings and employment opportunities, but these are frequently outweighed by the long-term effects, particularly on productivity in agriculture. For example, widespread sand mining alongside the banks of rivers in Vhembe District, Limpopo, contributed to soil erosion, riverbank collapse, and agricultural

deterioration, all of which have lowered crop yields for small-scale agricultural producers (Aniyikaiye et al., 2021). Similar to this, unauthorized mining close to water sources in some Eastern Cape regions has caused problems with irrigation systems that local farmers depend on, affecting long-term local income as well as food security.

Those who gain directly from the mining processes are not the only members of the general population impacted by these effects. Particularly in its general form, the ethical theory of consequentialism demands that the whole effect on every person's well-being, not just the immediate economic beneficiaries, be taken into consideration. The overall negative impact on society surpasses the regional benefits when sand mining causes widespread shortages of food, environmental damage, and the uprooting of rural neighborhoods. Because they do not result in a greater net good, such actions are morally wrong according to a consequentialist argument.

5.1.8 Exacerbation of Water Scarcity

Beyond its effects on agriculture, sand mining also impacts riverbanks and coastal areas. Rentier and Cammeraat (2022:5) argued that sand extraction disrupts water tables, lowering soil fertility and increasing coastal erosion. Reduced water availability for irrigation threatens food security and places communities dependent on farming at risk of financial loss and hunger. Over time, this can lead to higher food prices and shortages in affected areas.

Lowered water tables contribute to water scarcity in regions such as the Western Cape and Gauteng (Enquist & Ziervogel, 2019:2; Ramantswana, 2021:108). Given water’s critical role as a limited resource, the long-term damage to communities, agriculture, and industries reliant on water renders sand mining ethically problematic.

Sand mining not only lowers agricultural accessibility to water but also interferes with natural aquifer replenishment processes, which are vital for preserving the supply of groundwater, especially in semi-arid provinces like the Northern Cape and sections of the Limpopo. Sand and removing sediment affect riverbeds and lowers floodplains' ability for holding water, which additionally decreases water tables (Koehnken et al., 2020:22). In addition to making the already critical water shortage worse, this also degrades the quality of water used for drinking in the

neighboring rural areas, putting them at risk for waterborne illnesses from contaminated or stagnant water sources (UNEP, 2019:6).

According to the consequentialist theory, the short-term financial advantages of sand mining may be outweighed by these detrimental knock-on effects, which include health hazards, loss of income, and intercommunity water conflict. For example, excessive groundwater depletion has started to put strain on urban water infrastructure already under stress from population increase and climate variability in Gauteng, where sand mining is frequently associated with booms in informal building (Enquist & Ziervogel, 2019:2). In these situations, considerably more people are harmed overall in terms of social stability, food security, and public health than are directly benefited by the revenues from sand mining. Therefore, uncontrolled or excessive sand mining is morally unacceptable under consequentialist ethics, which place a higher priority on activities that maximize well-being overall, especially when it results in the depletion of a limited, life-sustaining resource like water.

The role of sand mining in exacerbating water scarcity raises profound ethical questions within a consequentialist framework. By destabilizing riverbeds, destroying aquifer recharge areas, and speeding up wetland decline, sand mining diminishes the land's capacity to store and control water just as climate change leads to more frequent and intense droughts (Kusangaya et al., 2014:48). The outcome is not only immediate water insecurity but also a long-term reduction in climate resilience for future generations.

River systems that lose sand, for instance, are less able to sustain ecosystems or provide clean water during dry spell conditions that climate models predict would get worse (Rangel-Buitrago et al., 2023:4). Future adaptation possibilities are eliminated by these ecological changes because degraded landscapes are no longer able to support agriculture, recharge aquifers, or cushion storms. The harms of water scarcity, climate change susceptibility, and heightened human suffering will impact more people in the future than the select few who profit from sand mining now, making these decisions unethical from a consequentialist perspective. Therefore, the cumulative and predictable suffering inflicted on generations who did not agree to the environmental harm they inherited bears the moral burden.

5.1.9 Increased Risk of Flooding

Rentier and Cammeraat (2022:5) emphasised that unregulated sand mining, as outlined in Chapter Two, damages vital infrastructure, including bridges, roads, and dams. Extracting sand from coastal and riverine environments can destabilise nearby buildings, causing collapses that require costly repairs. Leah Filho et al. (2021:11) also noted that excessive sand mining weakens riverbanks and bridges, raising the risk of infrastructure failure and floods triggered by environmental degradation.

Such damage deteriorates public infrastructure, including commercial and recreational spaces, and forces local governments to bear the financial burden of repairs and upgrades. This diverts funds from essential services like public safety, healthcare, and education. From a consequentialist viewpoint, the long-term costs of repairing infrastructure and managing flood risks far outweigh any short-term profits gained from sand mining.

Sand mining not only destroys infrastructure but also makes flooding much more likely and severe, particularly in urban and semi-rural regions close to rivers and the shore. Sand removal flattens natural barriers like dunes and wetlands, which typically absorb excess rainwater and prevent floods, erode riverbanks, and lower riverbeds (Koehnken et al., 2020:32). Heavy rainfall, which is already made worse by climate change, causes more frequent and deadly floods when these natural defenses are compromised. Because of the cheap land near rivers, informal communities are more likely to experience displacement, property loss, and waterborne illnesses (UNEP, 2019:17).

While sand mining earnings usually go to corporate enterprises or elite interests, the poor bear a disproportionate share of these social and environmental costs. Such activities are morally repugnant under the consequentialist ethical paradigm, which judges actions based on their overall results. The short-term financial benefits of sand mining are greatly outweighed by the long-term social hardship, financial burden on local governments, environmental damage, and health effects. In a consequentialist analysis, unregulated sand mining violates the fundamental criteria of moral acceptability because it causes more harm than good for the majority of impacted individuals, especially when it increases flood risk.

5.1.10 Contribution to Social Inequality

Sand mining often exacerbates social inequality and conflict, especially when profits are concentrated in the hands of a few small businesses or individuals, as noted by Mngeni, Musampa, and Nakin (2017:451). Unregulated mining typically brings little or no economic benefit to surrounding communities, with profits going mostly to external investors. This sense of exploitation can fuel social unrest and violent conflicts between sand miners and residents. For instance, in Chwebeni, South Africa, local communities clashed with government officials over an unregulated sand mining operation. While the community viewed it as a means to reduce poverty, the government opposed it due to its unregulated nature and sought to shut it down. This led to violent confrontations, human rights violations, and authoritarian measures (Mngeni, Musampa & Nakin, 2017:451).

According to consequentialist ethics, sand mining's role in water shortages contributes to inequalities and social injustices while also endangering the sustainability of the environment. The adverse consequences of sand mining are not fairly spread out; disadvantaged rural people, who already suffer from insufficient resources and inadequate accessibility to water services, are significantly impacted. Richer communities or metropolitan industries, on the other hand, often have the resources to access alternate water sources, widening the disparity in wealth. For instance, upstream sand mining operations close to riverbeds in KwaZulu-Natal's uMkhanyakude District have reportedly decreased accessibility to safe water for consumption for rural populations (Ramantswana, 2021:108).

Vulnerable groups have fewer resources to deal with the deterioration of the environment, which exacerbates already-existing disparities. According to consequentialism, moral choices should maximize the welfare of the majority. However, sand mining causes net social harm when it depletes common water resources and increases poverty or health hazards for sizable rural communities. Furthermore, as demonstrated in Chwebeni, the perceived inequity of these results, where one group suffers while another benefits, can stoke animosity, mistrust of public officials, and even violent protest. In these situations, sand mining's morality is seriously called into question because its total effects include not just ecological harm but also a rise in human misery, inequality, and war (Mngeni, Masumpa, and Nakin, 2017:451).

5.1.11 Health Issues in Marginalised Communities

Communities living near sand mining sites, particularly in informal settlements, often suffer respiratory problems from dust and pollution. These health issues place extra strain on already overburdened public health systems. The negative health impacts on vulnerable populations may outweigh any economic benefits from sand extraction, rendering the practice ethically questionable.

According to Bangel-Buitrago et al. (2023:8), sand mining activities cause noise pollution, silicosis, and degrade air and water quality, increasing the risk of infectious and sanitation-related diseases. Bangel-Buitrago et al. (2023:9) further stated that water quality is also affected, as residual sand and additives from extraction sites are sometimes discharged into aquatic environments like lagoons and coastal waters, contaminating groundwater through highly permeable sand in beaches, dunes, and floodplains.

Bindixen et al. (2021:7) observed that dust and noise pollution from sand mining cause serious health problems in nearby communities. Silica dust can lead to respiratory conditions and raise the risk of other diseases. Extensive sand extraction often involves fuel spills and exhaust fumes that severely harm air quality, impacting humans, animals, and plants (Bangel-Buitrago et al., 2023:9; Gondo et al., 2019:4). Contaminated water sources from mining pollution increase the risk of waterborne diseases.

Kim and Yoo (2020:2) noted that various inorganic and organic pollutants, including chemicals, pesticides, metals, microplastics, and pathogens, accumulate in sand and multiply during extraction and transport. Neal and Rangel-Buitrago (2022:119) highlight that mining leaves polluted debris on beaches with terrigenous sands.

Cullinan et al. (2017:2) explained that inhaling crystalline silica dust, common among sand miners, causes silicosis, a chronic, irreversible lung disease. This dust inflames and scars lung tissue, severely impairing lung function and potentially leading to death. Silicosis is especially prevalent among Indian sand miners.

Without adequate protective gear, sand miners face daily exposure to hazardous conditions, increasing their vulnerability to diseases such as malaria, sexually transmitted infections,

diarrhoea, and tuberculosis (Watts & Bedinelli, 2023:1). Stagnant water near mining sites also promotes mosquito breeding and parasitic infections.

Sand mining also increases noise pollution, which can harm both people and wildlife (Peng, Zhao & Liu, 2015:12305; Rangel-Buitrago et al., 2022:106294). Heavy machinery used in coastal mining produces loud noises far beyond natural coastal sounds, disrupting animals' ability to mate, find food, and avoid predators. This noise stress affects animal heart health and reduces reproduction rates. Noise pollution further impacts tourism negatively.

From a consequentialist perspective, which seeks the greatest good for the greatest number (Sinnott-Armstrong, 2003:10), these health risks disproportionately harm marginalised communities living closest to mining sites. The dust-related respiratory illnesses, water contamination, and chemical exposures cause chronic health problems, including cancer and skin infections, affecting vulnerable groups due to social and economic inequalities. Without effective mitigation, allowing such harm is unethical.

Policies that permit these health disparities to continue are morally indefensible. A fairer approach would ensure an equitable distribution of risks and benefits, for example, by reinvesting mining revenues into healthcare, pollution control, and community development. Currently, profits from sand mining are concentrated among companies, developers, and government officials, while marginalised communities bear the health burdens.

5.1.12 Environmental Degradation and River System Damage

In South Africa, sand mining along rivers such as the Umgeni has damaged riverbanks and ecosystems, disrupted natural water flow, and increased sedimentation (Nomcebo Myeza, 2020:6). Riverbed sand extraction has also led to the destruction of aquatic systems, altering the natural flow of rivers and disturbing habitats for aquatic species, which in turn reduces biodiversity (Rentier and Cammeraat, 2022:3). These operations interfere with ecosystems vital for the reproduction and feeding of fish, plants, and other aquatic organisms. The removal of sand further diminishes organic deposition processes that are crucial to maintaining environmental balance in these areas.

Sand mining causes soil erosion in both inland and coastal regions, a problem worsened when mining is unregulated (Asabonga et al., 2017:1). Extracting sand degrades soil structure,

leaving the land vulnerable to erosion, particularly after heavy rains. Coastal sand mining accelerates beach erosion, which negatively impacts tourism and weakens natural barriers against storm surges. According to Madyise (2013:5), this results in the loss of valuable soil, harming agriculture and increasing flood risks.

In river systems, sand mining disrupts water flow and reduces water quality. Excessive sand removal has caused water shortages for both humans and wildlife in some parts of South Africa (Rangel-Buitrago, 2023:8). The release of sediments and pollutants from mining activities frequently contaminates water bodies, lowering water quality and threatening aquatic life. This contamination also compromises clean water supplies for local communities. Viewed through a consequentialist lens, the damage to water systems, which harms biodiversity and downstream water users, may outweigh the economic benefits of mining, especially in water-scarce regions.

The destruction of natural habitats is another major environmental concern linked to sand mining in South Africa. Gracia, Rangel-Buitrago, and Castro-Barros (2019:603) explained that mining harms critical habitats for mammals, reptiles, and birds by degrading coastal dune systems, wetlands, and riverbanks. The loss of these habitats disrupts local ecosystems and leads to a decline in biodiversity, threatening many species dependent on these environments for nesting, food, and shelter. Fang, Hassan, and LePageso (202:153) argued from an environmental ethics perspective, stating that ecosystems possess intrinsic value equal to that of humans. Deep ecology argues that all living beings on earth have equal moral worth, meaning that disturbing ecosystems for human gain is ethically unjustifiable.

5.1.13 Intergenerational Consequences in a Climate-Vulnerable Country

South Africa is already vulnerable to climate change, facing droughts, extreme weather, and rising sea levels (Kusangaya et al., 2014:47). Sand mining accelerates environmental degradation and reduces the resilience of future generations. It increases South Africa's susceptibility to climate impacts, which are expected to bring more frequent and intense storms (Rangel-Buitrago et al., 2023:2). The loss of sand leads to coastal erosion, diminishing natural barriers that protect ecosystems and communities from extreme weather and rising sea levels. According to Rangel-Buitrago et al. (2023:7), South Africa's coastal areas are especially prone to flooding and storm surges due to sand mining damaging beaches and dunes. The long-term environmental harm passed to future generations makes current sand mining practices ethically questionable, as the consequences extend well beyond immediate economic gains.

Sand mining not only increases vulnerability to storms and sea level rise, but it also places long-term financial and environmental costs on future generations that are not involved in today's decision-making processes. Sand mining limits possibilities for flood management, sustainable tourism, agricultural use, and freshwater conservation by hastening the degradation of beaches, riverbeds, wetlands, and dune systems. This decreases future societies' capacity to adapt to climate change (Koehnken et al., 2020:28). The possibility that future governments may have to make significant investments in pricey artificial infrastructure, such as floodgates and seawalls, to make up for the harm done to ecosystems is further increased by the loss of protective coastal barriers. These expenses will probably take money away from vital public services like poverty alleviation, healthcare, and education. According to consequentialist ethics, the cumulative impacts of current sand mining operations are utterly unacceptable. The fact that the long-term harm would affect a bigger, more vulnerable group, namely, future generations, makes current unregulated sand mining ethically unacceptable, as consequentialism weighs total outcomes when evaluating moral judgments. The advantages are limited and transient, while the drawbacks, which include irreversible ecological harm, financial suffering, and climate vulnerability for future generations, increase with time.

5.1.14 The Displacement of Animals

Animal displacement caused by sand mining is a significant ecological issue that threatens ecosystems and biodiversity. Whether legal or illegal, sand mining disrupts natural habitats, forcing animals from their ranges and causing population declines (Hassan and Rahmat, 2016:29). This disturbance impacts the balance of entire ecosystems and individual species.

One of the major concerns is habitat destruction. Sand mining alters sediment flow and river structures, putting aquatic environments at risk (Malebana, 2021:33). Important habitats for fish, reptiles, and invertebrates are destroyed, while riparian zones, key for otters, birds, and amphibians are lost due to vegetation removal along riverbanks (Bangel-Buitrago et al., 2023:8). Coastal sand mining damages beaches and dunes, harming the habitats of turtles, seabirds, and crabs that rely on these areas for shelter and breeding (Gracia et al., 2019:603).

Disruption of ecosystems also affects food chains. In aquatic environments, damage to primary producers like algae limits food availability for smaller organisms, which in turn affects predators

(Kumar et al., 2023; Zou et al., 2019:4). Animals may be forced to migrate in search of resources, disturbing both their original and new ecosystems.

Human activities involved in sand mining, such as machinery noise and pollution, exacerbate the problem. Continuous disturbance makes many animals, including mammals and birds, more vulnerable and likely to abandon their habitats (Gracia, Rangel-Buitrago & Castro-Barros, 2019:603). Habitat fragmentation caused by mining also restricts access to essentials like food and water, particularly endangering amphibians and reptiles that depend on riverbanks and dunes.

Displaced animals face increased risks in their new environments, including higher exposure to humans, predators, and illegal hunting. When forced into residential or agricultural areas, conflicts with humans can further reduce populations. Species with specific habitat needs, such as migratory birds, reptiles, and turtles, suffer significantly. For example, the removal of riverbanks and sandbars deprives migratory birds of breeding sites and causes reptiles and turtles to struggle to survive.

Permanent environmental changes from sand mining include damage to wetlands critical for some species, altered water flow, and increased erosion. Since plants form the basis of many ecosystems, vegetation loss due to mining contributes to ongoing biodiversity decline. Native wildlife often finds altered ecosystems unsuitable, leading to the displacement and extinction of species.

The loss of biodiversity is one of the most serious consequences of animal displacement. Sand mining destroys wetlands, coastal areas, and riverbank habitats crucial for many species. Animals forced into new areas face competition for food, shelter shortages, and greater predator exposure. This can lead to local extinctions and disrupt food chains.

From a consequentialist perspective, if the environmental harm outweighs the economic benefits of sand mining, the practice is immoral. Such ethics would advocate for alternative strategies that minimise ecological damage, as the long-term collapse of ecosystems would have severe effects on biodiversity and human society.

The welfare of future generations is another crucial consideration for consequentialist ethics. Large-scale animal displacement could drive species to extinction, permanently altering ecosystems and reducing biodiversity for generations to come. This contradicts the principle of maximising well-being over time. Future South Africans may inherit a planet with fewer natural resources, diminished ecological resilience, and greater environmental instability if key species like freshwater dolphins, migratory birds, or mangrove fish disappear. Policies allowing widespread animal displacement without mitigation would be morally unacceptable, as decisions must benefit both present and future generations.

5.2 ANALYSIS OF SOUTH AFRICA'S SAND MINING IMPLICATIONS USING SUSTAINABLE DEVELOPMENT

Governance is a key factor when working towards sustainable development. The following are core elements of good governance concerning sustainable development.

5.2.1 Sustainable Development and Mineral Resource Governance

5.2.1.1 Transparency and Accountability

Transparency is a fundamental principle of mineral resource governance, ensuring that all stakeholders, including local communities and the general public, have access to information about who holds mining rights, the expected environmental impacts, and how revenues are managed (Hope, 2005:308). However, this transparency is often lacking in South Africa's sand mining sector. Many sand mining operations, particularly in KwaZulu-Natal and the Eastern Cape, are informal or illegal (Chevallier, 2014:1).

As a result, communities are frequently unaware of who is extracting sand from nearby rivers or land and are seldom informed about potential environmental consequences or any profits generated. Furthermore, this lack of transparency and accountability makes it almost impossible to regulate activities or ensure they align with the national sustainable development goals. The absence of accountability fosters the growth of illegal mining practices.

In addition to the absence of enforcement capabilities, South Africa's mineral resource governance is also lacking in transparency and information accessibility. In addition to lacking access to clear information regarding licenses, environmental impact assessments (EIAs), and revenue flows, affected communities are frequently not adequately consulted in decisions about

sand mining (Nzimande & Madonsela, 2020:11). This lack of transparency exacerbates social tensions and goes against fundamental sustainable development ideals like inclusive decision-making and participation. Social cohesiveness is weakened, institutional trust is impeded, and opposition to mining projects is fuelled when communities feel left out or misinformed.

5.2.1.2 Rule of law

The effectiveness of mineral resource governance depends largely on the strength of institutions and their ability to enforce laws consistently and fairly (Morita & Zaelke, 2005:15). Unfortunately, many areas in South Africa suffer from a lack of governmental capacity. Authorities, mining officials, and environmental regulators often do not have sufficient resources or personnel to properly monitor sand mining activities, investigate illegal operations, or hold offenders accountable. There have been allegations of corruption and complicity among officials, allowing illegal sand mining to continue unchecked (Maphanga & Madonsela, 2023:254). This breakdown in the rule of law undermines the country's ability to implement sustainable development effectively and erodes public trust.

Sustainable development initiatives are further harmed by the uneven application of current mining and environmental laws. Even in cases where EIAs are carried out, they are frequently insufficient or not strictly implemented (Phala & Musingwini, 2017:66). Landscapes are deteriorated, and ecosystems are not restored as a result of mining activities' frequent disregard for rehabilitation obligations. The rule of law and the Sustainable Development Goals (SDGs), especially those about life on land (SDG 15) and responsible consumption and production (SDG 12), are directly at odds with this lax implementation of the law.

Governance of mineral resources is also hampered by impunity and corruption. Public trust in institutions is weakened by reports of bribery, coordination between authorities and illegal miners, and the lack of prosecution of environmental violations, which imply that the rule of law is enforced selectively (Maphanga & Madonsela, 2023:254). The World Bank (2020) claims that unaccountable governance structures frequently permit extractive businesses to thrive at the price of social and environmental sustainability. Illegal sand mining persists with little repercussions in the absence of strong control, hence perpetuating a governance climate in which laws are in place in theory but not in reality.

5.2.1.3 Participation

Inclusive governance is a vital component of sustainability. It ensures that communities, especially disadvantaged ones, have a voice in decisions affecting their future, livelihoods, and environment. However, community engagement in sand mining is often minimal or completely absent. Local people are usually excluded from mining decisions, and when consulted, their participation tends to be limited or superficial (Gqada, 2011:5-6). Indigenous groups and underprivileged rural communities, those most affected by environmental degradation, are particularly marginalised. This exclusion damages the relationship between government agencies, corporations, and communities, often leading to social unrest and conflict.

In addition to being a democratic ideal, public engagement is also a necessary step toward long-term sustainability and environmental justice. The United Nations Economic Commission for Africa (UNECA, 2011:29) asserts that meaningful participation guarantees that development projects take into account local demands and knowledge systems, prevents environmental exploitation, and empowers communities to hold decision-makers accountable. However, in South Africa, especially in rural or customary land regions, sand mining projects frequently move forward without free, prior, and informed consent (FPIC).

International standards like the Aarhus Convention, which acknowledge participation and access to environmental information as fundamental rights, as well as state initiatives on cooperative governance, are both broken by this marginalization. Ineffectively excluding local voices weakens legitimacy and increases opposition to both public and private sector actors.

Even when consultation procedures are started, they are usually procedural or tokenistic rather than substantive. Because their concerns are not taken into consideration while making choices, local stakeholders may be "heard" but not truly listened to. Environmental Impact Assessments (EIAs) and community meetings are frequently held late in the project cycle or are written in a way that is difficult for the general public to understand, which restricts public participation, according to Gqada (2011:6). The idea that mining exclusively benefits political or economic elites is fueled by this shallow involvement, which breeds mistrust. Early, educated, ongoing, and powerful participation is essential for sustainable development because it gives communities the power to decide not just how mining occurs but also whether it should continue at all.

5.3 SUSTAINABLE DEVELOPMENT AND HUMAN RIGHTS

When analysing South Africa's sand mining sector through the lens of sustainable development, the violation of human rights emerges as a critical issue. Respecting human rights is essential for good corporate practice and integral to sustainable development. Below are some rights being compromised.

5.3.1 Right to Clean Water

A significant human rights concern in South Africa's sand mining industry is the lack of access to clean, safe water. According to Ochieng, Seanego, and Nkwontaone (2010:3352), pollution is a major threat to the country's freshwater systems. Mine water contributes to water quality decline by increasing suspended solids and activating harmful elements like zinc, aluminium, and iron, while also lowering pH levels. As discussed in Chapter Two, this leads to the deterioration of surface water quality, impacting agricultural, industrial, and domestic water use.

Sand mining in riverbeds can lower water tables and release sediments into the soil, resulting in water shortages for local communities and increasing the risk of unsafe water. This further violates the right to clean and safe water and threatens water sustainability for future generations.

According to Section 27 of the Constitution, the right to clean, safe water is both a fundamental necessity and a human right in South Africa. Sand mining, however, still violates this right, particularly for marginalized and vulnerable rural and peri-urban groups. Sand extraction from aquifers and riverbeds raises sedimentation and turbidity in water bodies, decreases water tables, and interferes with hydrological cycles (Koehnken et al., 2020:28). Poor households, who already do not have constant access to piped water, are unfairly burdened by these consequences, which make water sources less dependable and more costly to treat.

Additionally, illegal and poorly managed mining operations harm freshwater habitats, which is against Sustainable Development Goal 6, which calls for universal and equitable access to safe and affordable drinking water, according to the Department of Water and Sanitation (DWS, 2018). In addition to violating a fundamental human right, failing to safeguard clean water supplies weakens the environmental underpinnings that support long-term health, food security,

and economic resilience, according to the theory of sustainable development. To protect the right to water and the ecosystems that provide it, immediate changes in law, policy, and enforcement are needed.

5.3.2 Right to an Environment not Harmful to Health or Well-being

As outlined in Chapter Two, sand mining causes environmental degradation, including pollution, health hazards, and water contamination, which adversely affect human well-being. People living near sand mining sites may suffer from health issues, environmental damage, and reduced agricultural productivity.

Section 24 of the Constitution of the Republic of South Africa, 1996, states: "Everyone has the right: to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development" (McConnachie, 2014:285). This means all South Africans have the right to live in a healthy, clean, and safe environment. If sand mining harms ecosystems or creates unhealthy living conditions, it violates section 24(a) of the Constitution.

5.3.3 Right to Access Information

The South African Constitution guarantees that "everyone has the right of access to any information held by the state; and any information that is held by another person and that is required for the exercise or protection of any rights" (Klaaren & Penfold, 1996:2). This right ensures fair and lawful decision-making.

If the Department of Mineral Resources and Energy grants sand mining permits without making this information publicly accessible, communities remain unaware of approvals until mining begins and damage occurs. Without notification, community members cannot participate in decision-making, raise concerns about unregulated activities, or hold polluters accountable. This denies people their constitutional right to access information and undermines the participatory principle of sustainability, allowing unsustainable practices to continue unchecked.

5.4 CONCLUSION

This chapter has shown that sand mining can lead to serious negative effects, such as reduced agricultural productivity, which in turn drives up food prices, impacting many more people than those who benefit from the industry, raising ethical concerns. It highlighted key factors to consider when examining sand mining's implications in South Africa. While sand mining brings some benefits like job creation, infrastructure development, and new land opportunities, the harmful impacts, such as environmental degradation, climate change, and coastal erosion, outweigh these positives. The chapter also discussed governance challenges and human rights violations linked to sand extraction. The next chapter will summarise the study and offer recommendations to address the negative impacts of sand mining.

CHAPTER SIX

SUMMARY, RECOMMENDATIONS, AND CONCLUSION

6.0 INTRODUCTION

The previous chapter discussed the impacts of sand mining on the environment, society, and the economy, as well as the project's methods and methodology. This chapter presented a summary, recommendations, and a conclusion. It aimed to demonstrate how the researcher's subquestions were answered and fulfilled by providing an overview of the study's chapters, followed by recommendations and the conclusion.

6.1 SUMMARY OF THE CHAPTERS

✞ Chapter One

Chapter One introduced the study, outlining the chapters and briefly describing the focus of each. It highlighted sand mining as a global activity with significant effects on South Africa's environment, economy, and society. The literature review described sand mining and evaluated its socio-ecological and environmental impacts, while also identifying research gaps.

With growing demand for sand, mining activities increasingly disrupt ecosystems, threaten water tables, and cause environmental and land degradation. Rivers are the primary sand sources due to their proximity to towns and naturally occurring materials, which reduces costs (Koehnkel et al., 2019:362).

Sand is vital not only for concrete, glass, and ceramics but also for chemical production and water purification in construction and industry (Gavrletea, 2017:1). As the second most used natural resource, sand consumption rises with population and development growth. However, its extraction leads to severe environmental consequences such as habitat destruction, altered river courses, siltation, land degradation, coastal erosion, biodiversity loss, and risks to infrastructure like roads and bridges.

Sand mining also provides job opportunities and income, helping to alleviate poverty. For example, communities in Mngazi have invested mining income into upgrading local facilities

such as roads and hospitals. Environmentally, sand is important for building coastal defences that reduce erosion.

✞ Chapter Two

Chapter Two presented a detailed literature review on sand mining in South Africa, covering themes such as its definition, causes, impacts, and illegal mining activities.

Sand mining is defined as the extraction of sand and gravel from natural sources, closely linked to land and environmental degradation. The demand for sand has mainly increased for construction (Naveen, 2012:125). Over-extraction can cause mine fires, land degradation, and environmental imbalance (Ankali et al., 2017:452). Rivers provide low-cost sources as rocks are naturally ground into sand (Koehnken et al., 2020:363).

The chapter also examined why sand mining occurs, noting its use in the construction of infrastructure like bridges (Da & Le Billon, 2022:1). Sand contributes to environmental restoration by preventing erosion and restoring beaches, and it supports agriculture and water purification industries.

Environmental impacts on water include reduced photosynthesis in trees, altered feeding habits of aquatic species, decreased oxygen levels causing breathing difficulties, and a decline in aquatic populations (Pitchaiah, 2017). Sand mining also causes soil and coastal erosion, water quality degradation, and groundwater contamination. Negative effects extend to both living and non-living organisms, human health concerns, and the release of harmful metals.

Soil impacts include habitat loss, deforestation, landscape changes, and degradation of beach sand defences. Mining damages soil, causing erosion and infertility, which undermines agricultural productivity.

✞ Chapter Three

This chapter presented the theoretical framework, using consequentialism to examine the environmental and socio-economic implications of sand mining in South Africa. Consequentialism judges an action as ethically right or wrong based on its outcomes and

whether it produces the greatest good for the greatest number. If an action leads to the most benefit, it is considered ethically acceptable.
Other relevant theories included ethical egoism, described by Rachels (2012:194) as a normative stance focused on one's own interests and those directly involved, such as sand mining businesses or beneficiaries, rather than the wider community.

The chapter also explored Act consequentialism, which assesses whether an action maximises the greater good, such as the benefits sand mining brings to local communities (Armstrong, 2003:10). Universal consequentialism is discussed as a theory aiming to produce the greatest good for all, considering the broader impact on everyone involved (Armstrong, 2003:1).

Critics of consequentialism argued that it risks undermining ethical standards by justifying unethical behaviour if it results in favourable outcomes, potentially leading to moral relativism and confusion (Grisez, 1978:22–24). They also highlighted that consequentialism lacks clear behavioural guidelines, tends to ignore the intrinsic value of actions, and focuses too heavily on results.

Supporters claim consequentialism encourages beneficial outcomes, as utilitarianism holds that actions are morally right if they maximise positive results for the community. Two consequentialist approaches, i.e., ethical egoism and hedonistic utilitarianism, explain how self-interest and the pursuit of pleasure can motivate behaviours like sand mining, even when these actions carry risks (Tännsjö, 1996:98).

✞ Chapter Four

This chapter outlined the research methods and methodology, including the research design, data collection, and analysis methods, as well as ethical considerations. An exploratory research design was selected, as it suits the aim of addressing the environmental, social, and economic impacts of sand mining by raising awareness and providing recommendations.

A qualitative approach was employed to gain deeper insight into the beliefs, actions, and perceptions surrounding sand mining. The study was conducted as desktop research, sourcing secondary data from credible materials such as journal articles, books, and other scholarly works, ensuring accuracy and reliability. The information collected was analysed by organising it into themes to identify trends and patterns.

The DECA method: Describe, Evaluate, Consult, Act, guided the process. According to Williams and Bentley (2016:14), this involves outlining the problem, exploring potential solutions through consequentialism, consulting additional sources for validation, and then making recommendations.

All sources, including books, articles, and reports, are publicly accessible and correctly referenced. This chapter also emphasised that the research was conducted with integrity, transparency, and honesty throughout.

✞ Chapter Five

This chapter presents the analysis and findings. It uses the ethical theory of consequentialism and the principles of sustainable development to evaluate the ethical issues surrounding sand mining, weighing its negative and positive impacts. According to consequentialism, an action is ethical if it benefits the majority (Cummiskey, 2013:2). Economic benefits such as job creation, improved financial stability for local communities, and environmental restoration of mining sites are considered positive outcomes of sand mining.

However, the chapter also highlights significant disadvantages, including health problems, pollution, loss of biodiversity, environmental disruption, governance challenges, and human rights concerns related to sustainable development. These issues threaten ecosystems and the well-being of people. Ratter, Petzold, and Sinane (2016:113) noted that sand mining increases vulnerability to floods and coastal erosion, raising ethical concerns about its long-term effects on local communities.

Additionally, carbon emissions from sand mining and transportation contribute to climate change, which consequentialism recognises as an ethical issue affecting future generations (Vimpere et al., 2021:1 & 8). Sand mining also impacts anthropogenic activities by causing pollution, weakening infrastructure, and reducing water quality. The long-term social and economic consequences contribute to the rise of illegal sand mining, driven by strong market demand. From a consequentialist perspective, sand mining is unethical unless mitigated by environmentally friendly practices when the negative consequences outweigh the benefits.

Sustainable development, as discussed in this chapter, involves good governance principles such as transparency, accountability, the rule of law, and participation. These principles relate

to what the South African government should uphold or is currently implementing within the sustainable development framework. The chapter further explores human rights violations linked to sand mining in South Africa, specifically the rights to clean water, a healthy environment, and access to information.

- **Chapter six (The current chapter)**

6.2 SUMMARY OF FINDINGS

This summary is divided into the positive and negative implications of sand mining.

- **The Argument for Sand Mining**

Despite the negative effects sand mining causes to the environment and society, as noted by Sonna, Edewor, and Chuks (2022:120), it also offers benefits, particularly in job creation, infrastructure development, and economic growth. Sand is vital for modern infrastructure and construction, being a key resource in the production of glass, asphalt, and materials used to build schools, roads, bridges, homes, and hospitals. Access to sand supports infrastructure development in South Africa, which is crucial for both the population and economic progress. Improved infrastructure enhances transportation, healthcare facilities, and educational opportunities, all of which contribute to the upliftment of local communities and socioeconomic development.

From an economic perspective, Musampa and Nakin (2017:444 448) argued that sand mining provides important revenue and employment, especially in rural and semi-rural areas where job opportunities are limited. Sand mining can strengthen local economies and support family livelihoods by creating jobs directly in mining and indirectly in related industries such as construction, transport, and manufacturing. Many see these job opportunities as a path to financial independence and poverty alleviation. Additionally, income generated through sand mining can support public services and development initiatives at both the local and national levels.

Overall, sand mining makes affordable construction materials available, which positively influences urban growth and housing. Cheaper access to sand reduces concrete prices, enabling government and private sectors to build houses and infrastructure like roads and bridges more

easily. This, in turn, can improve living standards in informal settlements, reduce housing shortages, and increase access to clean water and sanitation services. These benefits are particularly evident in rapidly urbanising areas where meeting demand for housing and services is essential for social stability and improved livelihoods. Sand mining, therefore, contributes to community development, economic resilience, and the global need for infrastructure.

✞ The Argument against Sand Mining

While important for development, sand mining raises serious ethical concerns due to its impacts on society, the environment, and the economy. Waas et al. (2011:1646) highlighted that sand mining harms habitats and disrupts ecosystems, especially in beaches, rivers, forests, and coastal areas. Extracting sand from coasts and riverbeds causes erosion, disturbs sediment flow, and depletes resources vital for clean water and marine life. The degradation harms fish, birds, and other wildlife reliant on stable environments, threatening biodiversity. The gradual loss of these ecosystems challenges our ethical responsibility to protect the rights of non-human species to peaceful existence and to preserve natural environments for future generations.

Sand mining often creates unfair power dynamics, disadvantaging vulnerable groups. Communities living near mining sites frequently suffer health problems, loss of livelihoods, and displacement due to environmental degradation, particularly in developing countries like South Africa (Hassan & Rahmat, 2016:29). Benefits mostly flow to large companies or corrupt officials, leaving local people with little say in decisions affecting their land and resources. This social injustice raises ethical dilemmas around informed consent, justice, and community participation in resource management. Moreover, illegal mining activities often exacerbate conflict and exploitation, further threatening local security and stability.

Although sand mining may stimulate economic growth, its benefits are rarely shared fairly. Profits tend to go to businesses, while disadvantaged communities bear the environmental costs. This unequal distribution of wealth and resources deepens social inequality and raises ethical concerns about economic justice. Furthermore, sand mining is often unsustainable; over-extraction increases the risk of resource depletion, threatening availability for future generations.

6.3 RECOMMENDATIONS

According to Durden et al. (2017:193), there are several ways to reduce the negative impacts of sand mining, which, despite its benefits, is generally considered unsustainable due to its harm to society, the economy, and the environment. First, comprehensive research must be carried out in every area earmarked for sand mining. This research should include high-resolution mapping and assessments of local animal communities as well as temporal and spatial patterns in the chemical and physical environment. Considering ecosystem functioning before and after mining will help ensure that the vital services people rely on continue, and this knowledge can improve environmental management by identifying endangered communities.

Environmental impact assessments (EIAs) are the next essential step to evaluate the potential effects of sand mining. A thorough EIA examines the risks and environmental sensitivities of the proposed project and identifies mitigation measures to minimise harm to vulnerable ecosystems and communities (Durden et al., 2018:198). Negative effects can be reduced by applying the four-stage mitigation hierarchy during mining activities. This hierarchy involves: (1) avoiding mining in endangered habitats by relocating projects, (2) minimising impacts by using new technology to reduce silt plumes caused by mining vehicles, (3) remediating through restoring biodiversity in previously mined areas, and (4) offsetting by restoring biodiversity elsewhere to compensate for losses caused by mining (Durden et al., 2017:195).

However, the final two stages, remediation and offsetting, are often difficult or impossible to achieve, especially in deep-sea mining (Van Dover et al., 2017:1). Once risks have been minimised, decisions about whether the economic, social, and political benefits outweigh the costs can be made. If monitoring plans are in place to track environmental impacts, projects may proceed, but any severe negative effects should halt operations.

The research also emphasised the importance of adopting sustainable mining practices. This includes choosing ecologically less sensitive sites and employing methods that limit ecosystem damage, ensuring extraction rates do not exceed natural sand replenishment. Such sustainable approaches protect the quality of rivers, beaches, and the organisms that depend on these habitats.

Vander Velpen et al. (2022:13, 16) highlighted that sand mining affects a wide range of stakeholders, including local communities, industry leaders, environmental organisations, and

policymakers. Inclusive, participatory approaches ensure local voices are heard in planning and enforcement, promoting ethical mining practices.

To better control sand mining, regulatory frameworks in South Africa need strengthening. The government should enforce stricter environmental regulations, oversee permit issuance, and monitor mining activities closely. Illegal sand mining remains a significant issue; regular inspections and sanctions can curb these harmful operations. Establishing an anonymous hotline for reporting illegal mining could further help reduce environmental degradation caused by unlawful activities. Coordinated policies and laws at local, national, and regional levels are critical to tackling illegal mining. These regulations should focus on habitat conservation, extraction limits, and effective enforcement. Tailoring frameworks to specific environmental and socioeconomic contexts can encourage more sustainable practices.

Another important recommendation is to promote alternative materials. Reducing dependence on natural sand by supporting research into environmentally friendly substitutes, such as manufactured or recycled sand, can ease pressure on ecosystems and encourage greener construction methods. Mandatory post-mining rehabilitation can also limit long-term ecological and economic damage. Companies committed to environmental stewardship and community wellbeing can help restore ecosystems, prevent erosion, and promote biodiversity, striking a balance between social justice, sustainability, and economic needs.

Vander Velpen et al. (2022:8 12) stressed that sand is often underestimated as a resource but is essential for maintaining natural landscapes, infrastructure development, and biodiversity conservation. It should be valued as strategically as water or energy, with its environmental and economic worth carefully assessed to prioritise sustainable use and secure availability for future infrastructural needs.

Since this research is guided by the ethical theory of consequentialism, several recommendations can be made to primarily reduce the negative impacts of sand mining. These include implementing long-term resource management policies that consider environmental consequences. To prevent over-extraction, consequentialists would support determining the carrying capacity of available sand resources by improving mapping and regularly updating resource data using remote sensing and Geographic Information System (GIS) technology.
It is also advisable to require sand mining companies to undertake environmental restoration and reclamation efforts. From a consequentialist standpoint, restoring plants, wetlands, and

other affected ecosystems in mined areas should be compulsory. Mining businesses should be mandated to carry environmental liability insurance or contribute funds specifically allocated to restoration. These funds must be used to rehabilitate damaged land and ecosystems and to compensate communities impacted by mining activities. Furthermore, ongoing environmental monitoring should be established to track the effects of sand mining, using the data to adapt mining practices, legislation, and mitigation measures accordingly.

From studying sand mining, it is clear that sand must be recognised as a strategic resource crucial to infrastructure development in growing townships and cities, as well as attracting key service industries. Raising public awareness about the increasing demand for sand can also pressure the government to enact stronger legislation. Additionally, further research is needed on sand extraction from rivers, beaches, and dunes.

Hübler and Pothen (2021:1) proposed market-based policies, such as taxing sand production or sales through a Sand Extraction Allowances Trading Scheme (SEATS), or levying taxes on sand traded via imports and exports. These measures could be combined with certification systems to verify that traded sand is sourced outside protected areas. Such policies are likely to increase the cost of sand, reducing demand and trade, while making alternatives like steel, wood, recycled concrete, manufactured sand, or other reused materials more attractive for construction.

Post-mining recovery can sometimes lead to the emergence of new ecological habitats (Yamishiki et al., 2006:127). For example, mined pits are often converted into artificial lakes or aquatic ecosystems that provide homes for birds, amphibians, and other species. These water bodies can act as carbon sinks and help replenish groundwater, benefiting surrounding ecosystems. Some sand mining activities even promote landscape restoration that mimics natural systems, for instance, dune rehabilitation projects designed to prevent coastal erosion can be integrated with sand extraction along coastlines. These dunes serve as natural barriers against storm surges and rising sea levels, supporting diverse plant and animal life.

Integrating resource cycling with sand mining can further improve environmental stability. Operations can reduce pressure on natural ecosystems by encouraging the use of alternative materials such as crushed rock or recycled construction waste. Effective methods to minimise sand wastage during mining help preserve this resource while limiting disturbance to sediment replenishment processes. When adhering to regulations, sand mining can promote more

sustainable resource use (Gavriletea, 2017:16). For example, using sediments from lakes or riverbeds for local construction reduces the need to extract from undisturbed ecosystems, balancing human needs with environmental conservation.

To tackle the issues caused by sand mining, a comprehensive policy approach is necessary at the national, provincial, and municipal levels. Enforcement agencies need sufficient funding, training, and resources to effectively monitor and address illegal mining, especially in rural areas. Licensing processes should be simplified to minimise corruption, delays, and regulatory confusion, while maintaining strong environmental standards. Sand mining operations should be officially incorporated into spatial development frameworks, integrated development plans, and municipal land use management systems.

Community-based monitoring systems should be established, allowing residents to report illegal activities and engage in planning efforts. Incentives should be provided for using alternative materials like manufactured sand or recycled aggregates in public infrastructure projects. Interdepartmental collaboration must be enhanced among the Department of Mineral Resources, the Department of Forestry, Fisheries, and the Environment, and provincial environmental offices to ensure regulatory goals are aligned.

6.4 CONCLUSION OF THE STUDY

The research highlighted the complex and far-reaching implications of sand mining in South Africa. This paper has demonstrated that sand mining plays a vital role in the country's ongoing development, serving as an essential resource for the construction industry and broader economic activity. However, the study focused on the challenges South Africa faces due to sand extraction. Sand mining here reflects a global issue; unregulated extraction has caused significant environmental damage and exacerbated socioeconomic inequalities. Evidence of degraded river ecosystems, biodiversity loss, soil erosion, and wetland deterioration illustrates the severe environmental consequences. These challenges are worsened by climate change, which threatens the livelihoods and water supply of vulnerable communities.

The study aimed to address three key objectives. The first was to explore the nature of sand mining in South Africa. This objective was met by highlighting sand's importance for various uses such as concrete production and construction. The research explained that sand mining

mainly occurs in rivers and along beaches and is governed by the Mineral and Petroleum Resources Development Act.

The second objective was to examine the ethical issues and consequences of sand mining. This was also achieved by discussing concerns such as illegal mining activities, community exploitation, and environmental degradation. The consequences addressed included health risks, habitat loss, and social conflicts.

The third objective focused on how the ethical theory of consequentialism can inform sand mining practices in South Africa. This paper drew on two ethical frameworks: consequentialism and sustainable development. Consequentialism, which assesses actions based on their outcomes, suggests that sand mining should be judged by its long-term social, economic, and environmental impacts. If sand mining causes significant harm, such as biodiversity loss or vegetation destruction, it is deemed unethical. Sustainable development was defined as an approach aiming for growth and human development that meets current needs without compromising those of future generations. This theory advocates balancing economic growth with environmental protection and social equity.

The paper also placed South Africa's sand mining challenges within a global context, reflecting the rising concern over the unsustainable use of natural resources. Like many countries facing increasing demand for construction materials, South Africa struggles to regulate extraction to prevent environmental harm. This research highlighted the widespread nature of these issues and pointed to the potential for collaborative, multi-stakeholder solutions.

Further theoretical discussion on environmental justice and sustainable development emphasised the connection between social justice, environmental integrity, and resource exploitation. The paper underlined that unregulated sand mining causes environmental damage and social and economic injustices, disproportionately affecting disadvantaged communities. This highlights the urgent need to embed environmental justice principles into resource management and policy decisions.

Ethically, the study underscored the responsibility of citizens, businesses, and policymakers to safeguard natural resources for future generations. Although sand is often seen as an endless resource, it is ultimately finite and crucial to ecosystems. A shift in perception is necessary from viewing sand as a mere commodity to recognising it as a shared heritage that demands

sustainability over short-term profit. This ethical stance also calls for ensuring that affected communities' voices are acknowledged and valued through meaningful participation in decision-making.

Finally, the paper concluded that urgent action is needed to address accelerating ecological degradation and rising sand demand. Policymakers and stakeholders must translate research findings into practical strategies that consider social, economic, and ecological factors. Investment in ecosystem restoration can help repair damage from irresponsible mining and support long-term environmental recovery.

The study envisioned a future where sand mining in South Africa is balanced with ecological systems, governed by transparent policies, and guided by empowered communities. This thesis lays the foundation for recognising a shared responsibility to protect the nation's natural resources. By embracing sustainable development principles and encouraging collaborative, innovative solutions, South Africa can ensure that sand mining supports a more equitable, resilient, and environmentally sustainable future.

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APPENDIX 1: PROOF OF EDITING LETTER

Mr R Manzini

1 Main Road, Vulindlela Township, KwaDlangezwa, [redacted]

[redacted]

15 June 2025

To Whom It May Concern

This letter serves to confirm that I completed the language editing of the Master of Arts (MA) in Applied Ethics dissertation submitted by Miss Nomvuzo Amanda Maphumulo (Student Number: 220029047), titled: ***A critical exploration of the ethical implications of sand mining in South Africa.***

The dissertation was edited for grammar, spelling, punctuation, clarity, and overall writing style. Microsoft Word's "Track Changes" feature was used throughout the process, enabling the student to review and accept or reject the suggested edits on a chapter-by-chapter basis.

Please note that while I made every effort to ensure consistency in the formatting of in-text citations and the reference list, I did not verify the accuracy or authenticity of the cited sources.

A final copy of the edited document is on record.

Sincerely,

Mr R Manzini

APPENDIX 2: ETHICAL CLEARANCE LETTER

Miss Nomvuzo Amanda Maphumulo (220029047) School of Rel Phil & Classics, Pietermaritzburg

Dear Miss Nomvuzo Amanda Maphumulo,

Original application number: 00027416
Project title: A critical exploration of the ethical implications of Sand Mining in South Africa

Exemption from Ethics Review

In response to your application received on 13 August 2024, your school has indicated that the protocol has been granted EXEMPTION FROM ETHICS REVIEW.

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach, and Methods, must be reviewed and approved through an amendment/modification before before its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited. In case you have further queries, please quote the above reference number.

PLEASE NOTE:

Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your studies. Yours sincerely,

[redacted]

Prof Herbert Moyo
Academic Leader Research

AcademicLeader
School of Philosophy & Classics

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000

A critical exploration of the ethical implications of Sand Mining in South Africa.

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